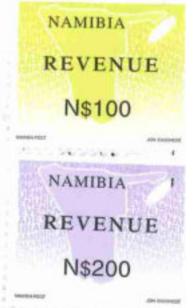
Form 1

REPUBLIC OF NAMIBIA ENVIRONMENTAL

MANAGEMENT ACT, 2007 (Section 32)

APPLICATION FOR **RENEWAL** OF ENVIRONMENTAL CLEARANCE CERTIFICATES



PART A: DETAILS OF APPLICANT

1. Name: (person or business):

   Rössing Uranium Ltd

2. Business Registration / Identity No.

   70/1591

3. Correspondence Address:

   C/o Rössing Uranium Ltd

   Private Bag 5005

   Swakopmund

   Namibia

4. Name of Contact Person:

   Mr. Johan Coetzee

5. Position of Contact Person:

   Managing Director

6. Telephone No.:

   +264 64 520 3400

7. Fax No.:

   +264 64 520 3432

8. E-mail Address: (if any)

   Johan.coetzee@rossing.com.na

PART B: SCOPE OF RENEWAL OF ENVIRONMENTAL CLEARANCE CERTIFICATES

1. The renewal application for environmental clearance certificates is for
THE OPERATIONS OF RÖSSING URANIUM LIMITED PV POWER PLANT NEAR ARANDIS, ERONGO REGION.

2. Details of the activity(s) covered by the environmental clearance certificate:
[Note: Please attach plans to show the location and scope of the designated activity(s) and use additional sheets if necessary:

Title of Activity:

THE OPERATIONS OF RÖSSING URANIUM LIMITED PV POWER PLANT NEAR ARANDIS, ERONGO REGION

Nature of Activity:

Rössing Uranium Limited (RUL) was issued ECC – APP2767 for the proposed PV Power Plant near Arandis. The construction phase of the plant is near complete, and the plant is envisaged to be operational in 2025. This application aims to secure a renewal for this ECC with the intention to satisfy the requirements under listed activities:

Energy generation, transmission and storage activities
1.a) the generation of electricity and
1.b) the transmission and supply *(for own use)* of electricity *to Rössing substation*

Location of Activity:

The RUL PV Power Plant is located near Arandis, on a portion of the mine's Accessory Works Area, wedged between the access road, south of the B2 Road and the NamWater pipeline, which supplies water to (amongst others) RUL. The Rössing Reservoirs are located ~1 km northeast of the PV Power Plant site. The PV Power Plant is linked to Rössing Substation via an overhead distribution powerline of ~ 6.8 km. This 11 kV line largely follows the same route as the existing 11 kV powerline (with a service road) between the Rössing Substation and Arandis.

Scale and Scope of Activity:

As contained in the relevant Environmental Assessment Report and Environmental Management Plans.

PART C: DECLARATION BY APPLICANT

I hereby certify that the particulars given above are correct and true to the best of my knowledge and belief. I understand the environmental clearance certificate may be suspended, amended or cancelled if any information given above is false, misleading, wrong or incomplete.

Signature of Applicant	**Johan Coetzee** Full name in Block Letters	**Managing Director** Position
On behalf of	**Rössing Uranium Ltd**	Date: **10 July 2025**

PROPOSED SOLAR PHOTOVOLTAIC POWER PLANT OF RÖSSING URANIUM LIMITED NEAR ARANDIS, ERONGO REGION

ENVIRONMENTAL IMPACT ASSESSMENT AMENDMENT REPORT

Prepared for: Rössing Uranium Limited

June 2022

DOCUMENT CONTROL

Report Title	ENVIRONMENTAL IMPACT ASSESSMENT AMENDMENT REPORT FOR THE SOLAR PHOTOVOLTAIC POWER PLANT OF RÖSSING URANIUM LIMITED NEAR ARANDIS
Report Author	Pierré Smit
Report Reviewer	Werner Petrick
Client	Rössing Uranium Limited
Project Number	NSPRUL20221
Report Number	1
Status	Final - for submission
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EXECUTIVE SUMMARY

1. General introduction and project motivation

Rössing Uranium Limited (RUL) holds the Mining License (ML) 28 (valid until 2036) for the Rössing Uranium Mine and Accessory Works Area. The Environmental Clearance Certificate (ECC) for RUL was renewed in November 2021 and is valid for three years, i.e., until November 2024. The mine is situated in the Arandis Constituency and the mine's main entrance gate is less than 10 km from Arandis. Mine development commenced in 1974, commissioning of the plant and the initial production commenced in July 1976.

RUL is conducting a feasibility study for its Life of Mine Extension (LoME) Project which includes the evaluation of constructing a solar photovoltaic (PV) Power Plant (and a distribution overhead powerline to the Rössing Substation onsite) to support electricity supply to the mine, processing plant and associated infrastructure.

The proposed Solar PV Power Plant is planned on a portion of the mine's Accessory Works Area, wedged between the access road, south of the B2 national road and the NamWater pipeline, which supplies water to (amongst others) the Rössing Uranium Mine. The Rössing Reservoirs are located ~1 km northeast of the proposed PV power plant site, on the opposite side of the access road (see Figure A).

2. Environmental Impact Assessment (amendment) process

Prior to implementing any of the new changes, an ECC (amendment) is required from the regulatory authority, the Directorate of Environmental Affairs (DEA) of the Ministry of Environment, Forestry and Tourism (MEFT) in terms of the Environmental Management Act, 7 of 2007. This Act was gazetted on 27 December 2007 (Government Gazette No. 3966) and its associated regulations were promulgated in January 2012 (Government Gazette No. 4878).

RUL appointed Namisun Environmental Projects and Development (Namisun), as an independent environmental consulting company to undertake the required environmental impact assessment (EIA) process, to compile the EIA Amendment Report and amend the accompanying Environmental Management Plan (EMP) as part of the application process for the necessary amendments to the current ECC.

It is thought that this EIA Amendment Report and Amended EMP will provide sufficient information for MEFT to make an informed decision regarding the proposed changes, and whether an ECC for the proposed amendments can be issued or not.

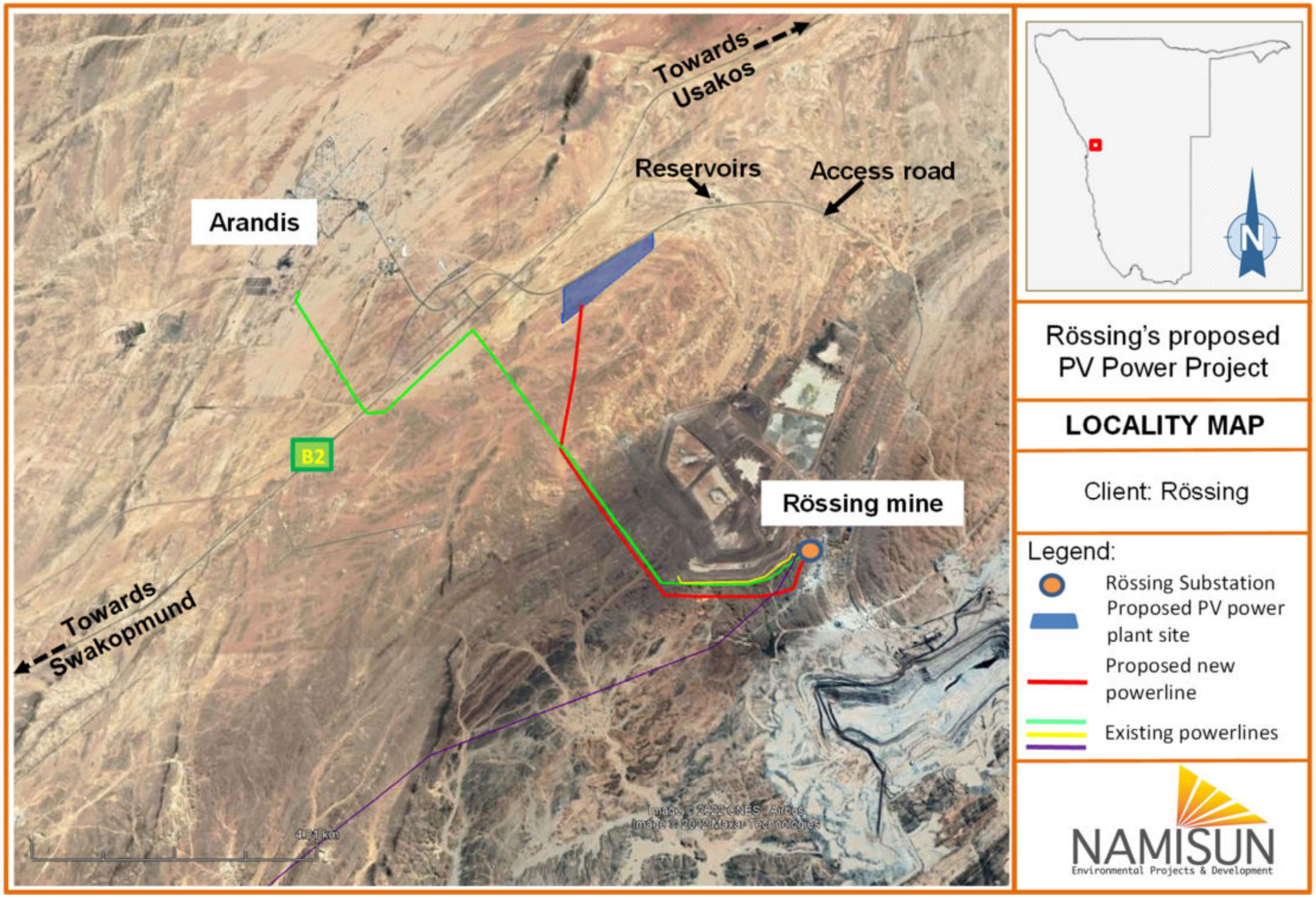

FIGURE A: LOCATION OF THE PROPOSED SOLAR PV POWER PLANT AND CONNECTING POWERLINE

3. Project description

RUL proposes to use monocrystalline Bi-Facial technology for the Solar PV Power Plant. It is anticipated that each module would have dimensions in the order of 2,256 mm (length) x 1,133 mm (width) (i.e., ±2.88 m^2), with a 540 Watt (peak) output. The maximum height of the panels would be ± 1.8 m. 572 double table PV trackers are proposed, each consisting of 2 strings of 29 modules each, resulting in a total of 33,176 modules. The total area required for the PV Power Plant is ~72 ha, including associated infrastructure, and the capacity is planned at 15 Megawatt (MW) alternating current (AC).

The PV modules would be placed on PV trackers which track from east to west at a maximum angle of 60° to capture solar irradiance on the monocrystalline silicon PV cells and emit the direct current (DC) into inverters that will convert the current into AC. The AC is then fed into two transfer stations and a collector substation onsite. To connect the proposed substation onsite with the Rössing Substation an overhead distribution powerline of ~ 6.8 km is planned. This proposed new 11 kV line will largely follow the same route as the existing 11 kV powerline (with a service road) between the Rössing Substation and Arandis (see Figure A).

Provision is made for a temporary construction camp and laydown area on the roadside of the proposed site. Access to the site is also planned on the roadside of the site. A guard house, parking area, ablution facilities with a septic tank and security office are planned at the access gate. A weather station is also planned near the substation onsite. The entire site will be fenced-in to prevent unauthorized access. A freshwater pipeline will be installed from the Rössing Reservoirs to provide potable water onsite. Freshwater will be needed in the kitchen and ablution facilities, but also to clean the solar panels from dust, which can affect their productivity.

Water consumption for module cleaning is approximately 9,700 L/MWp. There would be 6 cleaning cycles with a total PV DC capacity of 18 MWp. Therefore, the approximate yearly water consumption is 1,050 m^3.

During construction approximately 80 people would work onsite over a period of ± 6 months, peaking at approximately 180 people over a period of ± 2 months. The construction workers would be sourced, as far as possible, from within the Erongo Region. The appointed contractor would transport the workers from nearby municipal areas such as Walvis Bay, Swakopmund and Arandis to site and back daily.

The implementation of the project is dependent on the approval of the EIA (ECC) by MEFT as well as the issuing of a Generation License by the Ministry of Mines and Energy (MME). Provided the necessary authorizations and approval by the RUL Board have been obtained, procurement of the proposed project is planned to commence in December 2022 and construction to commence in May 2023 and completed by December 2023.

A small number of people will be permanently employed during the operational phase of the project. These persons will be responsible for daily tasks as well as routine inspections, monitoring and maintenance. Security personnel will be from a contracted company.

4. Identification of environmental aspects and potential impacts

The proposed project has the potential to cause impacts on the environment. Environmental aspects and potential impacts were identified by the environmental team during the screening and scoping phases, in consultation with authorities, Interested and Affected Parties (I&APs) and the project team.

For context, the description of the potential impacts should be read with the corresponding descriptions of the current environment in Chapter 6 of this report. Furthermore, it must be noted that the Solar PV Power Plant and powerline would be constructed in proximity of RUL's existing infrastructure and operations, on an already disturbed area and potential impacts are considered cumulatively (taking the existing activities into consideration). The potential impacts were reassessed by Namisun, taking the existing situation as well as additional studies into consideration.

Based on the discussions in Chapter 6, the following aspects / potential impacts require further assessment (see Chapter 7):

- Biodiversity (Loss of biodiversity from physical destruction (i.e. removing and killing of vegetation and killing of fauna).
- Avifauna (Disturbance, injury and killing of birds).
- Visual aspects (including glint and glare).
- Obstacles in relation to aviation safety.
- Positive and negative socio-economic impacts, largely during construction.

5. Environmental impact assessment findings

This section describes and assesses the significance of the potential impacts related to the proposed project, taking the proximity of RUL's existing infrastructure, operations and associated activities into consideration.

The issues that were identified as requiring further assessment; and the assessment findings are summarised in Table A (see Chapter 8).

TABLE A: SUMMARY OF POTENTIAL IMPACTS ASSOCIATED WITH THE PROPOSED SOLAR PV POWER PLANT AND ASSOCIATED CONNECTION POWERLINE

Potential Impact	Significance	
	Before mitigation	After mitigation
Loss of vegetation and associated biota due to the building of the water pipeline	M	L
Loss of vegetation and associated biota due to the building of the powerline	M	L
Loss of vegetation and associated biota due to the building of the Solar PV Power Plant and associated infrastructure	M	L
Change of habitat due to the Solar PV Power Plant infrastructure and restriction of animal movement (operational phase)	M-H	L-M
Spread of alien invasive plants (operational phase)	M	L
Disturbance of birds during construction: Solar PV Power Plant	M	L
Disturbance of birds during construction: Powerline	L	L
Direct and indirect modification / loss / destruction of bird habitat during construction: Solar PV Power Plant	M	L
Direct and indirect modification / loss / destruction of bird habitat during construction: Powerline	L	L
Bird collisions with infrastructure: Solar PV Power Plant infrastructure	L-M	L
Bird collisions with the powerline	M	L
Bird electrocutions with the powerline	M	L
General visual impacts and sense of place	L	L
Glint and glare impacts relating to the Arandis Aerodrome	L	L
Impacts to aviation, specifically the Arandis Aerodrome – relating to additional obstacles	L	L
Employment and skills development	M+	M+
Inward migration	L-M	L

6. The way forward

The way forward is as follows:

- MME and MEFT review the final report and provide record of decision.

7. Environmental impact statement and conclusion

Namisun believes that all environmental aspects and potential impacts associated with the proposed amendment was identified and appropriately assessed ('re-assessed").

The activities associated with the proposed amendment have the potential to cause additional impacts to the environment. However, the impacts can all be avoided / minimized (i.e., mitigated) to acceptable levels, comparable to those previously assessed and approved with the implementation of the current (amended) EMP applied. The current (amended) EMP has measures in place to manage all impacts.

Based on the findings of the EIA amendment and associated specialist input, Namisun is of the opinion that this EIA Amendment Report is sufficiently robust and provides sufficient information for MEFT to make an informed decision on the proposed amendments.

It is recommended that, if MEFT provides a positive decision on the application for the proposed project changes, they should include a condition to the clearance that RUL must implement all commitments in the (amended) EMP.

EIA AMENDMENT REPORT FOR THE PROPOSED SOLAR PHOTOVOLTAIC POWER PLANT OF RÖSSING URANIUM LIMITED

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ACRONYMS AND ABBREVIATIONS

The list of acronyms and abbreviations used in this report are summarized in the table below:

Acronyms / Abbreviations	**Definition**
AC	Alternating Current
AEWA	African-Eurasian Migratory Waterbird Agreement
AR	Anti-reflective
BIL	Basic Insulation Level
CCTV	Closed-circuit television
CTAN	Coastal Tourism Association of Namibia
CV	Curriculum vitae
DEA	Department Environmental Affairs
DC	Direct current
EAPAN	Environmental Assessment Professionals' Association of Namibia
ECC	Environmental Clearance Certificate
EIA	Environmental Impacts Assessment
EMP	Environmental Management Plan
EPC	Engineering, procurement and construction
EQO	Environmental Quality Objective
ha	Hectares
HDPE	High-density polyethylene
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome
HSE	Health, Safety and Environment
I&APs	Interested and/or affected parties
IBA	Important Bird Area
IHME	Institute for Health Metrics and Evaluation
IPP	Independent Power Producer
km	kilometres
kV	kilovolts
LDPE	Low-density polyethylene
LoME	Life of Mine Extension
MEFT	Ministry of Environment, Forestry and Tourism
ML	Mining Licence
MME	Ministry of Mines and Energy
MoHSS	Ministry of Health and Social Services
MP	Management program
MSDS	Material Safety Data Sheets
MW	Megawatt
MWp	Megawatt peak
NAMCARs	Namibia Civil Aviation Regulations
NAMCATs	Namibia Civil Aviation Technical Standards

NAMREP	Namibian Renewable Energy Program
NBSAP	National Biodiversity Strategy and Action Plan
NCAA	Namibian Civil Aviation Authority
NIRP	National Integrated Resource Plan
NNNP	Namib-Naukluft National Park
NPC	National Planning Commission
NSA	Namibia Statistics Agency
OPGW	Optical ground wire
PPA	Power Purchase Agreement
(Pty) Ltd	Proprietary Limited
PV	Photovoltaic
PVC	Polyvinyl chloride
RTE	Rare, threatened, and endangered (species)
RUL	Rössing Uranium Limited
SACAA	South African Civil Aviation Authority
SAIEA	Southern African Institute for Environmental Assessment
SCADA	Supervisory Control and Data Acquisition
SEA	Strategic Environmental Assessment
SEIA	Social and Environmental Impact Assessment
SEMP	Social and Environmental Management Plan
SME	Small and medium enterprise
TB	Tuberculosis
TSF	Tailings storage facility
VAC	Visual absorption capacity
WHO	World Health Organization

1 INTRODUCTION

This chapter describes the purpose of the report, briefly describes the background and proposed project / amendment, summarizes the legislative requirements, explains the report structure, summarize assumptions and limitations of the study, and explains how the input from key stakeholders was included.

1.1 Purpose of this Report

This Environmental Impact Assessment (EIA) Amendment Report has been compiled as part of the EIA amendment application process for the proposed solar photovoltaic (PV) Power Plant of Rössing Uranium Limited (RUL) and associated overhead distribution powerline.

This report describes and assesses proposed changes associated with the current / approved activities and facilities at the RUL Mine and, based on the assessment, the existing (approved) environmental management and mitigation measures are reviewed and where relevant, changes / additional measures were documented as part of the amended EMP.

1.2 Background and Context for the Proposed Amendment

RUL holds the Mining License (ML) 28 (valid until 2036) for the Rössing Uranium Mine and Accessory Works Area. Approximately 720 ha of ML 28 overlaps with the Namib-Naukluft National Park (NNNP) on the southern bank of the Khan River and the Dorob National Park is ~10 km to the west of ML 28. ML 28 is otherwise bordered by the #Gaingu Conservancy in the west and south-east. The rest of ML 28 is bordered by the Accessory Works Area, which in turn is overlain by the #Gaingu Conservancy except for the northern part that borders, and partly overlaps, the town of Arandis and its Townlands (RUL, 21). See Figure 1.

The Environmental Clearance Certificate (ECC) for RUL was renewed in November 2021 and is valid for three years, i.e., until November 2024. The mine is situated in the Arandis Constituency and the mine's main entrance gate is less than 10 km from Arandis. Mine development started in 1974, commissioning of the plant and the initial production commenced in July 1976.

RUL is conducting a feasibility study for its Life of Mine Extension (LoME) Project which includes the evaluation of constructing a Solar PV Power Plant (and a distribution overhead powerline to the RUL Substation onsite) to support electricity supply to the mine, processing plant and associated infrastructure.

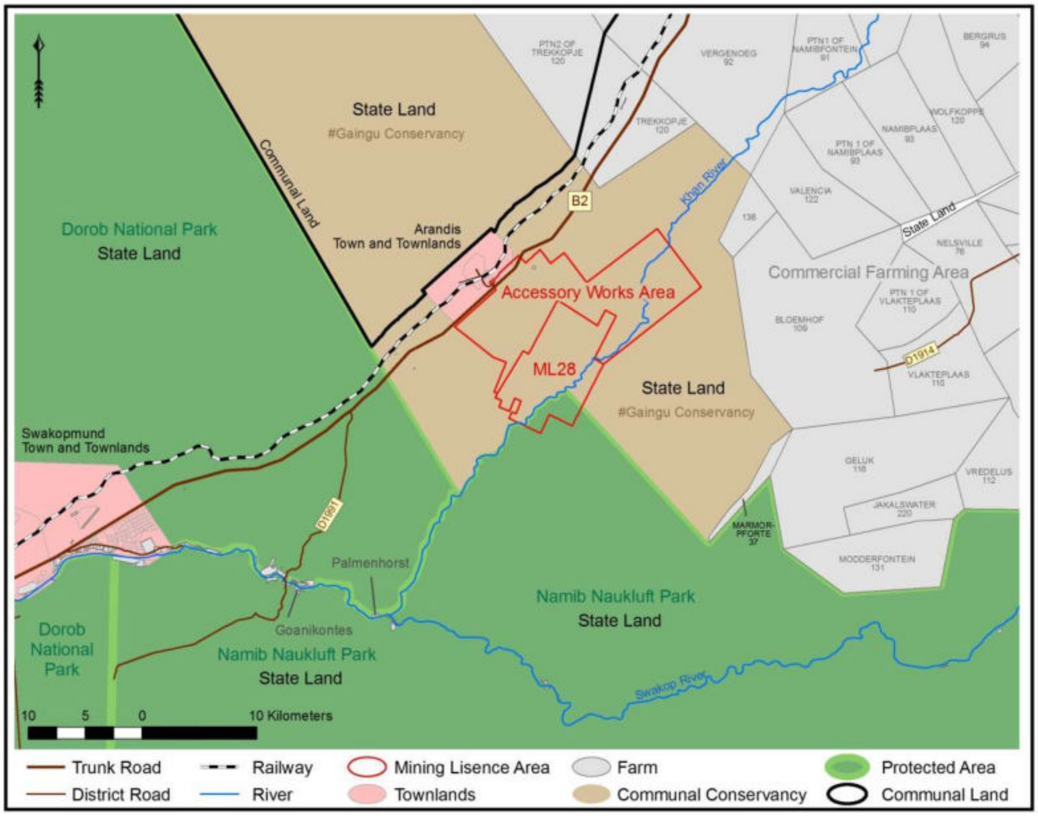

FIGURE 1: LOCATION OF ML 28

(Source: EMP of RUL, 2021)

The proposed Solar PV Power Plant is planned on a portion of the mine's Accessory Works Area, wedged between the access road, south of the B2 national road and the NamWater pipeline, which supplies water to (amongst others) RUL's Mine. The Rössing Reservoirs are located ~1 km northeast of the proposed project site, on the opposite side of the access road. See Figure 2.

Prior to implementing any of the new changes, an ECC (amendment) is required from the regulatory authority, the Directorate of Environmental Affairs (DEA) of the Ministry of Environment, Forestry and Tourism (MEFT) in terms of the Environmental Management Act, 7 of 2007.

RUL appointed Namisun Environmental Projects and Development (Namisun), as an independent environmental consulting company to undertake the required environmental impact assessment (EIA) process, to compile the EIA Amendment Report and amend the accompanying Environmental Management Plan (EMP) (i.e. EMP Addendum) as part of the application process for the necessary amendments to the current ECC.

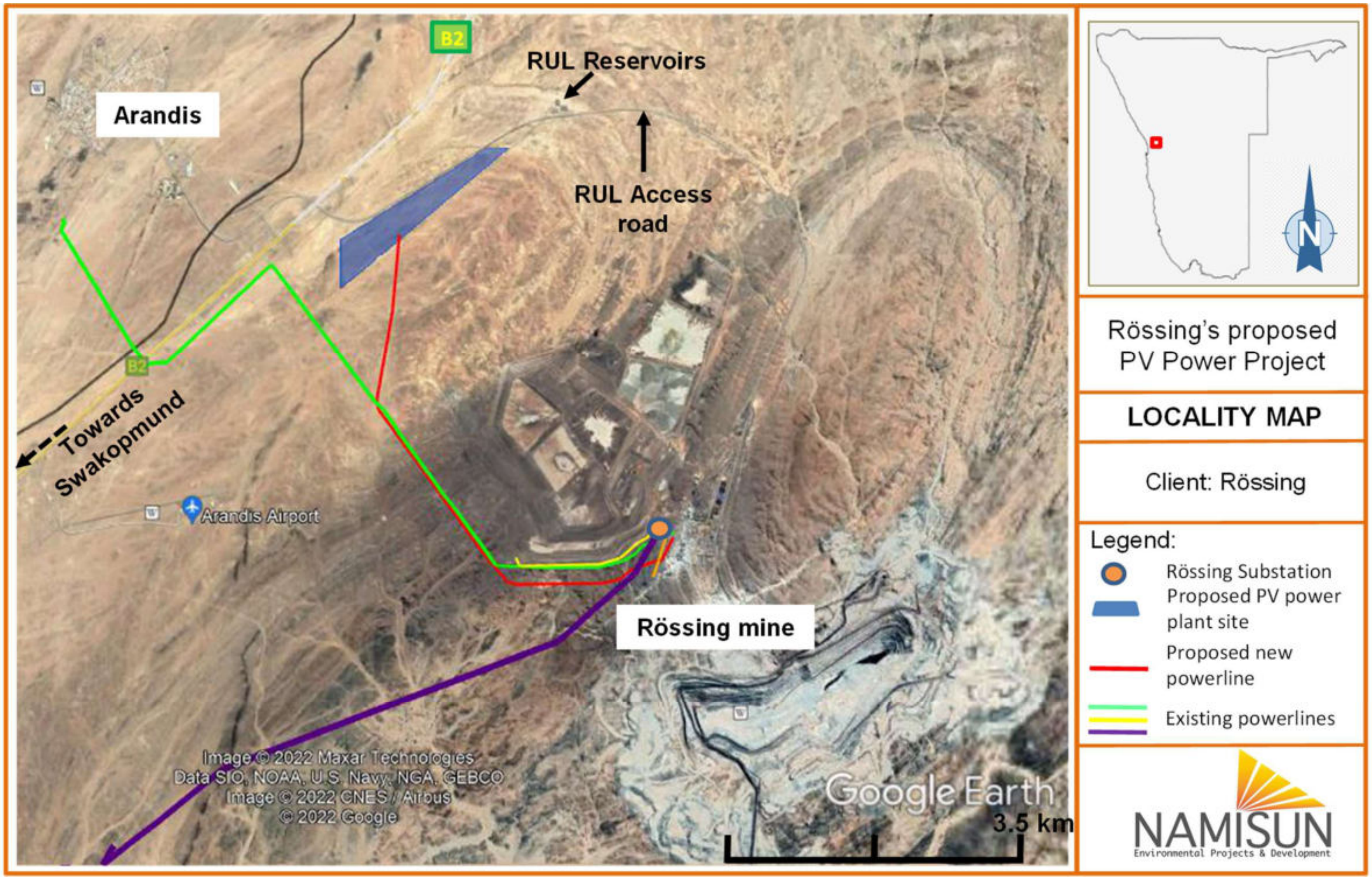

FIGURE 2: LOCATION OF THE PROPOSED SOLAR PV POWER PLANT AND CONNECTING POWERLINE

1.3 MOTIVATION (NEED AND DESIRABILITY) FOR THE PROJECT AND AMENDMENT APPLICATION

RUL's approved EMP (2021) states the following in terms of their power infrastructure:

"*Power is supplied from the national grid by NamPower. Rössing itself has a switching substation, from where power is distributed to the mine, to Arandis, to the NamWater booster stations along the pipeline, and to the Arandis Airport. At Rössing the 220 kilovolt (kV) power supply is stepped down to 11 kV into a network of overhead and underground cables. The powerline supplying power to the external sites partly runs along the southern slope of the tailings facility. Rössing's main 11 kV substation distributes power to the various areas via overhead and underground cabling. Furthermore, equipment is fed from 6.6 kV, 3.3 kV or 550 V lines, which are stepped down by transformers at various substations. Trolley assist technology is utilised in the open pit to increase the energy efficiency of haul trucks. The haul trucks can be operated by diesel fuel or electricity. Overhead lines are erected on haul truck runs which are economically viable, upon which haul trucks engage trolley assist mode in order to operate on electrical power. Shovels in the open pit use power via portable 6.6kV transformers*".

With reference to Section 1.2, RUL now proposes to construct and operate the Solar PV Power Plant to provide electricity for own consumption, as part of their feasibility study for its LoME Project. The electricity generated from the Solar PV plant will be consumed in conjunction with the existing power supply to the mine as (as described above).

1.3.1 NEED FOR RENEWABLE ENERGY

Energy is vital to the economic and social development of Namibia. There is a constant need to contribute to Namibia's ability to generate electricity from its own sources, thus reducing its dependency on external suppliers and to take advantage of the good solar resource in Namibia. NamPower, the national power utility, continues to negotiate Power Purchase Agreements (PPAs) and Transmission Connection Agreements with Independent Power Producers (IPPs). In addition, several mechanisms encourage the generation of renewable energy and the establishment of Solar PV Power Plants in Namibia:

- Vision 2030: One of the objectives of Vision 2030 is to *"ensure the development of Namibia's 'natural capital' and its sustainable utilization, for the benefit of the country's social, economic and ecological well-being"*.

- White Paper on Energy Policy of 1998: Over the years several initiatives to explore the renewable energy potential of Namibia have been guided by this policy. In addition, the Namibian Renewable Energy Program (NAMREP) was developed to increase affordability and access to renewable energy services and accelerate market development for renewable energy technologies by reducing existing barriers to solar energy, including human capacity, financial, technical, awareness and other market limitations.

- Regulatory framework for renewable energy and energy efficiency: This is one of the projects implemented by NAMREP, which promotes two strategic objectives – supporting environmentally sustainable technologies and attaining greater energy security through a steady increase of electricity production in Namibia using fuels or energy sources that are available in Namibia, e.g., solar, biomass and wind.

- National Integrated Resource Plan (NIRP): The goal of this plan is to identify the mix of resources for meeting short- and long-term consumer energy needs in Namibia in an efficient and reliable manner, at the lowest reasonable cost. The plan focuses on electricity supply, but also considers the impact of developing other energy sources and demand management measures capable of reducing electricity demand in the country. One of the objectives of the NIRP is to increase the diversification, security, reliability and efficiency of electricity supply, including the substitution of electricity by other energy sources such as oil, gas, biofuels and solar in order to improve efficiency.

- National emission targets: Namibia is signatory to numerous conventions and is striving to maintain climate change as a priority within its development framework. Against this background, Namibia aims at a reduction of about 89% of its Greenhouse Gas (GHG) emissions compared to the business-as-usual scenario at the 2030-time horizon. One of the proposed measures to achieve this relates to a shift from fossil fuels to renewable energy sources, to improve energy efficiency and to reduce fossil fuel consumption. Accordingly, the percentage of renewable energy (hydro, solar, wind and biomass) must increase from 33% in 2010 to 70% in 2030.

1.3.2 OPPORTUNITIES TO GENERATE RENEWABLE ENERGY

There is a growing worldwide awareness about environmental degradation, global warming and potential climate change, which forces the energy sector to find alternative sources for generation electricity.

Namibia renders great opportunity for energy generation through solar technology, with an average high direct insolation of 2 200 kilowatt hours per square meter per annum (kWh/m^2/a) and limited cloud cover.

Not only is solar energy a cheaper alternative over time, but it comes at a much lower environmental cost – being created from a renewable resource and without any pollution.

Generating electricity from its own Solar PV Power Plant implies possible cost savings in the long run which will assist RUL to be able to extend its Life of Mine. The Solar PV Power Plant also grants RUL the opportunity to participate and adhere to the principles of sustainable development.

The proposed project would manage to reduce the blended cost of energy, with a good internal rate of return and payback of less than 4 years (Senergy, 2020).

1.4 The EIA Process

1.4.1 Introduction to the proposed EIA (amendment) process

EIAs and amendment applications are regulated by the DEA of the MEFT in terms of the Environmental Management Act, No. 7 of 2007. This Act was gazetted on 27 December 2007 (Government Gazette No. 3966) and its associated regulations were promulgated in January 2012 (Government Gazette No. 4878) in terms of the Environmental Management Act, No. 7 of 2007.

Section 19 of the Regulations to the Act allows for an amendment of an ECC under Section 39 of the Act. An environmental clearance (amendment) is required based on an amendment application, prior to the commencement of the changes to the power supply to the mine being proposed by RUL.

The overall objectives of this assessment process are to:

- Provide information on the proposed project and its associated infrastructure.
- Describe the current environment in which it will be situated by referring to the existing baseline information and update, where relevant, the site-specific information.
- Identifies / update the potential environmental aspects associated with the project.
- Assess the potential impacts associated with the project.
- Review management and mitigation measures to avoid impacts or mitigate such impacts to acceptable levels by updating the approved EMP, where required.

1.4.2 EIAs completed and approved

Although no environmental assessment was required at the time of construction, the early mine operations of RUL commenced with due cognisance of the sensitive environment in which the mine is situated. Several investigations into specific aspects were conducted and documented, without any legal requirement at the time. These initial investigations focused on changes of dust levels, water use, seepage and groundwater flows. At the end of the 1970's, the Environmental Department at RUL was set up – something that was not mandated by law and considered as an unnecessary expense by many other mines (RUL, 2021).

After independence, and before the Environmental Assessment Policy was approved, RUL reiterated that one of its up-front, recorded goals (embedded in the business plan) is environmental improvement. The proactive pursuit of this philosophy moved RUL management beyond the compliance focus to a focus of continual improvement in environmental performance. In this spirit RUL committed itself to responsible environmental management in an independent Namibia by conducting an Environmental Impact Statement, completed in 1991. Without any kind of legislation RUL conducted one of the first impact assessments in Namibia during the 1990s when the proposed damming of the Khan River was investigated. Several other investigations were also conducted in the 1990s and 2000s, and in 2001 RUL was awarded certification to ISO 14001 (RUL, 2021).

The expansion activities proposed in the mid-2000s required authorisation and clearance and consequently a multiphase Social and Environmental Impact Assessment (SEIA) has been commissioned by RUL for the proposed expansion project in accordance with these requirements, as well as the internal standards and guidelines prescribed by Rio Tinto, to which RUL belonged then. Phase 1 of the SEIA process has been approved by the DEA at the then Ministry of Environment and Tourism (MET) by 2008 and Phase 2a in 2009. Phase 2b of the SEIA process culminated in the final SEIA Report and Social and Environmental Management Plan (SEMP) were submitted to the DEA by the end of 2011 and approved in 2012 (RUL, 2021).

The current ECC for RUL was renewed in November 2021 and is valid until November 2024.

1.4.3 EIA PROCESS FOR THE PROPOSED PROJECT

Prior to the commencement of the proposed project described in this document, an EIA process will be conducted and an (Amendment) Application will be submitted to the DEA of the MEFT in terms of the Environmental Management Act, 7 of 2007. This (EIA Amendment) Report will be submitted as part of the application. The EIA process includes: an internal screening phase and a scoping phase, which includes an impact assessment and an amended EMP (i.e. EMP Addendum) specific to the PV Power Project.

This report is the EIA Amendment Report, the main purpose of which is to provide information relating to the proposed additions to the current power supply infrastructure onsite and to indicate which environmental aspects and potential impacts have been identified during the internal screening and scoping phases. During the internal screening exercise, Namisun identified the need for an Avifauna Specialist Study, a Vegetation Specialist Study, and a Visual Specialist Study.

Existing information was used in this report and has been further augmented by a site visit, the additional specialist studies and input from comments gathered because of consultations with key stakeholders during focus group meetings. The potential cumulative impacts of the activities associated with the proposed Solar PV Power Plant, the connecting overhead powerline and the associated activities could therefore be assessed.

It is thought that this EIA Amendment Report and the accompanying amended EMP associated with the proposed project will provide sufficient information for the DEA of the MEFT to make an informed decision regarding the proposed changes and whether an ECC for the proposed amendments can be issued or not.

The EIA process and corresponding activities which have been undertaken for this project are outlined in Table 1. The process that was followed was in accordance with the requirements outlined in the EIA Regulations of 2012.

TABLE 1: THE EIA PROCESS

Objectives	Corresponding activities
Project initiation and screening phase (February 2022)	
• Information requirements • Initiate the EIA Scoping process	• Project initiation meetings and site visit with the RUL team to discuss the proposed project and EIA / ECC (Amendment) Application process. • Early identification of environmental aspects and potential impacts that might change because of the proposed project and determine additional legal requirements. • Decision on EIA process to be followed and specialists to be used in the process. • Identify key stakeholders and compose an Interested and Affected Party (I&AP) database.
Scoping (including assessment) phase (March – June 2022)	
• Involve I&APs in the scoping process through information sharing. • Identify further potential environmental issues associated with the proposed amendment. • Determine the terms of reference for additional assessment work. • Consider alternatives. • Identify any fatal flaws.	• Notify authorities and I&APs of the proposed EIA amendment process (Zoom calls, e-mails, newspaper advertisements and site notices). • I&AP registration and initial comments. • Key stakeholder (focus group) meetings and include IAP issues and concerns in the studies and assessments. • Conduct specialist studies (avifauna, vegetation, visual). • Compilation of EIA Amendment Report and EMP (Addendum). • Distribute EIA Amendment Report and EMP to relevant authorities and I&APs for review. • Update and finalizes EIA Amendment Report with EMP • Online registration of the project onto MEFTs portal.

• Provide further details associated with the potentially affected environment. • Assessment of potential environmental impacts associated with the proposed project. • Develop management and mitigation measures. • ECC amendment application. • Receive feedback on the application.	• Submit Application and finalized EIA Amendment Report with EMP and I&APs comments to MME and MEFT for decision-making.

1.4.4 EIA TEAM

Namisun Environmental Projects and Development (Namisun) is an independent environmental consultancy firm appointed by RUL to undertake the amendment process.

Werner Petrick, the project manager, has more than twenty-three years of relevant experience in conducting / managing EIAs, compiling EMPs and implementing EMPs and Environmental Management Systems. Werner has a B. Eng (Civil) degree and a master's degree in environmental management and is certified as lead environmental assessment practitioner (EAP) and reviewer under the Environmental Assessment Professionals Association of Namibia (EAPAN).

Dr Pierré Smit, the project coordinator, holds a PhD in Landscape Ecology and has more than twenty-seven years of experience in environmental management, managing environmental assessment, the implementation of EMPs and Environmental Management Systems in Namibia.

The relevant curriculum vitae (CV) documentation is attached as Appendix A.

The environmental project team and proponent details for the EIA amendment process relating to the proposed Solar PV Power Plant is outlined in Table 2.

TABLE 2: EIA TEAM AND PROPONENT DETAILS

Team	Name	Designation	Tasks and roles	Company
Project proponent	Mr Hennie Lacock	Superintendent - Projects	Technical input	RUL
	Mr Stefaans Gaeseb	Specialist - Environment	Implementation of the (amended) EMP	
Project manager	Mr Werner Petrick	EAP	Management of the EIA process and reporting	Namisun

Team	Name	Designation	Tasks and roles	Company
Project coordinator	Dr Pierré Smit	EAP	EIA Support and compilation of EIA Amendment Report and EMP	
Vegetation	Antje Burke	Vegetation specialist	Specialist input incorporated into this report: Vegetation survey and study	EnviroScience
Visual aspects	Mr Graham Young	Visual specialist	Specialist input incorporated into this report: Visual aspects	GYLA
Avifauna	Dr Ann and Mike Scott	Avifauna	Specialist input incorporated into this report: Avifauna survey and study	African Conservation Services cc

1.5 Assumptions and Limitations

Refer to the Specialist Studies in Appendices E to G for specific assumptions and limitations. Some general assumptions are described below.

1.5.1 Previous assessments and technical information

It is assumed that the information provided by RUL, including all baseline environmental descriptions are accurate.

1.5.2 Environmental assessment limit

The EIA (amendment) process focuses on the proposed changes related to the Solar PV Power Plant and the associated connecting powerline. Potential impacts associated with other proposed activities and facilities / infrastructure are not considered in this report.

1.6 Opportunity to Comment

This EIA Amendment Report (with EMP Addendum) will be distributed for public / authority review. I&APs are invited to comment on these documents, which are available for a review and comment period from 10 to 31 May 2022. Comments should be sent to Namisun at the telephone number, or e-mail address shown below by no later than 31 May 2022.

Namisun

Attention: Pierré Smit

E-mail address: oudoring@gmail.com

Cell number: +264 (0)81 752 7207

2 EIA PROCESS (SCOPING AND ASSESSMENT) METHODOLOGY

This chapter outlines the EIA (Scoping and impact assessment) methodology and I&AP consultation process followed in the EIA (amendment) process.

2.1 INFORMATION COLLECTION

Namisun obtained baseline information and a description of the proposed project activities from RUL to identify the environmental aspects associated with the proposed project; and to assess the potential impacts.

Information for the preparation of this EIA Amendment Report was sourced from:

- The existing, approved EMP (RUL, 2021).
- A vegetation specialist study conducted by EnviroScience (Antje Burke) in March / April 2022 (refer to Appendix E for the Vegetation Specialist Report).
- An avifauna specialist study conducted by African Conservation Services Dr Ann and Mike Scott) in March / April 2022 (refer to Appendix F for the Avifauna Specialist Report)
- A visual specialist study (including a qualitative assessment of the potential of glint and glare impacts) conducted by GYLA (Graham Young) in March / April 2022 (refer to Appendix G for the Visual Impact Assessment Report).
- Dr John Kinahan conducted previous archaeological studies and assessments for RUL, covering the entire tenement. The findings of these assessments and the subsequent management and mitigation measures are described comprehensively in the current approved EMP and were considered in this assessment.
- Atlas of Namibia (Mendelsohn et al., 2002).
- Technical information provided by RUL and their Technical Team / Engineers.
- Site visits by Namisun and technical team in February 2022.
- Consultations and focus group meetings with I&APs.
- Google Earth.

2.2 SCOPING REPORT STRUCTURE

The structure of this EIA Amendment Report is outlined in Table 3, following largely the Scoping Report requirements as set out in Section 8 of the EIA Regulations (2012), promulgated under the Environmental Management Act, No. 7 of 2007.

TABLE 3: REPORT STRUCTURE

Component	Report reference
(a) Details of the Environmental Assessment Practitioner (EAP) who prepared the report	Section 1.4.4 and Appendix A
(b) A description of the proposed activity (i.e., proposed amendments)	Chapter 4
(c) A description of the environment that may be affected by the activity and the way the physical, biological, social, economic, and cultural aspects of the environment may be affected by the proposed activity	Chapters 6, 7 and 8
(d) A description of the need and desirability of the proposed listed activity and identified potential alternatives to the proposed listed activity, including advantages and disadvantages that the proposed activity or alternatives may have on the environment and the community that may be affected by the activity	Section 1.3, Chapter 5, 7 and 8
(e) An identification of laws and guidelines that have been considered in the preparation of the Scoping Report.	Chapter 3
(f) Details of the public consultation process conducted in terms of Regulation 7(1) in connection with the application, including:	Section 2.3
(i) steps that were taken to notify potentially interested and affected parties of the proposed application;	Section 2.3.2 and Appendix B
(ii) proof that notice boards, advertisements and notices notifying potentially interested and affected parties of the proposed application have been displayed, placed or given;	
(iii) a list of all persons, organisations and organs of state that were registered in terms of Regulation 22 as interested and affected parties in relation to the application; and	Section 2.3.1 and Appendix D
(iv) a summary of the issues raised by interested and affected parties, the date of receipt of and the response of the EAP to those issues	Section 2.3.3 and Appendix C
(g) An indication of the methodology used in determining the significance of potential effects / A description and assessment of the significance of effects, including cumulative effects, that may occur as a result of the undertaking of the activity or identified alternatives or as a result of any construction, erection or decommissioning associated with the undertaking of the proposed listed activity	Chapters 7 and 8
(h) A description and comparative assessment of all alternatives identified during the assessment process	Chapter 5
(i) A description of all environmental issues that were identified during the assessment process, an assessment of the significance of each issue and an indication of the extent to which the issue could be addressed by the adoption of mitigation measures	Chapter 7 and 8
(j) An assessment of each identified potentially significant effect	
(k) A description of any assumptions, uncertainties and gaps in knowledge	Section 1.5
(l) A management plan	Chapter 8

Component	Report reference
(m) An opinion as to whether the proposed listed activity must or may not be authorised, and if the opinion is that it must be authorised, any conditions that must be made in respect of that authorisation	Chapter 9
(n) A non-technical summary of the information	Executive Summary

2.3 Public Participation Process

The public participation process for the proposed project was conducted to ensure that all persons and or organisations that may be affected by, or interested in, the proposed activities and infrastructure, were informed of the project and could register their views and concerns. By consulting with relevant authorities and I&APs, the range of environmental issues to be considered in this EIA Amendment Report has been given specific context and focus.

Section 2.3.1 provides a summary of I&APs consulted, Section 2.3.2 describes the process that was followed, and the issues that were identified are summarized in Section 2.3.3.

2.3.1 Interested and Affected Parties

The broad list of persons, group of persons or organisations that were informed about the project and were requested to register as I&APs, should they be interested and or affected, include:

- The Directorate: Energy at the MME.
- The DEA at the MEFT.
- National Heritage Council.
- Erongo Regional Council and the Arandis Constituency.
- Officials from Arandis Town Council (ATC).
- Representatives of NamPower, NamWater, the Namibia Civil Aviation Authority (NCAA), Roads Authority and Telecom Namibia.
- Other I&APs that registered on the project, including the Coastal Tourism Association of Namibia (CTAN), Rent-a-Drum and representatives for the Arandis Aerodrome.

These stakeholders were informed about the need for the proposed project activities, the EIA process (including the public consultation), as well as the outcomes of the assessment (see Appendix B).

The full stakeholder database for this project is included in Appendix D of this report.

Due to the limited scale and scope of the proposed project / changes at RUL's mine, no additional focus group meetings or further stakeholder engagement was deemed necessary. Minutes of the meetings are contained in Appendix C.

2.3.2 STEPS IN THE CONSULTATION PROCESS

Table 4 sets out the steps that were followed as part of the consultation process.

TABLE 4: CONSULTATION PROCESS WITH I&APS

TASK	DESCRIPTION	DATE
Notification - regulatory authorities and I&APs		
I&AP identification	The stakeholder database was developed. This database is updated as and when required. A copy of the I&AP database is attached in Appendix D.	February 2022 – ongoing
Distribution of Background Information Document (BID)	Copies of the BID were distributed via email to relevant authorities and I&APs on the stakeholder database and hard copies were made available on request. The purpose of the BID was to inform I&APs and authorities about the proposed activities, the assessment process being followed, possible environmental impacts and ways in which I&APs could provide input / comments to Namisun. A copy of the e-mail notification and BID are attached in Appendix B.	February - March 2022
Site notices	Site notices were placed at the RUL Mine entrance and at the Swakopmund Dome Notice Board to notify I&APs of the proposed project, and the EIA process being following. Photos of the site notices that were displayed are attached in Appendix B.	March 2022
Newspaper Advertisements	Block advertisements were placed in the Market Watch (on 16 and 23 March 2022) as part of the following newspapers: • The Namibian Sun • Die Republikein • Allgemeine Zeitung Copies of the advertisements are attached in Appendix B.	March 2022
Key stakeholder and focus group meetings and submission of comments		
Focus group meetings	Focus group meetings were held with CTAN on 29 March 2022, with NamWater on 30 March 2022, with the NCAA on 31 March 2022 and with Rent-a-Drum on 1 April 2022. The outcomes of these meetings are summarised and attached under Appendix C.	March 2022
Comments and responses	A summary of questions / comments / issues raised (with responses) during the meetings are documented in the minutes (see Appendix C) and were incorporated in this report.	March – April 2022
Review of EIA Amendment Report by I&APs and authorities and submission of Application to MME and MEFT		
I&APs and authorities review of EIA Amendment	Copies of the EIA Amendment Report with the amended EMP were made available for public review. Electronic copies of the report were available on request from Namisun.	May 2022

TASK	DESCRIPTION	DATE
Report with EMP (Addendum)	Summaries of the report were distributed to all relevant authorities and I&APs on the I&AP database via e-mail (see Appendix B). Authorities and I&APs had the opportunity to review the draft report and submit comments in writing to Namisun. The comments period commenced on the **10 May 2022** and the closing date for comments was **31 May 2022.**	
MME and MEFT review of Final EIA Amendment Report and decision on Application	Namisun (and the appointed environmental specialists) considered all the comments from I&APs and regulatory authorities received during the review period. A copy of the final report with the Application Form, including comments from authorities and I&AP, was submitted to the MME for their review and recommendation to MEFT who will do the final review for decision-making. The final report (including I&APs comments) and Application was uploaded onto the MEFT portal.	June 2022
Communicate decision to I&APs	MEFT's decision regarding the ECC application will be communicated to all register I&APs via email.	After MEFT's review period

2.3.3 SUMMARY OF THE ISSUES RAISED

<u>During the initial I&AP registration and BID-comment period:</u>

Very few comments were submitted by I&APs throughout the EIA process. The comments received from I&APs (also during the focus group meetings) include the following:

- Only a few I&APs contacted Namisun, requesting to be added to the database and to obtain further information about the project.
- The CTAN representative did not raise any issues / concerns relating to the project and indicated that no additional impacts are expected from a tourism perspective.
- NamWater commented about the existence of a servitude along the pipeline and the preferred stay-away width, as well as about the steps for acquiring permission to construct the connection powerline across the pipeline.
- Rent-a-Drum had comments about waste management (removal and disposal and the types of waste items). Comments about waste management were incorporated in this report.
- NCAA commented that compliance with the regulatory requirements related to aviation safety and specifically the Arandis Aerodrome is essential for this project. The key issues raised ensure that the assessment incorporates consideration of glint and glare, as well as the proximity of potential obstacles limitation surfaces, which may affect aviation safety.

During the public review period of the draft EIA (Amendment) Report:

The NCAA forwarded a formal letter with comments to Namisun during the public review period. The observations were itemized as three separate comments and the corresponding responses on them are contained in Table 5. The letter from the NCAA is attached in Appendix C.

TABLE 5: COMMENTS AND RESPONSES

Comment	Response
Section 8.4.1. page 87: Stipulate the prescribed NAMCARs Part 139.11.2 regulatory reference in the paragraph discussing the latter.	The text was amended to make provision for the correct regulatory reference. Refer to Section 8.4.1.
Section 9.3.3, page 106: Provide further elaboration on how the proposed mitigation of reducing and eliminating glare by a tracking system will reduce and / or eliminate the identified hazard to aviation operators.	Elaboration on this matter is provided in Section 9.3.3 (Issue 2), which specifically covers the mitigation and management measures regarding glare to aviation operators. Provision is also made for design requirements, as part hereof.
Section 9.3.4, page 108: The actions required, prior to the erection of any objects such as the powerline, solar plant and mobile crane(s) within 15 km radius of an aerodrome, prescribes that the applicant or interested entity through the aerodrome operator seeks approval from the Executive Director by completing and submitting an application package on the appropriate forms for evaluation.	RUL will engage with the NCAA regarding the application for the erection of permanent and / or temporary structures, prior to the implementation of the proposed project. The respective application forms, FSS-AGA-FORM-032 and FSS-AGA-FORM-033, are of relevance. This requirement is included in Section 9.7.

3 LEGAL FRAMEWORK

This chapter provides an overview of relevant Namibian policies and applicable Namibian legislation and international conventions / treaties applicable to the proposed project.

Statutory requirements relevant to environmental management at RUL is contained in Appendix 1 of the EMP of RUL.

The Republic of Namibia has five tiers of law and a few guiding policies relevant to environmental assessment and protection, which include the Constitution of the Republic of Namibia, statutory law, common law, customary law and international law.

As the main source of legislation, the Constitution of the Republic of Namibia (1990) makes provision for the creation and enforcement of applicable legislation. Article 95 (1) of the Constitution says: *"The State is obliged to ensure maintenance of ecosystems, essential ecological processes and biological diversity and utilisation of living natural resources on a sustainable basis for the benefit of Namibians both present and future"*.

In this context and in accordance with the constitution, Namibia has passed numerous laws intended to protect the natural environment and mitigate against adverse environmental impacts.

3.1 RELEVANT ACTS

The following acts are relevant to environmental assessments in Namibia:

- The Constitution of the Republic of Namibia of 1990.
- The Water Act, No. 54 of 1956 and Water Resources Management Act, No. 11 of 2013.
- Soil Conservation Act, No. 76 of 1969 and the Soil Conservation Amendment Act, No. 38 of 1971
- Nature Conservation Ordinance, No.14 of 1975 (as amended).
- Atmospheric Pollution Prevention Ordinance, No. 11 of 1976.
- Nature Conservation General Amendment Act of 1990, the Nature Conservation Amendment Act, No.5 of 1996, and the Nature Conservation Amendment Act, No. 3 of 2017.
- The Forestry Act, No. 12 of 2001 as amended by the Forest Amendment Act, No. 13 of 2005 and its regulations of 2015.
- National Heritage Act, No. 27 of 2004.
- Electricity Act, No. 4 of 2007
- Environmental Management Act, No. 7 of 2007 and its regulations of 2012.

- Minerals (Prospecting and Mining) Act, No. 33 of 1992:

  The management and regulation of mining activities are guided by the Minerals (Prospecting and Mining) Act, No. 33 of 1992 as well as the Minerals Policy of Namibia (2004), and fall within the jurisdiction of the MME, while the proposed Solar PV Power Plant and its associated connection powerline, also fall under the MME's mandate. A power generation licence for this project is required.

- Civil Aviation Act, No. 6 of 2016 and the Namibia Civil Aviation Regulations of 2001, as amended in 2018:

  Since the project is planned in proximity of the Arandis Aerodrome, the project must comply with the legal requirements implied by the Civil Aviation Act, No. 6 of 2016 and the Namibia Civil Aviation Regulations of 2001, as amended in 2018.

  Part 139.01.13 of the Namibia Civil Aviation Regulations (NAMCARs) of 2001, as amended in 2018, and the Namibia Civil Aviation Technical Standards (NAMCATs) – Aerodromes and Heliports, stipulate the requirements for lights that may endanger the safety of aircraft.

Glint and Glare

Part 1***39.12.7 Lights states:***

"1. General

1.1 Lights which may endanger the safety of aircraft

1.1.1 A non-aeronautical ground light near an aerodrome which might endanger the safety of aircraft must be extinguished, screened or otherwise modified so as to eliminate the source of danger. Compliance Note. See also NAMCARs Part 139.01.13.

- *Therefore, a glint and glare assessment is required prior to the construction of a Solar PV Plant. This assessment is to be conducted by the entity interested in constructing the plant in conjunction with all the relevant stakeholders (e.g., aerodrome operator and pilots).*
- *The assessment should then be submitted to the NCAA for review.*
- *Although, the NCAA has not yet domesticated the technical guidance material for glint and glare assessments, industry best practice is to be adhered to."*

Obstacle Limitation Surfaces

Subparts 11 of the Namibia Civil Aviation Regulations (NAMCARs) of 2001, as amended in 2018, and the NAMCATs – Aerodromes and Heliports, stipulate the requirements for Obstacle Restriction and Removal.

The following are the requirements for the erection of obstacles in accordance with the Namibia Civil Aviation Regulations (NAMCARs) of 2001, as amended in 2018:

Erection of obstacles

(1) *139.11.2 A person may not cause or permit the erection or growth of an obstacle at, or in the vicinity of, an aerodrome, where the obstacle may prevent an aircraft operation from being conducted safely or the aerodrome from being usable.*

(2) *The erection of buildings or other objects in the navigable airspace or in the vicinity of an aerodrome or navigation aid must be in accordance with standards prescribed in Document NAMCATs -* Aerodromes and Heliports*.*

(3) *A person may not cause or permit any object, including new or extension of existing objects to penetrate the obstacle limitation surface, established in accordance with regulation 139.11.3, without the written permission of the Executive Director.*

Subsequently, the above-stated regulations are further supplemented in the NAMCATs - Aerodromes and Heliports, as follows:

139.11.2 Erection of obstacles

(1) *The erection or growth of an obstacle at or in the vicinity of an aerodrome, must not be permitted where the obstacle may prevent an aircraft operation from being conducted safely or the aerodrome from being usable.*

(2) *Buildings or other objects which will constitute an obstruction or potential hazard to aircraft moving in the navigable air space in the vicinity of an aerodrome, or navigation aid, or which will adversely affect the performance of the radio navigation or instrument landing systems, may not be erected or allowed to come into existence without the prior written approval of the Executive Director and if erected in the absence of approval are liable to forced removal without right of compensation.*

(3) *No building or object higher than 45 meters above the aerodrome elevation, or in the case of a water aerodrome, the normal level of the water, maybe erected within a distance of 15 kilometers measured from the aerodrome reference point without the written approval of the Executive Director*.

(4) A person must not cause or permit any object, to penetrate the obstacle limitation surface, without the written permission of the Executive Director, where the object may cause an increase in an obstacle clearance altitude or the height for an instrument approach procedure or of any associated visual circling procedure.

(5) The object referred to in sub-regulation (4) includes a new object or an extension of an existing object above the obstacle limitation surface.

(6) In the event of a conflict of interest between land-use authorities and air space users, air safety must be regarded as predominant and not to be compromised by land development projects or other obstacles.

- Hence, an entity with the interests of erecting structures with the features mentioned in the requirements of the regulatory and technical standard, must seek approval from the Executive Director, prior to the erection of the structures.

- The interested party must complete for evaluation the following application forms; FSS-AGA-FORM-032 (permanent structures) and / or FSS-AGA-FORM-033 (temporary structures), as may be required, prior to the erection of the structure(s). Hereafter, the applications are then evaluated, and a response is provided to the applicant by the NCAA.

3.2 Relevant Policies

Policies and plans currently in force and relevant to this assessment include:

- Namibia's Environmental Assessment Policy for Sustainable Development and Environmental Conservation (1994).
- Policy for the Conservation of Biotic Diversity and Habitat Protection (1994).
- The EIA Policy (1995).
- The National Climate Change Policy of Namibia (September 2010).
- White Paper on the Energy Policy, 1998.
- National Development Plan, 2017/2018 – 2021/2022, guided by Vision 2030.
- Namibia Vision 2030.
- National Biodiversity Strategy and Action Plan (NBSAP) 1 (2002) and 2 (2014).

3.3 Other Guidance and Regulatory Frameworks

Some international legislation, treaties, standards and guidelines – some to which Namibia is a signatory – are also of relevance, including the following:

- Vienna Convention for the Protection of the Ozone Layer (1985).
- Montreal Protocol on Substances that Deplete the Ozone Layer (1987).
- Basel Convention on the Control of Transboundary Movements of Hazardous Waste and their Disposal (1989).

- The Convention on Biological Diversity (CBD) of 1992 details the preservation of rare and endemic species and Article 14 of the convention requires that EIAs are carried out for projects that are likely to have an adverse effect on biodiversity.
- The Convention to Combat Desertification of 1992 advocates the prevention of excessive land degradation that may threaten livelihoods.
- The Convention on International Trade in Endangered Species (CITES) of 1973 regulates the trade in endangered species – specifically species threatened with global extinction and species that may become extinct unless trade in them is strictly regulated.

The RUL tenement overlaps with the NNNP, which is an Important Bird Area (IBA), and therefore potentially sensitive. Furthermore, the wider landscape includes the Dorob National Park (about ten km to the west) and a chain of coastal wetlands (with a Ramsar site at Walvis Bay) and six other IBAs.

IBAs are sites of international significance for the conservation of birds at the global, regional (continental) or sub-regional (southern African) level, selected according to stringent criteria. However, not all IBAs receive official protection.

The Convention on Migratory Species has developed an inter-governmental treaty known as the African-Eurasian Migratory Waterbird Agreement (AEWA). Namibia is classed as a range state but, although guided by the principles of AEWA, is not yet a contracting party to this international agreement.

3.4 Strategic Environmental Assessment and Management Plan

In 2009, the MME, after obtaining funding from the German Federal Institute for Geo-science and Natural Resources (BGR), appointed the Southern African Institute of Environmental Assessment (SAIEA) to conduct a Strategic Environmental Assessment (SEA) for the Uranium Rush in the Erongo Region (SAIEA, 2011).

The Strategic Environmental Management Plan (SEMP), which was the outcome of the SEA, is an overarching framework and roadmap to address the cumulative impacts of existing and potential developments, within which individual projects have to be planned and implemented. Annual SEMP reports measure the performance around twelve Environmental Quality Objectives (EQOs) that show the extent to which uranium mining is impacting the central Namib. Each EQO articulates specific goals and targets that are monitored by a set of key indicators.

Even though the proposed Solar PV Power Plant and overhead powerline would fall outside the NNNP, reference is made to the Environmental Quality Objectives (EQOs) from the Strategic Environmental Assessment (SEA) 'Uranium Rush' (SAIEA, 2010).

The “SEA for the Central Namib Uranium Rush” sets out the likely cumulative impacts of mine-related developments in the NNNP, describes the ‘desired state’ that should be targeted by the various institutions and organizations involved and makes recommendations as to how this desired state can be achieved and maintained (SAIEA, 2010).

The relevant EQOs (and ‘aims’) from the SEA are presented in Table 66 and are incorporated into the EMP, where relevant.

TABLE 6: EQOS FROM THE STRATEGIC ENVIRONMENTAL ASSESSMENT

EQO	AIMS
EQO 1: Socio-Economic Development	Uranium mining improves Namibia and the Erongo Region’s sustainable socioeconomic development and outlook without undermining the growth potential of other sectors.
EQO 2: Employment	Promote local employment and employment equity.
EQO 3: Infrastructure	Key infrastructure is adequate and well maintained, thus enabling economic development, public convenience and safety.
EQO 7: Effect on Tourism	• The natural beauty of the desert and its sense of place are not compromised unduly by uranium mining; and to identify ways of avoiding conflicts between the tourism industry and prospecting/mining, so that both industries can coexist in the Central Namib. • Uranium mining does not prevent the public from visiting the usually accessible areas in the Central Namib for personal recreation and enjoyment; and to identify ways of avoiding conflicts between the need for public access and mining.
EQO 8: Ecological Integrity	The ecological integrity and diversity of fauna and flora of the Central Namib is not compromised by uranium mining. Integrity in this case means that ecological processes are maintained, key habitats are protected, rare and endangered and endemic species are not threatened. All efforts are taken to avoid impacts to the Namib and where this is not possible, disturbed areas are rehabilitated and restored to function after mining/development.
EQO 10: Governance	Regulators and industry protect Namibia’s reputation as a responsible uranium producer by means of ethical conduct and environmentally, socially and financially responsible practices.
EQO 11: Heritage	Uranium exploration and mining and related infrastructure developments will have the least possible negative impact on archaeological and paleontological heritage resources. Survey, assessment and mitigation will result in significant advances in knowledge of archaeological and paleontological heritage resources, so that their conservation status is improved and their use in research, education and tourism is placed on secure and sustainable footing.
EQO 12: Mine Closure and Future land-use	To maximize the sustainable contribution mines can make post closure to society and the region, and to minimize the social, economic and biophysical impacts of mine closure.

4 PROJECT DESCRIPTION

This chapter provides a description of the proposed Solar PV Power Plant Project and the associated connection overhead powerline from the site to the Rössing Substation.

4.1 INTRODUCTION

Power is currently supplied by NamPower to RUL via the national grid (see Section 1.3 for further details). An existing powerline from the Khan Substation is connected to the Rössing Substation onsite. From this substation power is distributed onsite, as well as to Arandis via a 11 kV powerline.

To reduce cost, RUL is investigating all avenues and aspects of its operations to reduce cost. The option to self-generate electricity from a proposed Solar PV Power Plant is evaluated as part of an overall feasibility study for its LoME Project. The capacity is planned at 15 Megawatt (MW) alternating current (AC).

4.2 PHOTOVOLTAIC POWER GENERATION

Photovoltaics is a method of generating electrical power by converting solar radiation into direct current electricity. This is done by using semiconductors that exhibit the photovoltaic effect. The photovoltaic effect is the generation of voltage and electric current in a material upon exposure to light.

Photovoltaic power generation uses solar panels composed of several solar cells connected in series containing a photovoltaic material (see Figure 3).

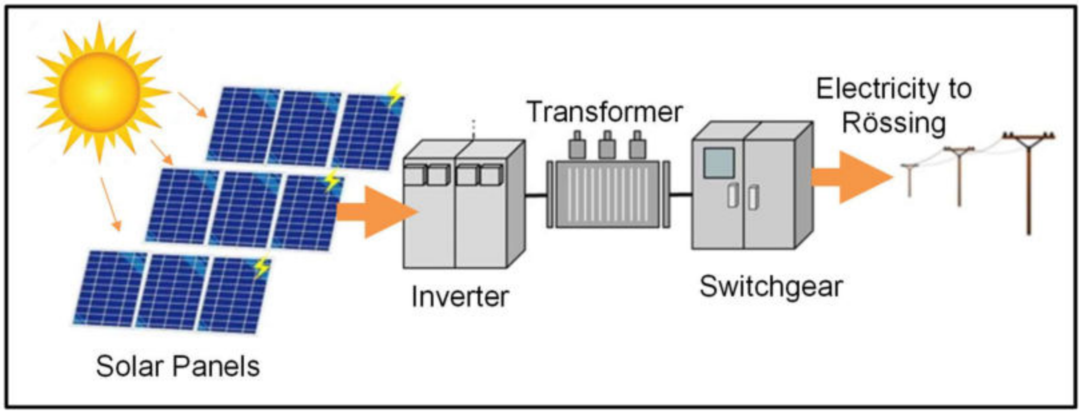

FIGURE 3: DIAGRAMATIC ILLUSTRATION OF THE POWER SUPPLY FROM THE PROPOSED SOLAR PV POWER PLANT

4.3 MODULARS AND SOLAR ARRAYS

RUL proposes to use monocrystalline bi-facial technology for the Solar PV Power Plant. It is anticipated that each module would have dimensions in the order of 2,256 mm (length) x 1,133 mm (width) (i.e. ±2.88 m^2), with a 540 W (peak) output each. The maximum height of the panels would be ± 1.8 m. 572 double-table PV trackers are proposed, each consisting of 2 strings of 29 modules each, resulting in a total of 33,176 modules. The total area required for the Solar PV Power Plant is ~72 ha, including associated infrastructure.

The PV modules would be placed on horizontal single axis trackers, which will be oriented north south (see Figure 4 as an illustration). The PV modules are mounted on an actuated torque tube, which will tilt the modules at an angle of 55 to 60 degrees from the horizontal, facing the rising sun in the east, then gradually tilt to a horizontal position (0 degrees) at noon and again to an angle of -55 to 60 degrees to the west, during sunset. The dimensions of the single axis tracker that will be used on the proposed site, is illustrated in Figure 5. Solar irradiance is captured on the monocrystalline silicon PV cells and emit the direct current (DC) into inverters that will convert the current into AC. The AC is then fed into a transformer station and further via an overhead powerline into the Rössing Substation (see Figure 2 for the proposed powerline route).

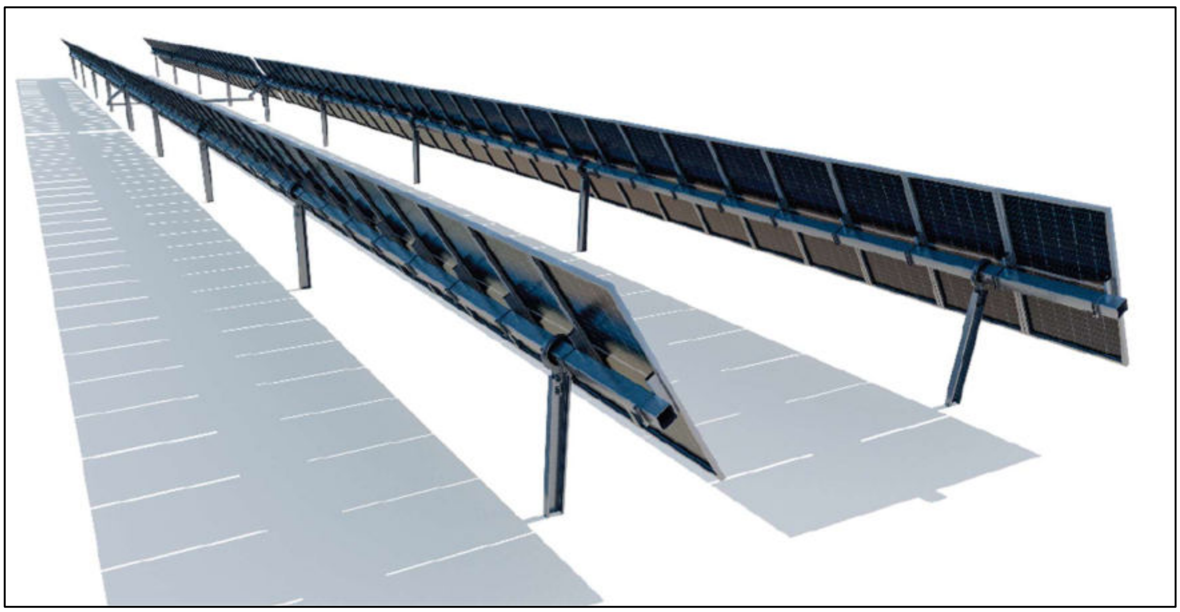

FIGURE 4: DIAGRAMMATIC ILLUSTRATION OF A SINGLE AXIS TRACKER

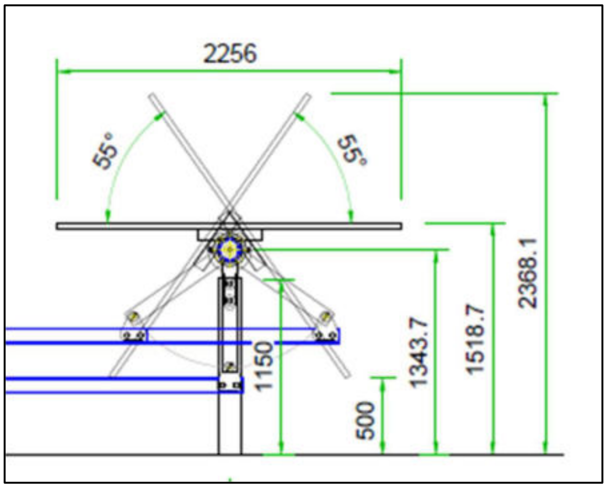

FIGURE 5: SKETCH TO ILLUSTRATE THE DIMENSIONS OF THE SINGLE AXIS TRACKER

4.4 LOCATION OF THE PROPOSED PROJECT AND LAYOUT

The proposed Solar PV Power Plant is planned on a portion of RUL's Accessory Works Area, described in Section 1.2, and illustrated in Figure 2.

Although relatively large sections of the proposed project site were previously prone to disturbance by the construction activities of the road and pipeline respectively, a good stand of natural vegetation occurs, mostly confined to two ill-defined drainage lines that cross the site from southeast to northwest. Overall, the terrain is flat with a very gentle decline towards the northwest. Except for a row of survey beacons, no other structures occur onsite.

Based on the initial screening study, including a site visit by the Environmental Team and interactions with the RUL Technical Team, the proposed layout was refined to take cognizance of the above-mentioned environmental sensitive areas (i.e., drainage lines / "project exclusion zones") within the proposed project footprint. Most parts of two large drainage lines, for example, have been excluded as positions for the plant infrastructure, as can be seen in the schematic layout (Figure 6) and the design layout Figure 7. Refer to Sections 5, 6.4 and 6.5 for further details regarding the above-mentioned environmental sensitivities and the project layout options that were considered by RUL.

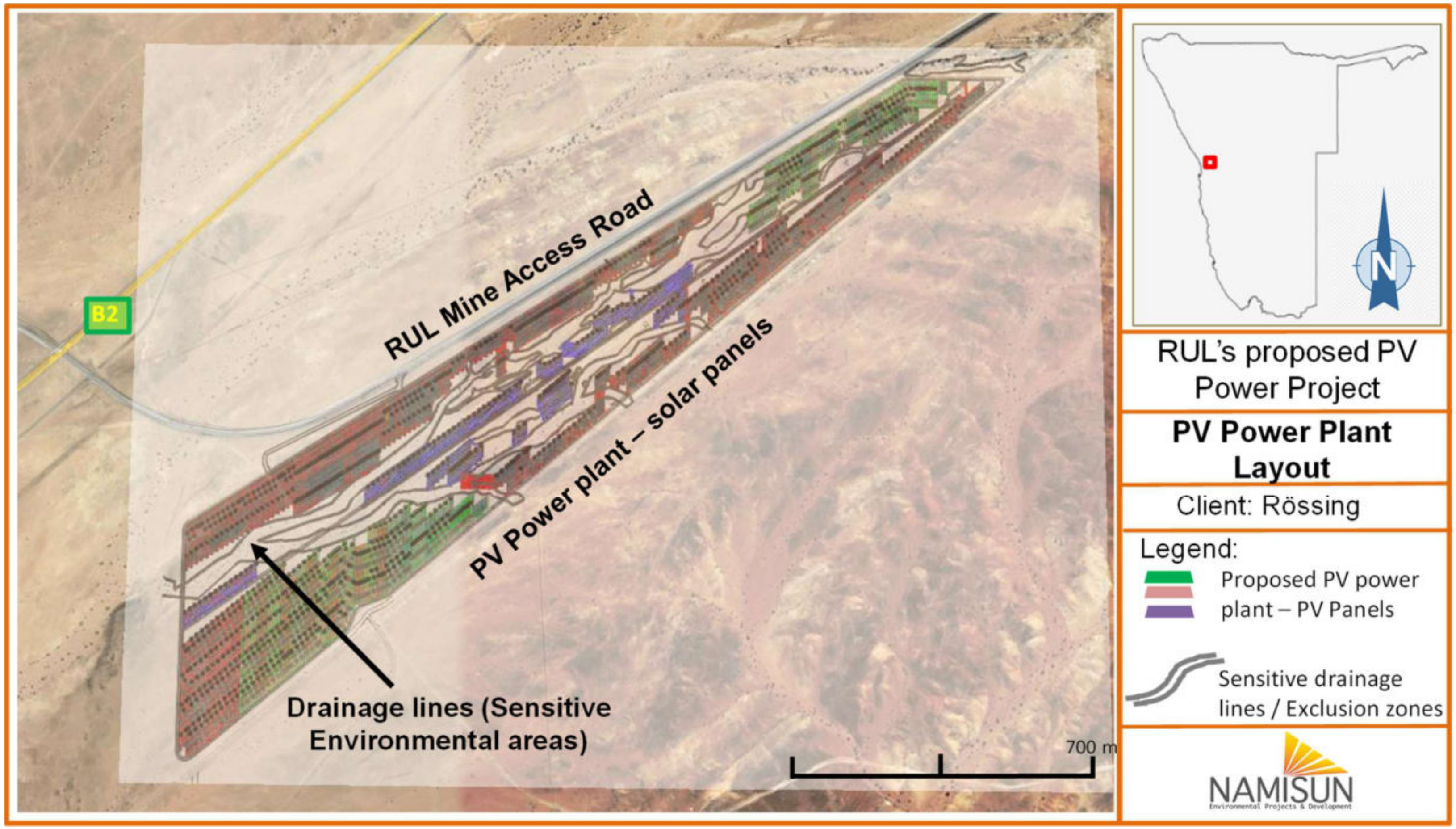

FIGURE 6: SCHEMATIC OF THE PROPOSED PV PLANT LAYOUT – AVOIDING THE DRAINAGE LINES ("PROJECT EXCLUSION ZONES")

(Ref: Google Earth)

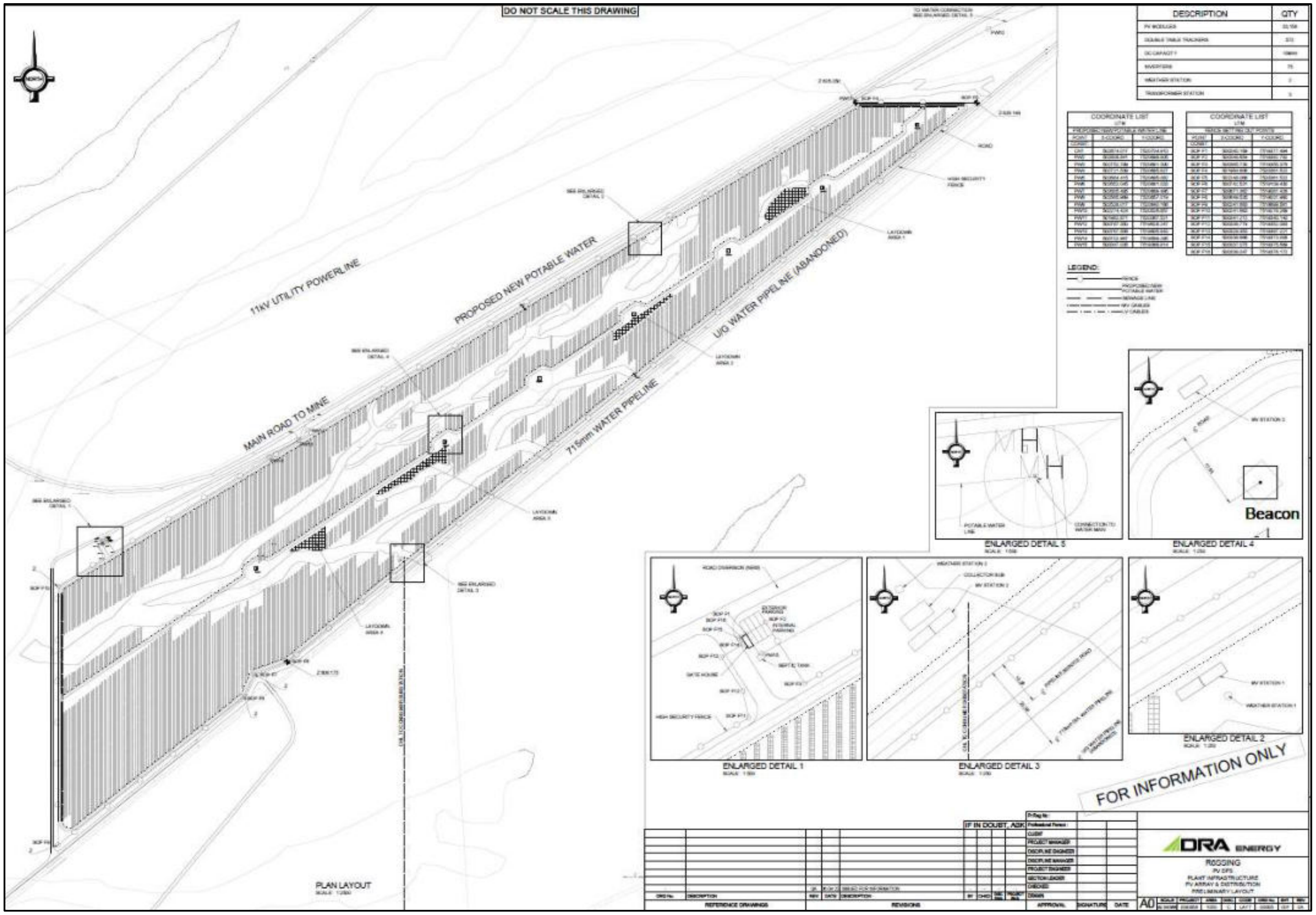

FIGURE 7: PROPOSED PV PLANT DESIGN LAYOUT

4.5 Associated Support Structures / infrastructure and services

Provision is made for a temporary construction camp and laydown area on the roadside of the proposed site.

Access to the site is also planned on the roadside of the site and no new access road is necessary.

The entire site will be fenced-in to prevent unauthorized access. In addition, there will be 24-hour closed-circuit television (CCTV) cameras and security guards onsite. No flood light or other external lighting is planned.

4.5.1 Powerline

To connect the proposed Solar PV Power Plant with the Rössing Substation an overhead distribution powerline of ~6.95 km is planned. For a short stretch the proposed new powerline will run in a southwest direction and then adjacent to the existing 11 kV line to Arandis (Figure 2).

The proposed structure consists of an H-pole design with crossbar, both either wooden or galvanized steel, with three conductors suspended from the crossbar and horizontally aligned, and a shield (earth) wire and an optical ground wire (OPGW) above. Each pole structure will have 4-6 stay wires. The specification is for a 33 kV structure, but the line will be operated at 11 kV.

Further technical details relating to the proposed powerline is summarised in Table 77.

TABLE 7: PROPOSED POWERLINE TECHNICAL DETAILS

ASPECT	DETAILS
Servitude	The proposed powerline will be constructed within the same corridor / servitude as the existing 11 kV powerline in the eastern section (4.9 km), with a new servitude towards the north in the final 2.1 km. The existing 11 kV powerline is a "wishbone" wooden monopole design.
Centreline distance between existing and proposed line (where they run in parallel)	13 m
Total length of powerline	~6.95 km
Span length between poles	Average ~80 m (range 47 - 154 m)
Pole structure	H-pole configuration, using steel or wooden upright poles (depending on span length); and steel or wooden crossbar
No. of structures	84
Pole height	Range 10.0 - 19.4 m (above ground)
No. of stay wires to each structure	4 - 6
No. of conductors and insulators per pole structure	3 in parallel, suspended from the crossbar in horizontal configuration
Length of insulator	0.8 - 1.0 m

ASPECT	DETAILS
Earthing system	A shield (earth) wire and an OPGW (optical ground wire) will each run horizontally above the conductors. An earth wire will be connected with the horizontal shield wire and run straight down to the bottom of each pole. Typically, six earth rod poles will be installed in the ground (min 500 mm).
Steel perching bar for birds	Fitted onto the top of each steel pole: 530 mm long, 220 mm above pole (as a mitigation for bird electrocutions)

4.5.2 BUILDINGS / OTHER

A guard house, parking area, ablution facilities with a septic tank and security office are planned at the access gate. Two transfer stations and a collector substation will be built onsite. No new main electrical substation would be required, as the proposed project would link directly into the existing Rössing Substation.

A weather station is also planned onsite.

4.5.3 BATTERIES

No batteries will be used for night-time power supply.

4.6 WATER SUPPLY

A freshwater pipeline (150 mm diameter) high-density polyethylene (HDPE) pipe will be installed below ground from the RUL Reservoirs to provide potable water onsite, already during the beginning phase of construction.

For operations freshwater will be needed in the kitchen and ablution facilities, but also to clean the solar panels from dust, which can affect their productivity.

Water consumption for module cleaning is approximately 9,700 L/MWp. There would be 6 cleaning cycles with a total PV DC capacity of 18 MWp. Therefore, the approximate yearly water consumption is 1,050 m^3.

4.7 WASTE MANAGEMENT

During the construction phase the appointed contractor will be responsible for the collecting, handling, temporary containment, and removal of waste. General waste must be removed from site and taken for disposal of at the Swakopmund Municipal waste dump.

Expected waste items include damaged materials, waste from packaging and recyclables such as pallets, boxes, paper and plastics. Damaged materials will be handled as hazardous waste, if classified so, otherwise as general waste.

Mobile toilets will be provided by the contractor during the construction period, and it is the responsibility of the contractor to manage the toilets during this phase.

Waste management onsite will be done according to the standards of RUL – the necessary protocols and procedures exist and will be applied to all kinds of waste management, including the cleaning and removal of hydraulic oil spills, hazardous waste, etc.

4.8 PROJECT PHASES AND RELATED ACTIVITIES

The implementation of the project is dependent on the approval of the EIA (ECC) by MEFT as well as the issuing of a generation license by MME. Provided the necessary authorizations and approval from the RUL Board have been obtained, procurement of the proposed project is planned to commence in December 2022 and construction to commence in May 2023 and completed by December 2023.

4.8.1 CONSTRUCTION PHASE

During construction approximately 80 people would work onsite over a period of ± 6 months, peaking at approximately 180 people over a period of ± 2 months. The construction workers would be sourced, as far as possible, from within the Erongo Region. The appointed contractor would transport the workers from nearby municipal areas such as Walvis Bay, Swakopmund and Arandis to site and back daily.

Onsite general construction activities include excavations for foundations and trenching for cables and pipes, drilling, civil works and building activities, laying of cables and pipes, storage, handling and use of building material, the use of construction vehicles and equipment, transport of materials and equipment, the handling, storage, and transportation of non-hazardous and hazardous goods and waste, disposal and treatment of contaminated soil, use of an access and internal roads, refuelling of equipment and the use of water and electricity.

No blasting is considered during construction, only drilling will be allowed onsite where holes are needed to be made for the powerline.

Building material, equipment and all components will be transported to the site and a temporary storage area with a contractors' laydown area onsite is planned. Other temporary facilities proposed previously include waste collection and storage areas, temporary change houses and sanitation facilities, water and electricity supply and a parking area for vehicles and equipment.

Concrete will be mixed and poured onsite; subsequently all concrete constituents (crushed stone, cement, water, and sand) must be transported to and stored onsite. Ready mix concrete trucks will also be allowed where the plant requires continuous pouring, and relevant standards must be maintained.

4.8.2 OPERATIONAL PHASE

A small number of people may be permanently employed during the operational phase of the project. These persons will be responsible for daily tasks as well as routine inspections, monitoring, and maintenance.

Security personnel will be from a contracted company.

4.8.3 DECOMMISSIONING AND CLOSURE

If the current LoME project is proven feasible, the life of the mine may be extended by a further ±10 years. This implies that the Solar PV Power Plant is planned to be utilised for approximately 12+ years. RUL intends to leave the power plant behind as a positive legacy, i.e., a new owner can take over and operate the power plant if (and when) RUL closes.

5 ALTERNATIVES

This chapter describes the various alternatives that were considered as part of the planning of this project.

5.1 Alternative Supply of Electricity

During recent years PV power has reduced in price and has become a feasible and attractive alternative to power generated from fossil fuels. Nowadays PV power is widely used, has a low operational cost and has the notion of being easily financed (see also Section 1.3).

Against this scenario, RUL considers the construction and operation of a Solar PV Power Plant as part of an overall feasibility study for its LoME Project. To reduce costs at RUL, one of the options under investigation is to generate electricity from the proposed Solar PV Power Plant.

5.2 Alternative Locations

Some alternative sites were considered before it was decided upon the preferred site. Considerations included terrain, and in particular topography, available area and connections to existing infrastructure. Furthermore, the location of the preferred site was also evaluated in terms of its eventual relinquishment and alternative use and operation of the plant after RUL's operational activities cease – for this reason the site must be located where it is not going to be affected by infrastructure earmarked for demolition and dismantling.

The current site was chosen because it ranked to be the most advantageous location.

5.3 Alternative Layout because of Sensitive Biodiversity

The conceptual design entails that some of the infrastructure would have been placed within and across the sensitive drainage lines (refer to Sections 6.3, 6.4 and 6.5 for further details). See Figure 8 for one of the original designs by RUL for the PV Plant layout, i.e. with the infrastructure (PV panels) being placed in the drainage lines).

Drainage channels in the Namib Desert are very sensitive because they support critical ecological processes, stores moisture in its sandy aquifers, and supports a relatively higher biomass and a more complex food web (Namisun, 2022).

Furthermore, placement of infrastructure in the drainage lines could have an impact on the free flow of water and drainage during a storm event, however, the type of infrastructure (i.e. the PV panel poles) would cause limited obstruction.

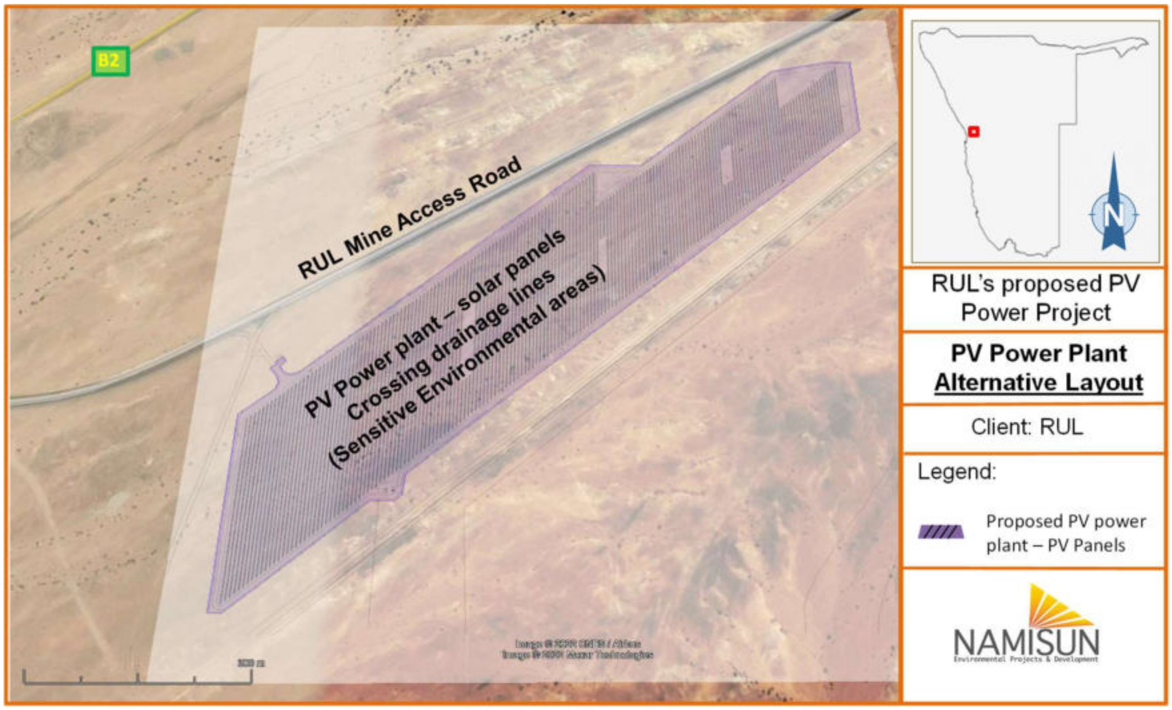

FIGURE 8: PV PLANT ALTERNATIVE LAYOUT

Against this consideration, specific exclusion zones were determined – these should be avoided due to their sensitivity. Resulting from this flexible approach, the initial site was enlarged to avoid damage to the drainage lines, including sensitive vegetation onsite although it implies a larger footprint (~72 ha) and a fragmented layout of the physical infrastructure. As such the detailed layout was further refined to take, as far as possible, plant species of conservation concern occurring on the site into consideration (see Section 4.4 and Figure 6 and Figure 7).

5.4 POWERLINE ROUTE OPTIONS

An 11 kV powerline is required to connect the proposed Solar PV Power Plant to the Rössing Substation onsite. Instead of creating a powerline that is stand-alone, the route of the required new powerline was selected to run for its maximum length adjacent to the existing 11 kV powerline from the Rössing Substation to Arandis.

This means that, except for the short stretch of the powerline immediately from the power plant site to the existing powerline route, no new service road along the powerline is required (see also Figure 2).

5.5 No-Go Option

The No-Go alternative relates to the option of not developing the proposed Solar PV Power Plant and its associated connection powerline. In this case, the residual impacts (i.e., impacts after implementation of mitigation measures) of the proposed activities would not occur (refer to Sections 7 and 8). The specific proposed project area (i.e., the already disturbed area) would have to be rehabilitated.

Implications in case RUL does not go ahead with the proposed project are listed as follows:

- RUL will not have any cost savings on power supply.
- The potential job creation during construction will not happen.
- The renewable energy industry in Namibia will not benefit from jobs related to this project and the transfer of skills to locals.
- Without this project, an innovation opportunity to generate renewable (clean) energy is lost.
- Options to generate future power supply would be compromised and fossil-fuel-based energy would possibly be used to supply for the growing national demand. This could result in potential (cumulative) negative environmental and social impacts elsewhere.
- Without exploring the alternative renewable energy sources in Namibia with projects like these, the country will continue to mainly rely on electricity imports from outside Namibia.
- There would be a lost opportunity to improve Namibia's energy security and to diversify the country's energy mix.

6 DESCRIPTION OF THE CURRENT ENVIRONMENT AND LINK TO ENVIRONMENTAL ASPECTS AND IMPACTS

An understanding of the environment and the sensitivity of the site and surroundings is important to understand the potential impacts of the project. This chapter provides a general overview of the current baseline conditions associated with the proposed project, drawing on the baseline information provided by RUL and considering the potential changes and subsequent management measures implied – with reference to the additional investigations and specialist input. Furthermore, this chapter draws links between the various environmental aspects and commitments in the approved EMP to identify which aspects require further infestation / re-assessment and potentially an update of the management and mitigation measures.

This chapter was compiled by utilizing the following sources of information:

- The existing, approved EMP (RUL, 2021).
- Flora specialist study for the RUL Solar PV Power Plant (EnviroScience, 2022) (Appendix E).
- Avifauna Scoping and Assessment Study (Report) (ACS, 2022) (Appendix F).
- Visual Impact Assessment Report (GYLA, 2022) (Appendix G).
- Dr John Kinahan conducted previous archaeological studies and assessments for RUL, covering the entire tenement. The findings of these assessments and the subsequent management and mitigation measures are described comprehensively in the current approved EMP and were considered in this assessment.
- Atlas of Namibia (Mendelsohn et al., 2002).
- Site visits by Namisun and technical team in February 2022.
- Consultations and focus group meetings with I&APs.
- Google Earth.

Only baseline environmental information specific to the proposed Solar PV Power Plant and the associated connection powerline are described in this chapter.

6.1 CLIMATE

No new or updated information in addition to the information contained in existing documents was necessary. Based on the climatic properties described in existing documents, the following remarks are relevant as background information:

- Annual average precipitation – in the form of rain or fog – is low, potential evaporation is high, and the range of temperatures are wide. Combined, these factors result in a water-stressed environment with adapted vegetation growth, implications for water supply and management, and required dust suppression.

- Due to the erratic nature of rainfall in the area, there is a potential for episodic flash floods. This means that provision should be made for stormwater events and flood and erosion control measures, despite the long dry periods in between.
- The wide diurnal ranges in temperature and the contrast between stable and windy periods determine the airborne dispersion of dust and other atmospheric impurities. Activities during construction have the potential to generate airborne dust and other pollutants. These activities are temporary though and no residual impacts after construction are expected. During stable periods the ground level concentrations are the greatest onsite, which may have impacts on workers and vegetation, while it is mobilized and dispersed during windy periods, which may impact third parties (e.g., residents of Arandis) and lead to wind erosion.

6.2 Topography and Soils

The proposed site of the Solar PV Power Plant has a gentle gradient, sloping from 630 m above mean sea level in the east to 608 m above mean sea level in the west. Despite the low elevations, sporadic flash floods of a high intensity have the potential to cause extensive fluvial erosion.

Plains and wide, shallow washes characterise the study area. Quartz gravel covers most of the plains, and sand dominates in washes. The underlying granite is exposed in some sections of these washes. These drain largely in a north-east to south-west direction. Soils at the proposed project site are mostly shallow lithosols and locally arenosols in the washes (EnviroScience, 2022).

The importance of soil is highlighted here because soil plays an indirect but critical role as it provides important ecosystem services. Soil is a filtering medium for water and a growth medium for plants, and it constitutes shelter and a habitat for specialist vertebrate and invertebrates.

As the soils do not retain water well and the nutrient levels are generally low, vegetation cover is sparse, and the organic content is low. The scarcity of vegetation cover and further restriction of plant growth because of disturbance reduces the amount of organic matter that is added to the soil, which results into a lower fertility causing, in turn, a lower ability to harbour plants. Moreover, the removal, displacement, and compaction of soil restricts its ecological functionality as a filter and growth medium, resulting into a reduced infiltration and recharge rate of water on the one hand and compromising the rooting ability of plants on the other hand. Compaction may also result into a lack of aeration, an increased likelihood to erode and a reduced ability to harbour plants.

The currently proposed layout under consideration implies selective earthworks (i.e., only where it is necessary), excavations for the preparation of foundations and trenches for cables. Large-scale earthworks are thus not expected. However, compaction of parts where vehicle use is necessary may occur.

Based on the most recent information relevant to the project, potential disturbances on the soil onsite through construction activities can be summarized as follows:

- Excavations and trenching can loosen soil, albeit temporary and localized, which may result into a loss of soil in the form of wind erosion as well as potential enhancing of water erosion over a short period (during construction).
- Soil can be compacted by heavy equipment, vehicles or when it is overlain by heavy structures.
- Construction activities have the potential to cause contamination of soil through leaks and spills from equipment and vehicles, thereby impacting on the soils' ability to sustain vegetation. Contamination is also closely related to the potential contamination of surface and groundwater.
- Excavations, trenching and the building of new structures and infrastructure might create a temporary danger to people and animals.
- The new structures on the site can create minor changes to the surface water drainage.

It must be noted that the soil over parts of the current site is already disturbed because of previous construction activities (apparently of the water pipeline and access road).

Avoiding of large-scale earthworks (through selective clearing and grubbing) is the best form of mitigation, especially to minimize impacts such as erosion, compaction and the loss of the soils' ecological functionality.

6.3 Surface and Groundwater

Surface runoff is a rarity in the part of Namibia where the Solar PV Power Plant is proposed – water either evaporates or percolates into the ground shortly after a rainfall event. Occasional strong rainfall events, however, can lead to temporary surface runoff. This runoff is a key driver of the desert ecosystem by means of recharge, rejuvenation and nutrient input. Outside of the drainage lines, the terrain has a gentle gradient, and no obvious surface wash is present. Sheet wash after episodic heavy downpours over these flat terrains are possible, also because the crusts reduce rainfall infiltration rates and enhance run-off.

The occasional surface runoff in drainage lines is concentrated and responsible for the recharge of aquifers in proximity of the drainage lines, in the case of the shallow drainage lines water retention is mainly confined to the loose alluvium. Recharge of groundwater from precipitation is expected to be low to very low otherwise.

The direction of surface drainage is south-westwards (refer to Figure 6), towards a confluence near the northwest corner of the site.

Drainage lines are important sources of nutrients though, and in combination with the occasional run-off, gives reason why plants concentrate along the lines. The sensitivity of the drainage lines of the Namib Desert has been confirmed in numerous studies, and as a result the placement of any permanent structures within or across the other smaller drainage lines onsite was discouraged.

Based on the existing information, the following points can be highlighted:

- The permanent placement of surface infrastructure within drainage lines is unlikely – not only because it is ecological insensitive, but also because it will be prone to the risks of flash floods and erosion. In addition, the placement of structures inside the drainage lines creates unnecessary topographical challenges. At most underground channelling of cables across the drainage lines is considered.
- Construction of the facilities and structures for the Solar PV Power Plant may introduce small alterations of surface runoff but no significant impacts are expected. Damming or redirecting of surface water, on a small scale and only temporary, is possible but may only affect small (i.e. localised) areas.
- Accidental spills and leaks of hydrocarbons from vehicles and equipment and leaks and spills of effluent during construction are possible. However, potential pollution sources from the proposed operations are expected to be of a diffuse nature and no significant impacts are expected. It is unlikely that such incidents will be of a large extent and the incidents will be managed according to existing management mechanisms. Potential pollution of surface and groundwater is therefore unlikely.

6.4 BIODIVERSITY

Construction activities have the potential to destroy biodiversity through the physical destruction of organisms and habitats. Drainage lines and washes are ranked as sensitive habitats because they support a critical ecological process (water flow), store moisture in their sandy aquifers, and consequently support a relatively higher biomass and a more complex food web. Construction in the drainage lines and washes of the site is discouraged as a result of, not only the ecological reasons, but also the risk of flash floods that may cause damage.

6.4.1 FLORA

The following section is an extract from the flora specialist study (EnviroScience, 2022) (see Appendix E for the full report), which was undertaken by Dr Antje Burke in March 2022, near the end of the vegetation season.

The proposed area for the Solar PV Power Plant and pipeline presents a plain which is dissected by a network of dry washes. There are some low ridges to the south and north of these plains, but only the water pipeline, and the powerline will cross these ridges. The perennial vegetation (trees, shrubs and multi-seasonal herbs) is mostly concentrated along and around washes and in shallow depressions. The plains show a patchy cover of annual grasses during the survey period but will be barren during the dry season. Overall, the vegetation reaches about 0.5 m height, except for the trees and shrubs in the washes. Here single trees can grow up to 2 m high and shrubs are on average 1.5 m high. The pipeline route crosses these in its northern section but crosses an area of undulating granite hills in its southern section where it approaches the mine.

The vegetation overall is relatively diverse, despite the arid area, and it is difficult to allocate one dominant perennial plant species. However, the annual grass *Stipagrostis hirtigluma* subsp. *pearsonii* dominated both washes and plains during the survey period, but these will disappear during the dry season. The dwarf shrubs *Adenolobus pechuelii* and *Monechma genistifolium* are common in drainage lines and so is the succulent *Aloe asperifolia*, which grows largely along the banks. There are also *Acacia reficiens, Boscia foetida, Commiphora saxicola* and *Parkinsonia africana* trees. The undulating granite hills, although still dominated by the shrubs *Adenolobus pechuelii* and *Zygophyllum stapffii* support additional species such as *Adenia pechuelii Euphorbia gariepina, Lithops ruschiorum* and *Petalidium canescens*.

The section of undulating hills crossed by the powerline, however, is very sparsely vegetated, but some populations of the protected *Lithops ruschiorum* occur to the east of the alignment. These are not affected by the powerline though.

Plains and washes grade into each other and particularly species growing along the banks of washes cannot be clearly allocated to one habitat only. The habitat allocation shows what was generally observed during the rapid field survey, but more species can possibly also be found on plains. A species list is presented in Annex E of the Specialist Report (Appendix E).

Conservation status of the flora

Just over 50 plant species were recorded during the site visit. This included the annual flora such as herbs and geophytes. None of the recorded plant species are red-listed, but there are two protected species: *Aloe asperifolia* and *Commiphora saxicola*. Ten endemic and one near-endemic plant occur in the project area, but none of these with such a limited distribution that the planned development may imperil the survival of the species. There are also some interesting species without formal protection such as the small bushman candle *Sarcocaulon salmoniflorum* and the elusive dwarf grass *Triraphis pumilio*. Most of the species occur in the washes.

6.4.2 FAUNA

The absence of animals onsite might be ascribed to the proximity of the built areas of Arandis, RUL's mining and associated activities, existing disturbances and the proximity of the access road and railway line.

The following is an extract from the approved RUL EMP that provides a summary of animal life at the RUL Mine in general (RUL. 2021):

"The abundance and diversity of spiders is relatively lower than expected, and the numbers of solifuges is exceptionally low, in contrast to the central Namib which is known as a world hotspot of solifuge diversity. Fourteen scorpion species are known to inhabit the Rössing licence area, of which three are classified as threatened. A total of 271 species of ground-living insects are recorded from Rössing, and this excludes flying groups such as moths and lacewings. Of the 271 species, 20 are classified as threatened.

The Namib Desert is known for its reptile diversity, particularly of lizards and geckos. At Rössing 33 reptile species are expected to occur. Of these, one (a tortoise) is classified as threatened but it prefers a moister habitat and its occurrence in the area is very marginal. The Namib chameleon (*Chamaeleo namaquensis*) is more common. Information about the endemic Husab Sand Lizard (*Pedioplanis husabensis*) is limited. Only small numbers of this species and relatively small areas of occurrence – rocky terrain along the lower Khan and Swakop Rivers – are recorded. By the precautionary principle the species is classified as threatened.

Three species of frogs are known to occur at Rössing, none of which are classified as threatened. The Namib Desert has relatively low avifauna species diversity but does have a relatively high occurrence of endemics and near endemics. From a local perspective the Khan River has the highest bird species diversity, indicating the importance of water availability and consequent supported plant life as well as the diversity of cliff habitats. Two species are classified as threatened.

The rocky hillsides, in particular those located in Lower Dome and along the Khan River are regarded as the most important habitats of the scarce invertebrates at Rössing.

Mammal diversity at Rössing is not very high, as is typical in the central Namib. Climatic variation is closely coupled with marked changes in the abundance of animal species. Many of the animal species that occur around Rössing use a wide range of habitats or may cross a wide range in the course of migrating from one habitat to another. Short-lived annuals dominate the plains after local showers of rainfall and provide a vital source of pasture to opportunistic grazers. Large mammal species occur occasionally because they are nomadic and use three main migration routes. Watering points like the pools of the Khan River and the springs are particularly important in attracting animals and serve as orientation guides along migration routes. Common animal species include Klipspringer, Springbok, Ostrich, Kudu, Hartmann's zebra, dassie (Rock hyrax), Black-backed jackal, Baboon and rodents (particularly gerbils)" (RUL, 2021).

With reference to Section 4.4, relatively large sections of the proposed project site were previously prone to disturbance by previous construction activities. However, natural vegetation occurs, mostly confined to the two ill-defined drainage lines. Even though very limited fauna (i.e. only few invertebrates and a very few reptiles) were found onsite during the site visit, some of the common animal species, mentioned above, would likely move through this area.

6.4.3 AVIFAUNA

Information presented in this section has been sourced from the avifauna specialist study (ACS, 2022). Two field visits were also conducted to ensure that the information collected is correct and comprehensive. See Appendix F for the specialist study that was composed accordingly.

Sensitive habitats

According to the baseline and scoping of bird habitats and species, the study area is potentially sensitive in terms of avifauna, especially when viewed in the broader context of adjacent protected habitats that include two nationally protected areas and a chain of coastal wetlands (with a Ramsar site and six IBAs), and its proximity to the ephemeral Swakop River system.

Sensitive bird species

A total of 130 bird species has been recorded in the study area and surrounds, representing around one fifth (19%) of the 676 species currently recorded in Namibia. This species richness is regarded as relatively low, but in accordance with the arid environment.

The bird checklist for the study area includes 10 (8%) species that are currently classed as Threatened in Namibia (Simmons et al. 2015, Brown et al. 2017, referenced in ACS, 2022), of which five (63% of the total) are also Globally Threatened.

The checklist also includes three species (2%) that are near-endemic to Namibia, and at least three Red Data species with migrant status. Other (non-Red Data) migrant species have also been recorded in the area. During the site visit, no evidence of bird breeding was recorded in the areas under investigation.

<u>Priority bird species</u>

Risk assessment and mitigation efforts are directed towards priority species, namely those that have a high biological significance, i.e. primarily Red Data species (including any with migrant status) and/or endemic or near-endemic species.

Twenty-one priority species have been identified as being potentially at risk in terms of the proposed project (including the new powerline). These comprise:

- Fourteen high priority (Red Data / near-endemic / migrant) species; and
- Eight non-Red Data / non-near endemic priority raptor species.

A third group of species has the potential to impact on infrastructure; seven examples are provided.

The priority species may be divided into the following groups, with the risk indicated, as follows:

- <u>Ten Namibian Red Data species (five of which are also Globally Threatened)</u>
    - Large terrestrial / cursorial species (1):
        - Ludwig's Bustard (Endangered, Globally Endangered; nomadic; medium-high risk).
    - Raptors (4):
        - Martial Eagle (Endangered, Globally Endangered; resident; low-medium risk).
        - Lappet-faced Vulture (Endangered, Globally Endangered; resident, with extensive movements in younger birds; low-medium risk).
        - Booted Eagle (Endangered; [intra-African and] Palearctic migrant; low risk).
        - Verreauxs' Eagle (Near Threatened; resident; low risk).
    - Aquatic species (5)
        - Lesser Flamingo (Vulnerable; Globally Near Threatened; nomadic, [partial] intra-African migrant; medium risk).
        - Greater Flamingo (Vulnerable; nomadic, [partial] intra-African migrant; medium risk).
        - Great White Pelican (Vulnerable; sedentary, nomadic; medium risk)

    - Maccoa Duck (Near Threatened, Globally Vulnerable; resident, nomadic; low risk)
    - Black-necked Grebe (Near Threatened; resident, nomadic; low risk)

- <u>Two species near-endemic to Namibia (90% of population)</u>
    - Rüppell's Korhaan (sedentary; medium-high risk)
    - Gray's Lark (nomadic; medium-high risk)
- <u>One species near-endemic to southern Africa (and collision-prone)</u>
    - Namaqua Sandgrouse (nomadic, medium-risk)
- <u>One Palearctic migrant</u>
    - Lesser Kestrel (Palearctic migrant; low risk)
- <u>Eight other raptors (all Least Concern / Secure, but vulnerable to powerline interactions)</u>
    - Black-chested Snake Eagle (at medium risk to powerline collisions and electrocutions; medium risk)
    - Spotted Eagle-owl, Pale Chanting Goshawk, Rock Kestrell (at low-medium risk to electrocutions, and collisions; low-medium risk)
    - Lanner Falcon, Western Barn Owl (low risk)
    - Augur Buzzard, Greater Kestrel (low risk)

Potential impacts on birds should therefore form an important component of the assessment of the construction of the proposed solar PV facility and its associated infrastructure. Cumulative impacts are also an important consideration, including the increase. Refer to Sections 7 and 8 for further details and the assessment of potential impacts.

6.4.4 ENVIRONMENTALLY SENSITIVE AREAS ONSITE AND LINK TO IMPACTS

Due to their species richness, occurrence of protected plant species and ecosystem services that are provided to this area, the washes are clearly sensitive areas. Wildlife and small fauna such as invertebrates use these more densely vegetated washes for shelter and as a food source. These washes should therefore be left undisturbed as far as possible. (EnviroScience, 2022).

Based on the existing information and additional field work by the Environmental Team at the proposed site and input from the specialists, the following points can be further highlighted:

- Key biodiversity processes and the functional linkages of parts in the ecosystem in an arid environment is closely related to surface runoff because flowing water dictates many of the spatial arrangements and scale of ecological processes. For this reason, the project will avoid, as far as possible, any development in and across the drainage lines and it is unlikely that any substantial encroachment into the drainage lines, and their verges and banks will occur.

- Development of the project can have direct or indirect impacts on biodiversity composition (due to physical destruction, or pollution) – on species and their abundance, specifically on the protected species. As a result of the potential impacts there might be a change in numbers, which may have a disproportionate effect on the ecosystem's stability or resilience. Although none of the protected species are known to be restricted in distribution to the site, these impacts may have wider relevance than the site alone.
- Establishing of permanent structures within the sensitive parts (drainage lines and dense concentrations), which may fragment or destruct important habitats, is unlikely, but habitats outside of the drainage lines can be temporarily impacted by construction activities.
- Fencing of the site can fragment habitat links and disturb the movement patterns of animals.

Potential impacts on biodiversity are further assessed in Chapters 7 and 8 of this report.

6.5 ARCHAEOLOGY

The immediate vicinity of Arandis is known to have a relatively sparse distribution of archaeological sites, besides of disturbance because of a wide range of reasons (urban development, construction of linear infrastructure, etc.)

Information for this section was retrieved from the existing EMP (RUL, 2021).

A comprehensive assessment conducted in 2007 documented a total of 49 archaeological and historical sites on the tenement of RUL, mainly outside the mining operational areas, meaning that it is unlikely that important archaeological and historical sites were destroyed in the course of mining activity. Although there is some evidence of upper Pleistocene occupation, most of the archaeological sites date to within the last 5,000 years. Historical sites relate to the narrow-gauge railway that operated between Khan Mine and Arandis siding until about 1918.

Many of the archaeological sites were confined to the west of the tenement and date between 2800 BC and AD 380. The third millennium BC, in climatic terms the mid-Holocene, was a period of above average rainfall in the Namib. This cluster of sites relate to the high-quality chert for stone artefact manufacture and the strategic use of Panner Gorge as a hunting area. The chert artefacts mainly came from the prominent dolerite dyke striking in a SW-NE direction in the northwest corner of the mine tenement, i.e. outside the proposed Project site (refer to Figure 9).

A second cluster of sites relates to grass seed digging activities in well-drained soils derived from weathered granite, estimated to post-date AD 1000. These sites occur mainly in the parts of the mine tenement north and northeast of the proposed site. These sites are concentrated around a series of low-lying granite outcrops associated with shallow depressions, which may contain water after rain, in between.

In conclusion, the tenement is not an area of outstanding archaeological importance and does not have the dense site clusters which are characteristic of some parts of the escarpment and ephemeral river systems of the Namib. The areas of highest heritage value lie outside the main focus of mining activity and the mining area and related high disturbance locations have a rather low heritage value. The sites also show a low vulnerability potential to disturbance. In general, the archaeological and historical sites are mainly of a low individual significance.

Based on the existing information, the following points can be highlighted:

- The proposed project site falls outside any of the identified significant heritage sites and the presence of any unknown heritage resource on the site is unlikely.
- Archaeological sites in Namibia are protected under the National Heritage Act, No. 27 of 2004. In the case of finding an unknown site, a Chance Find Procedure should be followed.

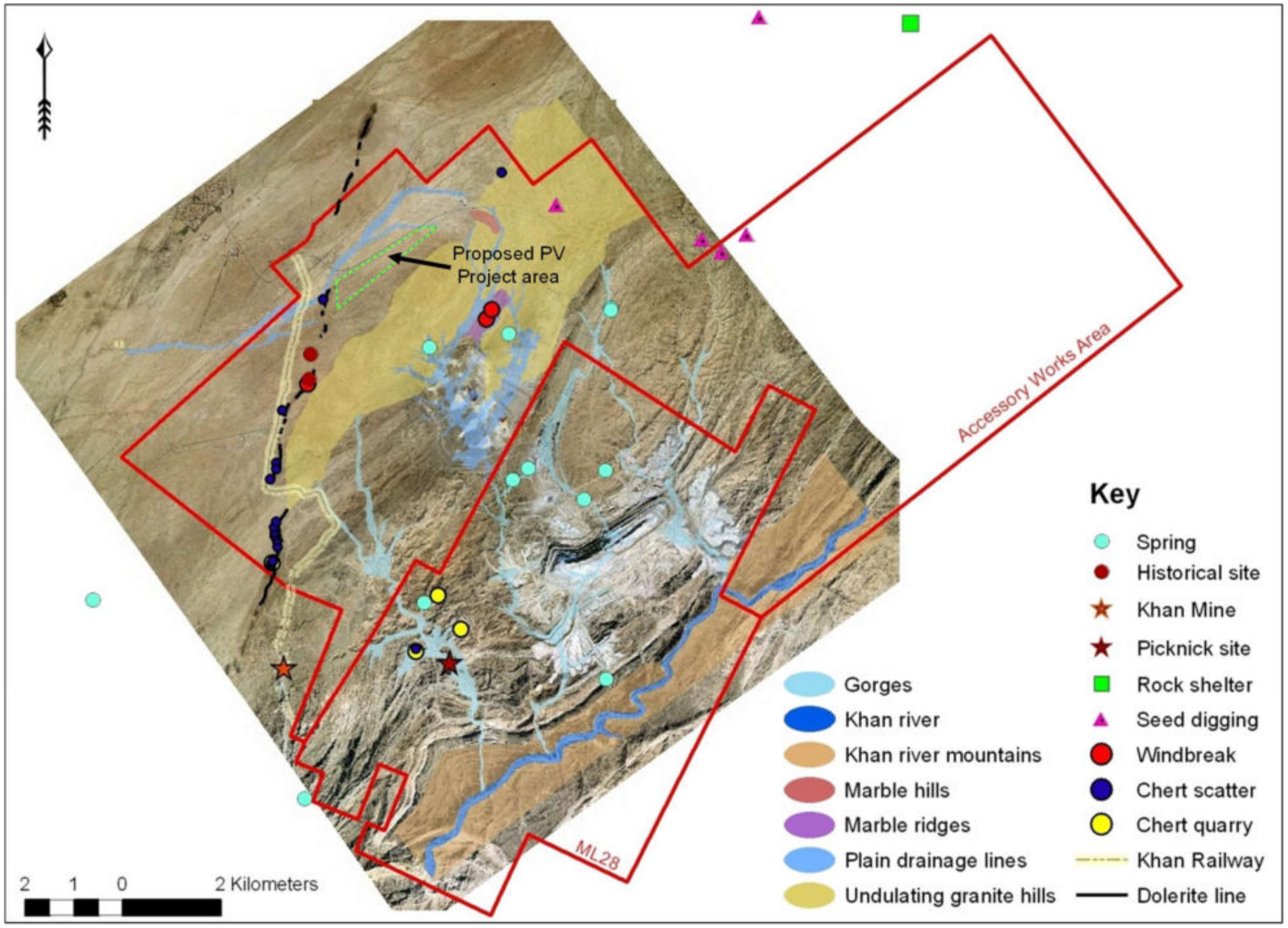

FIGURE 9: ARCHAEOLOGICAL AND SENSITIVE SITES AT RUL'S MINE IN RELATION TO THE PROPOSED PV POWER PROJECT

(Source: EMP of RUL, 2021)

6.6 Visual Aspects and current landforms

Information for this section was retrieved from the Visual Impact Assessment Report (GYLA, 2022) (refer to Appendix G) as well as site observation by Namisun and input form RUL.

6.6.1 Landscape Character and Nature of the Study Area

Within a 5 km radius of the proposed PV Power Project site, the study area comprises primarily flat land that gently slopes to the southwest across the study area (refer to Section 6.2). The site follows this slope, with the north-eastern section approximately 25 m higher than the southwestern section. The B2 national road is aligned along this slope, rising from the southwest to the northeast as it passes north of the project site (refer to Figure 2).

The study area is characterised by open land with only shallow drainage lines containing some low vegetation. The southern section of the study area is dominated by a series of hills and ridges and the RUL tailings storage facility (TSF) that protrude above the flat landscape. (The TSF is about 88 m from ground level). A series of isolated hills occur north of the B2 national road and east of Arandis. The town of Arandis is also north of the road and approximately 3.5 km north-west of the site.

The panoramas in the Visual Impact Assessment Report (Appendix G) indicate the nature of the landscape and its mining and power infrastructure characteristics. Figure 10 provides the location of the panorama viewpoints (as presented in Appendix G) and sensitive visual receptor locations.

The project area is crossed by many powerlines associated with the mine and Arandis. With reference to Section 4.5.1 and Figure 2, the proposed new powerline will be constructed within the same corridor / servitude as an existing 11 kV powerline in the eastern section (4.9 km), with a new servitude towards the north in the final 2.1 km. Compared to the elevation of the Arandis Aerodrome, the existing 11 kV powerline infrastructure at its highest point is 16 m higher.

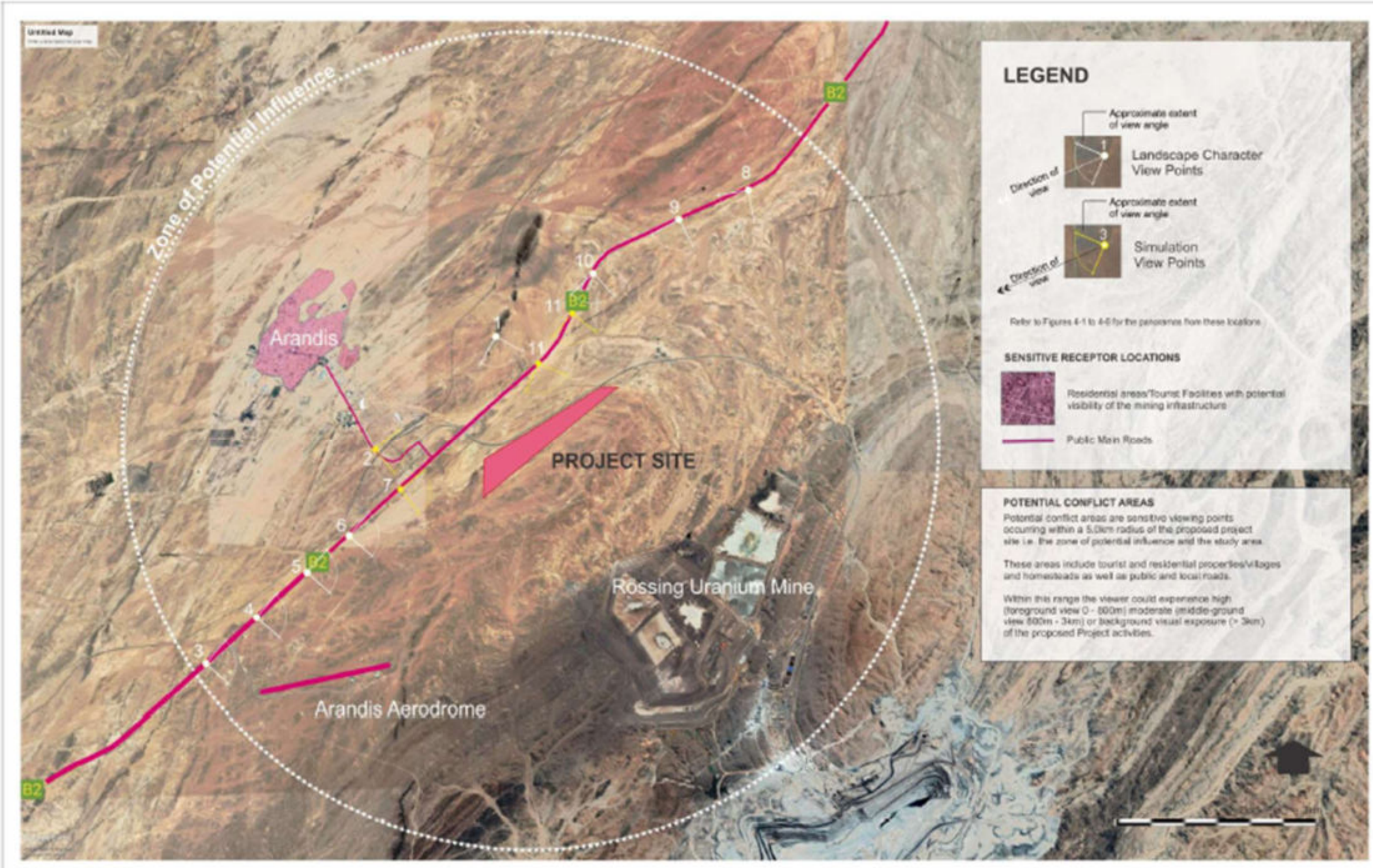

FIGURE 10: VIEWPOINTS AND SENSITIVE RECEPTOR LOCATIONS

(Source: GYLA, 2022)

6.6.2 VISUAL RESOURCE VALUE, SCENIC QUALITY AND LANDSCAPE SENSITIVITY

The value of the visual resource and its associated scenic quality are derived from the landscape characteristics described above. The sensitivity of the study area's landscape as a scenic resource can be defined as moderate to low (GYLA, 2022; see Appendix G), within the context of the sub-region. These ratings are dependent on the landscape's character: does it contribute to the area's sense of place and distinctiveness? Quality? – in what condition is the existing landscape? Value – is the landscape valued by people, local community, visitors, and is the landscape recognised, locally, regionally or nationally? Capacity – what scope is there for positive change in the existing landscape character?

Within the context of the sub-region, a visual resource value of low (degraded open land, mining areas and power infrastructure) and moderate for the hills in the southern regions of the study area is assigned to these landscape types.

The study area exhibits a mixed character, which is expected within the sub-region. It has some positive characteristics, but there is evidence of alteration and degradation of these features from mining and power infrastructure, resulting in negative areas.

6.6.3 SENSE OF PLACE

A sense of place is the extent to which a person can recognise or recall a place as being distinct from other places - as having a vivid, unique, or at least particular, character of its own. The sense of place for the study area derives from the local landscape types described above and their impact on the senses. The activities and land use in the study area are common within the sub-region and have been impacted by mining activities. This area does not evoke a consolidated, distinct sense of place other than the vast nature and landscape openness.

6.6.4 VISUAL RECEPTORS

Visual receptors include people living in, visiting, or travelling through the study area on the B2 national road and other public roads not associated with the mine.

6.6.5 SENSITIVE VIEWERS

The project site is on a portion of the mine's Accessory Works Area, wedged between the access road and the NamWater pipeline. The receptors and viewing areas identified in Table 8 below are potentially sensitive to the proposed development. Figure 10 identifies the location of these areas relative to the project site and indicates where potential conflict/impact could arise due to the project activities.

TABLE 8: POTENTIAL SENSITIVITY OF VISUAL RECEPTORS (GYLA, 2022)

High	**Moderate**	**Low**
Receptors of residential areas in Arandis. Tourists travelling along the B2 national road	Locals travelling along the B2 national road for business other than to visit a tourist destination	People working or travelling to work in the study area (RUL Mine and related service industries)
Visitors of tourist attractions and travelling along local routes, whose intention or interest may be focused on the landscape. Communities where the development results in changes in the landscape setting or valued views enjoyed by the community. Occupiers of residential properties with views affected by the development.	People engaged in outdoor sport or recreation (other than appreciation of the landscape, as in landscapes of acknowledged importance or value). People travelling through or past the affected landscape in cars or other transport routes.	Visitors and people working within the study area and travelling along local roads whose attention may be focused on their work or activity and who therefore may be potentially less susceptible to changes in the view.

6.7 Brief Socio-economic Baseline

The Erongo Region, where the project is located, has a well-developed infrastructure, second to the Khomas Region. Mining, fishing, tourism, transportation and storage comprise the principal economic activities in the Erongo Region, with most of these taking place in the western and coastal parts (RUL, 2021). Each region in Namibia is governed by a regional council, elected during regional elections per constituency. The Erongo Region is subdivided into seven constituencies, of which Arandis forms one. Towns are governed through local authorities, in the case of Arandis by a town council.

Arandis was established by Rössing Uranium Limited in 1976 to provide housing for workers and their families. Up until 1990 the company managed the town, while building schools, houses, sport fields and a hospital. In 1994, Arandis was proclaimed as a town with the ATC taking of the administrative functions of the town (RUL, 2021).

6.7.1 Demographic profile

Namibia is one of the least densely populated countries in the world (2.8 persons per km^2). Vast areas of the country are without people, in contrast to some fairly dense concentrations, such as the central-north and along the Kavango River. The last national census was conducted in 2011 and counted 2.1 million Namibians (NPC, 2011). An inter-censal demographic survey was conducted in 2016 and estimated the total population of the country at 2.3 million and for the Erongo Region at 182,402, i.e., 7.8% of the national population total (NSA, 2017).

Windhoek, the capital, functions as a primate city – not only is it the urban area with the biggest population, but the concentration of private and public head offices attracts Namibians from all parts of the country in search for a better live. National population growth rate is estimated at less than 2%, lower than most African countries. Namibia's population is young - although 57% falls in the age group 15 – 59, 37% of the total population is younger than 15 (NSA, 2017). Since 2005 there is a steady improvement in life expectancy, currently estimated at 65 years.

In 2018 it was estimated that 50% of all Namibians are urbanized, in other words living in an urban settlement (retrieved from www.worldpopulation.com). The Erongo Region covers a great part of the central Namib Desert, the main reason why this region has a small rural population and is the region with the second highest percentage of people living in an urban area – 92%. Only the Khomas Region (95%) has a more urbanized population, but due to the bigger size of the Erongo Region the population density is low and only marginally higher (2.9) than the national figure in 2016. Living in an urban environment implies better living conditions – 98% of all households have access to safe water, only 13% have no toilet facility, 76% have electricity for lighting and only 15% of all household make use of open fires to prepare food. Oshiwambo is the most spoken language (44% of all households) in the region, followed by Afrikaans (19%). Average household size is 3.1 and the literacy rate is 96% for people older than 15 (NSA, 2017). Compared to other regions in Namibia, the Erongo Region has the second highest level of development and the second lowest rate of human poverty. About 72% of the region's population aged 15 and above are estimated to have attained secondary education – the highest level in the country. The region is also estimated to have the second highest proportion (7.4%) of individuals with tertiary qualifications (RUL, 2021).

Although Walvis Bay is the biggest urban area in the Erongo Region, and the industrial hub of the region, the administrative capital of the region is Swakopmund and host most of the administrative and governmental headquarters of the region. Arandis is much smaller – even though the total population of Arandis was estimated at 6,500 people in 2011, the national census in the same year only counts 5,100 (NPC, 2011). At an estimated annual growth rate of 3.8% for the region, the expected total population of Arandis was 6,145 in 2016 (NSA, 2017).

6.7.2 ECONOMIC PROFILE

The economic activities of the Erongo Region revolve around the extraction of natural resources both renewable such as fish, as well as non-renewable such as minerals (Enviro Dynamics, 2012). Another important economic sector of Namibia and the Erongo Region is tourism, which is unfortunately still in limb-mode because of the global pandemic COVID-19.

Walvis Bay is the principal home of Namibia's fishing industry and the town boasts also the only deep sea port of the country, with world-class port facilities and linkages with the rest of Namibia and its neighbours via the Trans-Kalahari and Trans-Caprivi Highways as a well as a railway. An international airport located outside the town ensures a direct link to the rest of the world. Key economic activities of Walvis Bay include fishing, fish processing, manufacturing, logistics, marine engineering and storage.

Mining plays a pivotal role in the economy of Namibia. Since independence, it has consistently been the biggest contributor to Namibia's economy in terms of revenue and accounts for 25% of the country's income. Mining is a pronounced industry in the Erongo Region and the main commodities are uranium, gold, salt and dimension stones. Two of Namibia's large uranium mines – Rössing and Husab – are in proximity of Arandis. Two other uranium mines are currently under Care-and-Maintenance (Trekkopje and Langer Heinrich) while ongoing exploration and feasibility studies are done by Bannerman, Reptile and Marenica – all in the Erongo Region.

As a mining town, the local economy of Arandis was always closely coupled to the mining industry. Of lately many initiatives have been launched to diversify the town's economic base by marketing and attracting investments and as a result several new industries and businesses established in the town recently.

Since 2016 Namibia recorded slow economic growth, registering an estimated growth of only 1.1% in 2016. The primary and secondary industries contracted by 2.0 and 7.8% respectively. During 2017 the economy contracted by 1.7, 0.7 and 1.9% in the first, second and third quarters respectively (NSA, 2019). Despite the more positive expectations, the economy retracted to an average growth of not more than 1% annually since 2017.

6.7.3 EMPLOYMENT

The labour force participation rate is the proportion of the economically active population, given as a percentage of the working age portion of the population (i.e., older than 15 years of age). The rate of labour force participation for the Erongo Region was 80.9% compared to the average of 71.2% for Namibia in 2018 (NSA, 2019).

In 2018, 53.4% of all working Namibians were employed in the private sector and 21.5% by the state. State-owned enterprises employ a further 7.6% and private individuals 16.6%. Agriculture (combined with forestry and fishing) is the economic sector with the most employees – 23% of all employed persons in Namibia work in this sector. Wages and salaries represented the main income source of 47.4% of households in Namibia (NSA, 2019).

Low education levels affect employability and prevents many households to earn a decent income. Of all employed people in Namibia, 63.5% are not higher qualified than junior secondary level (Grade 10 and lower). In total 11.8% of all employed people had no formal education. In total 29.1% of all employed people fall in the category "elementary occupation" and 15.2% in the category "skilled agriculture. Overall, the rate for unemployment is estimated at 33.4% for Namibia, using the broad definition of unemployment. The highest unemployment rates are found amongst persons with education levels lower that junior secondary. The unemployment rate of persons with no formal education is 28.6%, with primary education 34.6% and with junior secondary education 32.7% (NSA, 2019).

Although declining over time, the primary sector (agriculture, mining and fishing) employs most Namibians (23%) and is also the sector with the most employers. It is also the sector that employs the most informal workers in Namibia, calculated at 87.6%. Wages of employees in this sector are lower than all other sectors except for workers in accommodation and food services and domestic work in private households (NSA, 2019).

In the Erongo Region 67.5% of all households depend on salaries and wages as the main income (NSA, 2019). Exact figures do not exist, but this high percentage can be ascribed to the dominance of the mining, fishing and manufacturing and processing sectors together with the prominence of state departments and the administrative sectors in the Erongo Region. A total of 12.6% of households receive their income from business activities (NSA, 2019).

While unemployment remains a significant challenge in the region, with 22.6% of the labour force estimated to be jobless, this figure is lower than the rest of the country. Poverty levels are on the lower side of the scale, with only 5.1% of all households in Erongo being considered poor, the lowest in the country. Households in the region spend about 17% on food and beverages (2nd lowest in the country), 23% on housing (3rd highest), 20% on transport and communication (2nd highest) and other unspecified items (RUL, 2021).

No official figure exists, but there is good reason to believe that most of the workforce in Arandis is employed by the mines and the contractors working at the mines.

6.7.4 HEALTH

Since independence in 1990, the health status of Namibia has increased steadily with a remarkable improvement in access to primary health facilities and medical infrastructure. In 2015 the World Health Organization (WHO) recommended strategic priorities of the health system in Namibia which entail improved governance, an improved health information system, emergency preparedness, risk reduction and response, preventative health care and the combating of HIV/AIDS and TB (WHO, 2016).

According to the website of the Ministry of Health and Social Services (MoHSS) the Erongo Region has a total of 18 primary health care facilities, two health centres, and four district hospitals – in Swakopmund, Walvis Bay, Omaruru and Usakos (retrieved from www.mhss.gov.na). There are also private hospitals in Swakopmund and Walvis Bay and a private medical centre in Arandis.

Like elsewhere in Namibia, HIV/AIDS remains a major reason for low life expectancy and is one of the leading causes of death in the Erongo Region. HIV/AIDS remains the leading cause of death and premature mortality for all ages, killing up to half of all males and females aged 40 - 44 years in 2013 (IHME, 2016). HIV/AIDS does not only affect the quality of life of those infected, but also that of those having to care for them. Tuberculosis (TB) is a leading killer of people infected by HIV/AIDS, and Namibia had a high burden in 2018, 35% of people notified with TB were infected with HIV. The country is included among the top 30 high-burden TB countries in the world, with an estimated incidence rate of 423 per 100,000 people and 60 fatalities per 100,000 people in 2018 (retrieved from www.mhss.gov.na).

In 2016 it was estimated that 12.6% of all people in the Erongo Region is younger than five years of age and 15.7% between five and fourteen years of age. Only 37.7% of children younger than five years of age in the region attended programs of early childhood development in 2016 (NSA, 2017), implying that access to these facilities and access to infant health care facilities is limited.

The largest percentage of people in the Erongo Region utilize hospitals for medical care (42.8%) and only 22.9% have to rely on a clinic. 15.6% of the total population of the region receive their medical treatment from a doctor (NSA, 2017). The death rate of 9.9 deaths per 1000 people for the region was lower than the national average of 10.8% in 2016 (NSA, 2017).

As of the beginning of 2020 COVID-19 caused illness in humans at a pandemic scale and has resulted in an increasing number of deaths worldwide. The viral outbreak is adversely affecting various socio-economic activities globally, and with reports of the increasing number of people testing positive, it has significant impacts on the operations of various economic sectors in Namibia too. The disease caused many countries to enter a state of emergency and lockdown mode, with dire economic consequences. In addition, these measures have a detrimental effect on tourism – and Namibia is in both cases no exception.

6.7.5 INWARD MIGRATION

The various current mining developments, as well as other expected mining developments (i.e. the so called “Uranium Rush”; the upgrading of the Walvis Bay Port; and developments in other sectors in the Erongo Region, caused inward migration to the central coastal towns of Namibia during the last couple of years. This inward migration is contributing to various social impacts at the central coastal towns of Namibia.

7 IDENTIFICATION AND DESCRIPTION OF POTENTIAL ENVIRONMENTAL IMPACTS THAT ARE LIKELY TO CHANGE AS A RESULT OF THE PROPOSED AMENDMENTS

This chapter outlines the environmental aspects and potential impacts that could change because of the proposed projects (i.e. amendment to the existing RUL activities and infrastructure), taking the approved EMP and existing Environmental Management System into consideration. It reasons potential cumulative impacts, and which environmental aspects need further assessment (Chapter 8).

7.1 Aspect and Impact Identification

Tables 9 and 10 provide a summary of the activities associated with the construction and operational phase of the proposed Solar PV Power Plant and connection powerline and the associated environmental aspects and potential impacts.

The potential impacts were identified during the scoping process, in consultation with I&APs and the project team. For context, the description of the potential impacts should be read with the corresponding descriptions of the current environment in Chapter 6 of this report. Furthermore, it must be noted that the Solar PV Power Plant and connection powerline would be constructed on the Accessory Works Area of the RUL-tenement, on an already disturbed area (to a certain extent) and potential impacts are considered cumulatively (taking the existing activities into consideration).

The relevance of the potential impacts ("screening") is presented in Tables 9 and 10 to determine if certain aspects need to be assessed in further detail (Chapter 8 of this report).

TABLE 9: ENVIRONMENTAL IMPACTS AND ASPECTS ASSOCIATED WITH THE CONSTRUCTION PHASE

ACTIVITY / FACILITY RELATING TO CONSTRUCTION PHASE	ASPECT	POTENTIAL ENVIRONMENTAL IMPACT	RELEVANCE (SCREENING) OF POTENTIAL IMPACT	Ref
1. Site preparation, earthworks, laydown areas and establish work areas				
• Site preparation and earthworks. • Establishing of working areas and stores, waste management facilities and construction staff amenities. • Drilling activity for installation of solar panel structures and tracking system. • Trenches and excavations. • Materials delivery and laydown / storage.	• Clearing of vegetation for the buildings onsite • Using of earthmoving equipment and machinery for trenching and the clearance for the buildings. • Waste generation	Potential impact on biodiversity (physical impacts and general disturbance)	The proposed project site is already a disturbed site (to a certain extent) with limited vegetation cover and topsoil either absent or disturbed (see Section 6.2 and 6.4). The site is also flat, and the drainage lines will be avoided, meaning that vegetation clearance is limited to the proposed sites of the buildings only. The existing access road will be used to deliver material and workers. As the site is wedged between the existing access road and the pipeline, no activities will be conducted outside the proposed site, and the workers will be restricted to the site boundaries; therefore, no impact outside the site boundaries could occur. However, various biodiversity sensitives have been identified (see Section 6.4) and the associated potential impacts are further assessed in Chapter 8.	**R01**
		Potential impact on archaeological resources	With reference to Section 6.5, no archaeological sites are present on the site and this issue will not be further assessed. As precautionary measures a Chance Find Procedure and relevant procedures are in place.	**R02**
		Interruption of drainage and interference with water flow. Increased storm water flows, reduced infiltration and increased risk of erosion.	With reference to Section 6.3, the drainage lines will be avoided. Potential temporary interference with surface run-off is of a very small scale and will not influence the natural flow from the site into the existing drainage lines. The interruption of drainage and the potential interference with surface water flow, as well as the risk of erosion is therefore regarded as insignificant and will not be assessed further in this report. Further management and mitigation measures are included in the EMP (Addendum) in Chapter 9.	**R03**

ACTIVITY / FACILITY RELATING TO CONSTRUCTION PHASE	ASPECT	POTENTIAL ENVIRONMENTAL IMPACT	RELEVANCE (SCREENING) OF POTENTIAL IMPACT	Ref
	Noise generation from earthmoving equipment and machinery	Increase in disturbing noise levels (nuisance)	There are various construction activities (particularly the movement of vehicles) relating to the proposed project that would generate noise onsite. It must however be taken into consideration that the activities will be conducted in addition to the existing activities of RUL as well as the adjacent road traffic. The closest noise sensitive receptors would be residents in Arandis, which are more than 3 km from the proposed site (on the other side of the B2 national road). Therefore, the additional noise impacts associated with the proposed project and the cumulative effect activities are regarded minimal and will not be further assessed.	**R04**
	Dust and gaseous emissions from earthmoving equipment and machinery	Increase in dust levels (nuisance and health impacts)	There are various activities or sources (particularly dust generating sources and movement of vehicles) relating to the proposed project that can pollute the air and cause resultant potential impacts (i.e., nuisance impacts and / or health) on humans and the surrounding environment. The gaseous emissions, in comparison to the particulates, are small with much lower impact significance. It must however be taken into consideration that the activities will be conducted in addition to the existing activities of RUL and the cumulative effect is regarded minimal and will not be further assessed. The current (approved) mining activities generate dust, and monitoring and mitigation measures are already in place.	**R05**
	Possible hydrocarbon spillages from vehicles; spills and leaks of hazardous substances	Contamination of surface water and groundwater resources and pollution of soil	Construction activities could result in the contamination of soil, surface water resources and groundwater. Potential sources of contamination include the leakage of oils and fuels, accidental spills, maintenance activities, wear and tear of hazardous containers and the disposal of waste and wastewater. Pollution to the groundwater quality is less likely due to the magnitude of the project activity during the construction process. The project design and implementation should aim to prevent leaks and spills and the necessary clean-up procedures must be in place in case it happens. The cumulative effect is regarded minimal and will not be further assessed.	**R06**

ACTIVITY / FACILITY RELATING TO CONSTRUCTION PHASE	ASPECT	POTENTIAL ENVIRONMENTAL IMPACT	RELEVANCE (SCREENING) OF POTENTIAL IMPACT	Ref
2. Solar PV Power Plant construction and powerline infrastructure and pipeline installation				
Installing panels, inverters, tracking system, powerline, etc.	Construction activities disturbing/ destroying biodiversity	Potential impact on biodiversity (physical impacts and general disturbance)	Refer to **R01.** No further assessment is required.	**R07**
		Interruption of drainage and interference with water flow	Refer to **R03.** No further assessment is required.	**R08**
	Possible hydrocarbon spillages from earth moving equipment	Contamination of surface water and groundwater resources and pollution of soil	Refer to **R06**. No further assessment is required.	**R09**
General building activities (i.e., painting, grinding, welding, concrete mixing, etc.)	Spillage of paint, concrete, etc.	Impact on surface water and groundwater water quality	Some of the construction activities (i.e., painting, mixing of concrete, etc.) could result in the contamination of soil, surface water and groundwater. Refer to **R03** and **R06**. No further assessment is required.	**R10**
3. General				
Waste management	Waste management and disposal	Emissions to land. Land degradation and impact on the biodiversity. Nuisance (visual) impacts to people.	Construction activities will generate a wide range of waste items that will be managed in compliance with existing operational practices of RUL. Waste generation is likely to be limited to the site. No further assessment is required.	**R11**
Refuelling of equipment	Hydrocarbon spillages	Pollution of soil, surface and groundwater	Refuelling activities could cause hydrocarbon spillages which could result in the contamination of the surface water resources and groundwater. Refer to **R06.** No further assessment is required.	**R12**

ACTIVITY / FACILITY RELATING TO CONSTRUCTION PHASE	ASPECT	POTENTIAL ENVIRONMENTAL IMPACT	RELEVANCE (SCREENING) OF POTENTIAL IMPACT	Ref
4. Socio-economic				
Temporary employment	Socio-economic	Employment and skills development	The proposed development would create temporary employment and business opportunities during the construction phase as described in Chapter 4. Employees will have to undergo the necessary inductions and risk assessment training as required by the existing policies and procedures of RUL. Potential impacts associated with employment and skills development is qualitatively assessed in Chapter 8.	**R13**
		Inward migration and community health	The establishment of the proposed project could attract job seekers to the area during the construction phase, which could increase the associated (cumulative) impacts to the surrounding communities (i.e., Swakopmund, Arandis, etc.). These potential impacts are qualitatively assessed in Chapter 8.	**R14**

TABLE 10: ENVIRONMENTAL IMPACTS AND ASPECTS ASSOCIATED WITH THE OPERATIONAL PHASE

ACTIVITY/FACILITY RELATING TO OPERATIONS PHASE	ASPECT	POTENTIAL ENVIRONMENTAL IMPACT	RELEVANCE (SCREENING) OF POTENTIAL IMPACT	Ref
1. Operating the Solar PV Power Plant, powerline and pipeline				
Solar PV Power Plant infrastructure	Solar PV Power Plant infrastructure contributing to the overall visual impacts	Visual impacts	The existing visual condition of the landscape and sense of place, as described in Section 6.6, may be affected by the infrastructure associated with proposed PV Power Project. These potential impacts are further assessed in Chapter 8.	**R15**
	Solar PV Power Plant	Glint and glare - Arandis Aerodrome	In addition to the potential (general) visual impacts (and sense of place issues) described above, the potential of glint and glare can be of concern.	**R16 a**

ACTIVITY/FACILITY RELATING TO OPERATIONS PHASE	ASPECT	POTENTIAL ENVIRONMENTAL IMPACT	RELEVANCE (SCREENING) OF POTENTIAL IMPACT	Ref
	infrastructure causing glint and glare		With reference to Section 2.3.3, the NCAA commented that compliance with the regulatory requirements related to aviation safety and specifically the Arandis Aerodrome is essential for this project. The key issues raised is *glint and glare*, as well as the proximity of potential obstacles limitation surfaces, which may affect aviation safety – relating to the Arandis Aerodrome. The associated potential impacts are therefore further assessed (qualitative) in Chapter 8.	
		Glint and glare - users of the B2 national road	Given that only a small portion (showing as a dark blue or black line in the landscape) of the PV arrays would be visible from any given view and that glare would infrequently occur, the effect on motorists using the B2 national road is considered low and would not contribute significantly to the visual impact of the project. Furthermore, PV panel surfaces are designed to absorb the sunlight as much as possible, therefore substantially reducing the potential for glint and glare. (GYLA, 2022). (See Section 8.3.2 and the Visual Impact Assessment Report – Appendix G, for further details on this topic). No further assessment is required.	**R16 b**
	Solar PV Power Plant and new powerline infrastructure causing additional obstacles relating to civil aviation	Aviation safety in terms of potential new obstacles	Refer to **R16a.** With reference to Section 2.3.3, the NCAA commented that compliance with the regulatory requirements related to aviation safety and specifically the Arandis Aerodrome is essential for this project. The key issues raised are glint and glare, as well as the *proximity of potential obstacles limitation surfaces, which may affect aviation safety* – relating to the Arandis Aerodrome. The associated potential impacts are therefore further assessed (qualitative) in Chapter 8.	**R17**
	New Solar PV Power Plant	Collisions of birds with photovoltaic		**R18**

<table>
<tr><th>ACTIVITY/FACILITY RELATING TO OPERATIONS PHASE</th><th>ASPECT</th><th>POTENTIAL ENVIRONMENTAL IMPACT</th><th>RELEVANCE (SCREENING) OF POTENTIAL IMPACT</th><th>Ref</th></tr>
<tr><td rowspan="2"></td><td rowspan="3">infrastructure impact on avifauna</td><td>(PV) panels and associated infrastructure</td><td rowspan="3">With reference to R01 and R07, as well as Section 6.4.3, various priority bird species are potentially at risk as a result of the proposed project activities / infrastructure. The potential impacts include:
• Physical / human disturbance of birds (resulting in avoidance / displacement); this could include road mortalities and / or poaching during construction
• Direct and indirect modification / loss / destruction of bird habitat (resulting in avoidance / displacement)
• Creation of novel (artificial) habitats and resources that could attract birds; this impact could lead to negative impacts on infrastructure, caused by bird nesting, perching and other activities. (Not further assessed in this report. Refer to the Avifauna Specialist Report in Appendix F for further information).
• Bird collisions with infrastructure such as solar panel arrays, fences, guyed masts and associated powerline infrastructure
• Bird electrocutions on powerline infrastructure (including by streamers of excrement)

These potential impacts on birds are assessed in Chapter 8.</td><td></td></tr>
<tr><td>Attraction of novel species to the area by the artificial provision of otherwise scarce resources</td><td>R19</td></tr>
<tr><td>New powerline</td><td>Collisions and / or electrocutions of birds on powerline structures</td><td>R20</td></tr>
<tr><td rowspan="2">Cleaning the solar panels</td><td>Water supply</td><td>Impact on water resources</td><td>In addition to the discussion in R03 and R06, the following:
With reference to Section 4.6 the water during both construction and operational phases of the proposed projects will be supplied from the Rössing Reservoirs.
Water consumption per year is estimated at 1,050 m^3.
The water requirements for the project is insignificant when compared to the volumes of water used by RUL. This issue will therefore not be assessed in further detail.</td><td>R21</td></tr>
<tr><td>Wash water flow to downstream vegetation</td><td>Contaminated water impacting downstream vegetation</td><td>Clean water will be used for the washing of the PV panels. Only stormwater after occasional rainfall events will naturally flow into the existing drainage lines, without interference.
This issue will therefore not be assessed in further detail.</td><td>R22</td></tr>
</table>

ACTIVITY/FACILITY RELATING TO OPERATIONS PHASE	ASPECT	POTENTIAL ENVIRONMENTAL IMPACT	RELEVANCE (SCREENING) OF POTENTIAL IMPACT	Ref
2. General				
Waste management	Waste disposal	Emissions to land Nuisance impacts	Refer to **R11.** Waste generation is likely to be limited onsite and will primarily be domestic and recyclable waste. Waste will be managed according to the existing RUL-practice and Environmental Management System. Accordingly, potential impacts relating to waste management can be avoided / mitigated. This issue will therefore not be assessed in further detail.	**R23**
3. Socio-economic				
Operating the Solar PV Power Plant and supply electricity to RUL.	Generation of clean, renewable energy	Air quality – positive impact	The establishment of a clean, renewable energy facility would reduce, albeit minimally, Namibia's reliance on energy imports and the generation of carbon emissions into the atmosphere. Since the proposed project will be constructed to (primarily) supply electricity to RUL, the potential positive impacts to Namibia's overall energy supply would be very minimal. This potential impact is not further assessed.	**R22**
Permanent employment	Socio-economic	Employment and skill development	Refer to **R13.**	**R23**
		Inward migration	Refer to **R14.**	**R24**

7.2 Summary of Environmental and Social Aspects and Potential Impacts that Require Assessment

Based on the discussions in Section 6.1 to 6.7, the following aspects / potential impacts require further assessment (see Chapter 7):

- Biodiversity (Loss of biodiversity from physical destruction (i.e. removing and killing of vegetation and killing of fauna).
- Avifauna (Disturbance, injury and killing of birds).
- General visual impacts and sense of place (including glint and glare).
- Obstacles in relation to aviation safety.
- Positive and negative socio-economic impacts, largely during construction.

8 ENVIRONMENTAL IMPACT ASSESSMENT

This chapter assesses the key potential impacts (as identified in Chapter 7), relating to the proposed PV Power Project and associated activities and infrastructure (including the new overhead powerline).

The environmental issues that require further assessment, as identified in Chapter 7, relate to:

- Impacts on biodiversity in general.
- Impacts on avifauna.
- General visual impacts and sense of place, including glint and glare.
- Impacts to aviation (safety) (i.e. Arandis Aerodrome - relating to additional obstacles).
- Positive and negative socio-economic impacts, largely during construction.

The activities that are summarised in this chapter are linked to the descriptions provided in Chapters 4 and 7 (Tables 9 and 10). This section must further be read in the context of the baseline conditions described in Chapter 6.

Management and mitigation measures to address the identified (potential) impacts are presented in the EMP Addendum (see Chapter 9).

The approach and criteria used to assess the impacts and the method of determining the significance of the impacts complies with the Environmental Management Act, No. 7 of 2007 and its regulations. Table 11 provides the impact assessment criteria and the approach for determining impact consequence (combining nature and intensity, extent and duration) and significance (the overall rating of the impact). Impact consequence and significance are determined from Table 12 and Table 13 respectively.

The potential impacts are cumulatively assessed, where relevant, taking the existing environment into consideration.

TABLE 11: IMPACT ASSESSMENT CRITERIA

IMPACT ASSESSMENT CRITERIA		
SIGNIFICANCE determination	**Significance = consequence x probability**	
CONSEQUENCE	**Consequence is a function of:** • **Nature and Intensity of the potential impact** • **Geographical extent should the impact occur** • **Duration of the impact**	
Ranking the NATURE and INTENSITY of the potential impact		
Negative impacts		
Low (L)	The impact has no / minor effect/deterioration on natural, cultural and social functions and processes. No measurable change. Recommended standard / level will not be violated. (Limited nuisance related complaints).	
Moderate (M)	Natural, cultural and social functions and processes can continue, but in a modified way. Moderate discomfort that can be measured. Recommended standard / level will occasionally be violated. Various third party complaints expected.	
High (H)	Natural, cultural or social functions and processes are altered in such a way that they temporarily or permanently cease. Substantial deterioration of the impacted environment. Widespread third party complaints expected.	
Very high (VH)	Substantial deterioration (death, illness or injury). Recommended standard / level will often be violated. Vigorous action expected by third parties.	
Positive impacts		
Low (L) +	Slight positive effect on natural, cultural and social functions and processes Minor improvement. No measurable change.	
Moderate (M) +	Natural, cultural and social functions and processes continue but in a noticeably enhanced way. Moderate improvement. Little positive reaction from third parties.	
High (H) +	Natural, cultural or social functions and processes are altered in such a way that the impacted environment is considerably enhanced /improved. Widespread, noticeable positive reaction from third parties.	
Very high (VH) +	Substantial improvement. Will be within or better than the recommended level. Favourable publicity from third parties.	
Ranking the EXTENT		
Low (L)	Local (confined to within the project concession area and its nearby surroundings).	
Moderate (M)	Regional (confined to the region, e.g. coast, basin, catchment, municipal region, district, etc.).	
High (H)	National (extends beyond district or regional boundaries with national implications).	
Very high (VH)	International (Impact extends beyond the national scale or may be transboundary).	
Ranking the DURATION		
Low (L)	Temporary / short-term. Quickly reversible. (Less than the life of the project).	
Moderate (M)	Medium Term. Impact can be reversed over time. (Life of the project).	
High (H)	Long Term. Impact will only cease after the life of the project.	
Very high (VH)	Permanent	
Ranking the PROBABILITY		
Low (L)	Unlikely	
Moderate (M)	Possibly	
High (H)	Most likely	
Very high (VH)	Definitely	
SIGNIFICANCE Description		
	Positive	Negative
Low (L)	Supports the implementation of the project	No influence on the decision.
Moderate (M)	Supports the implementation of the project	It should have an influence on the decision and the impact will not be avoided unless it is mitigated.
High (H)	Supports the implementation of the project	It should influence the decision to not proceed with the project or require significant modification(s) of the project design/location, etc. (where relevant).
Very high (VH)	Supports the implementation of the project	It would influence the decision to not proceed with the project.

TABLE 12: DETERMINING THE CONSEQUENCE

DETERMINING THE CONSEQUENCE					
INTENSITY OF IMPACT = LOW					
DURATION	VH	Moderate	Moderate	High	High
	H	Moderate	Moderate	Moderate	Moderate
	M	Low	Low	Low	Moderate
	L	Low	Low	Low	Moderate
INTENSITY OF IMPACT = MODERATE					
DURATION	VH	Moderate	High	High	High
	H	Moderate	Moderate	High	High
	M	Moderate	Moderate	Moderate	Moderate
	L	Low	Moderate	Moderate	Moderate
INTENSITY OF IMPACT = HIGH					
DURATION	VH	High	High	Very High	Very high
	H	High	High	High	Very High
	M	Moderate	Moderate	High	High
	L	Moderate	Moderate	High	High
INTENSITY OF IMPACT = VERY HIGH					
DURATION	VH	Very high	Very High	Very High	Very high
	H	High	High	Very High	Very high
	M	High	High	High	Very High
	L	Moderate	High	High	Very High
		L	M	H	VH
		EXTENT			

TABLE 13: DETERMINING THE SIGNIFICANCE

DETERMINING THE SIGNIFICANCE					
PROBABILITY	VH	Moderate	High	High	Very high
	H	Moderate	Moderate	High	Very high
	M	Low	Moderate	High	High
	L	Low	Low	Moderate	High
		L	M	H	VH
		CONSEQUENCE			

8.1 BIODIVERSITY (FAUNA AND FLORA)

The biodiversity and, more particularly, the sensitive habitats and avifauna, have been discussed in Section 6.4. During the construction activities temporary impacts by the workforce, vehicles, machinery, and equipment are possible. In the operational phase, the activities will be reduced to limited vehicle and people movements because of continuous inspections and maintenance. The operational phase impacts are therefore largely linked to the infrastructure itself.

The follows sections are (amongst others) extracts from the Flora Specialist Report (EnviroScience, 2022) (see Appendix E) and findings from Namisun's field work and investigations.

8.1.1 ISSUE: LOSS OF VEGETATION AND ASSOCIATED BIOTA DUE TO THE BUILDING OF THE WATER PIPELINE

Assessment of Impact

Nature and intensity, duration of impact and geographical extent

The proposed water pipeline to the Solar PV Power Plant is short (in the region of 1-2 km) and traverses partly disturbed area, such as the road and disturbances along the road. A low ridge with some *Aloe asperifolia* plants needs to be traversed though.

The impact intensity is rated as low because it is controllable and the biodiversity of the area is already compromised by a level of disturbance. The duration of the impact will be long-term, as the line will remain for the duration of the PV plant operation. Some of the protected species may however survive relocation, reducing the duration of the impact.

Although influences might be beyond the footprint area, the extent of the impact remains local and minor change to natural habitats are expected, therefore the extent is low.

Consequence

The consequence of the impact is therefore moderate, for the unmitigated scenario and low for the mitigated scenario.

Probability

The probability is high for the unmitigated scenario and moderate for the mitigation scenario as mitigation reduces impact to some extent.

Significance

The significance of the impact is rated as **moderate** for the unmitigated scenario and **low** with mitigation.

Tabulated summary of the assessed impact – Loss of vegetation and associated biota due to the building of the water pipeline

Mitigation	Intensity	Duration	Extent	Consequence	Probability of Occurrence	Significance
Unmitigated	**L**	**H**	**L**	**M**	**H**	**M**
Mitigated	**L**	**L**	**L**	**L**	**M**	**L**

Management and mitigation measures

- Refer to the EMP, see Section 9.3.1.

8.1.2 ISSUE: LOSS OF VEGETATION AND ASSOCIATED BIOTA DUE TO THE BUILDING OF THE POWERLINE

Assessment of Impact

Nature and intensity, duration of impact and geographical extent

The proposed powerline will be mostly constructed in an already existing service corridor. The *Lithops ruschiorum* populations occurring in the section of undulating granite hills that are traversed by the powerline are not affected.

The impact intensity is rated as moderate in the unmitigated scenario because there should only be limited change to the natural habitat (i.e. natural processes are altered in some areas). In the mitigated scenario, the section that needs to be newly disturbed, will avoid areas with denser vegetation, *Aloe asperifolia* and *Commiphora saxicola* plants. Most of the line will however be constructed on already disturbed area.

The duration of the impact will be long-term, as the powerline will remain for the duration of the PV plant operation. With mitigation, the impact would be avoided / minimised, thereby also reducing the duration of the impact.

The extent of the any impact caused would remain local and minor change to natural habitats are expected, therefore the extent is low.

Consequence

The consequence of the impact is considered as moderate for the unmitigated scenario and low for the mitigated scenario.

Probability

The impact will definitely occur (high) due to construction activities that will be undertaken. However, with mitigation the potential for impacts occurring is reduced

Significance

The significance of the impact is rated as **moderate** for the unmitigated scenario and **low** with mitigation.

Tabulated summary of the assessed impact – Loss of vegetation and associated biota due to the building of the powerline

Mitigation	Intensity	Duration	Extent	Consequence	Probability of Occurrence	Significance
Unmitigated	**M**	**H**	**L**	**M**	**H**	**M**
Mitigated	**L**	**L**	**L**	**L**	**L**	**L**

Management and mitigation measures

- Refer to the EMP, see Section 9.3.1.

8.1.3 ISSUE: LOSS OF VEGETATION AND ASSOCIATED BIOTA DUE TO THE BUILDING OF THE SOLAR PV POWER PLANT AND ASSOCIATED INFRASTRUCTURE

Assessment of Impact

Nature and intensity, duration of impact and geographical extent

The proposed PV Plant area will be constructed in partially disturbed area and will avoid major parts of sensitive area (i.e. the drainage lines) as far as possible. This "management and mitigation measure" had already been taken into consideration by the RUL Technical Team (see Sections 4.4, 5.3 and 7) – therefore, this assessment (i.e. unmitigated scenario) already takes this layout into account). Furthermore, although a large area will be affected, the solar modules do not entirely sterilise the ground.

Some vegetation, however, needs to be cleared, which would mean that some natural area is affected, i.e. wildlife and small fauna such as invertebrates and some retiles species use these more densely vegetated washes for shelter and as a food source. Natural processes are therefore altered to a certain extent. The impact intensity is therefore rated as moderate in the unmitigated scenario.

In the mitigated scenario, impacts could be minimised (i.e. minimal clearance of vegetation, relocation of *Aloe asperifolia* and *Commiphora saxicola* in case these plants cannot be avoided) and the intensity of the impact reduced.

The duration of the impact will be long-term, as the Solar PV Power Plant and associated infrastructure will remain for the duration of the plant's operation. With mitigation, the impact would be avoided / minimised, thereby also reducing the duration of the impact.

The extent of the any impact caused would remain local and minor change to natural habitats are expected, therefore the extent is low.

Consequence

The consequence of the impact is considered as moderate for the unmitigated scenario and low for the mitigated scenario.

Probability

The impact will definitely occur (high) due to construction activities that will be undertaken. However, with mitigation the potential for impacts occurring is reduced.

Significance

The significance of the impact is rated as **Moderate** for the unmitigated scenario, reducing to **Low** with mitigation.

Tabulated summary of the assessed impact – Loss of vegetation and associated biota due to the building of the Solar PV Power Plant and associated infrastructure

Mitigation	Intensity	Duration	Extent	Consequence	Probability of Occurrence	Significance
Unmitigated	**M**	**H**	**L**	**M**	**H**	**M**
Mitigated	**L**	**L**	**L**	**L**	**M**	**L**

Management and mitigation measures

- Refer to the EMP, see Section 9.3.1.

8.1.4 ISSUE: CHANGE OF HABITAT DUE TO THE SOLAR PV POWER PLANT INFRASTRUCTURE AND RESTRICTION OF ANIMAL MOVEMENT (OPERATIONAL PHASE)

Assessment of Impact

Nature and intensity, duration of impact and geographical extent

Flora

The solar modules of the PV plant are above-ground and will thus not sterilise the soil, but shading by the panels will alter the natural habitat. The effects on biodiversity are unknown at present and could be negative (e.g. less light for photosynthesis) as well as positive (e.g. run-off from panels, shaded habitat). As the main drainage lines are avoided for the position of infrastructure, no major alteration of water flow is expected.

Fauna

With reference to Section 6.4.2, relatively large sections of the proposed project site were previously prone to disturbance by previous construction activities. Even though very limited fauna (i.e. only few invertebrates and a very few reptiles) were found onsite during, some of the common animal species (i.e. Springbok, Ostrich, Black-backed jackal, and rodents (particularly gerbils, etc. would likely move through this area). Also, wildlife and small fauna such as invertebrates and some retile species use these more densely vegetated washes for shelter and as a food source. Fencing of the site can fragment habitat links and disturb the movement patterns of animals.

Taking the above into consideration, the impact intensity is rated as moderate to high in the unmitigated scenario. This has been largely rated us such because animal movement is restricted and natural processes are therefore altered. From a flora perspective, some natural areas would be affected and natural processes altered, but whether positive or negative cannot be determined presently. In the mitigated scenario, impacts could be minimised (i.e. allowing for suitable opening in the fence for some animals to cross and monitoring the effect of the solar panels on vegetation and habitats to better understand associated impacts in future) the intensity of the impact reduced.

The duration of the impact will be long-term, as the Solar PV Power Plant and associated infrastructure will remain for the duration of the plant's operation. With mitigation, the impact would be avoided / minimised, thereby also reducing the duration of the impact.

The extent of the impacts caused could influence natural process (i.e. animal movement) beyond the site boundary, therefore moderate for the unmitigated scenario and low to moderate with mitigation.

Consequence

The consequence of the impact is considered as moderate to high for the unmitigated scenario and low to moderate for the mitigated scenario.

Probability

In the unmitigated scenario, the impacts (i.e. largely impacts on animal movement as the impacts on flora below the panels needs further monitoring) will most likely occur (high). However, with mitigation the potential for impacts occurring is reduced.

Significance

The significance of the impact is rated as **moderate to high** for the unmitigated scenario and **low to moderate** with mitigation.

Tabulated summary of the assessed impact – Change of habitat due to the PV plant infrastructure and restriction of animal movement (operational phase)

Mitigation	Intensity	Duration	Extent	Consequence	Probability of Occurrence	Significance
Unmitigated	**M-H**	**H**	**M**	**M-H**	**H**	**M-H**
Mitigated	**L-M**	**L-M**	**L-M**	**L-M**	**L-M**	**L-M**

Management and mitigation measures

- Refer to the EMP, see Section 9.3.1.

8.1.5 Issue: Spread of alien invasive plants (operational phase)

Assessment of Impact

Nature and intensity, duration of impact and geographical extent

Invasive alien plants can establish near artificial water sources. The intensity is rated high in the unmitigated scenario as natural processes could be altered, because indigenous vegetation would be suppressed.

The duration is rated as moderate, i.e. during the life of the project. The extent is confined to the project area and rated as low in both the unmitigated and mitigated scenarios.

With mitigation (including monitor sites where additional water could potentially lead to the establishment of invasive alien plants and eradicating the emerging invasive alien plants), both the intensity and duration of impacts would be reduced and the appropriate management can reverse potential impacts.

Consequence

The consequence of the impact is considered as moderate for the unmitigated scenario and low for the mitigated scenario.

Probability

The probability of spreading of alien invasive plants is moderate, without controls. With mitigation it is low.

Significance

The significance of the impact is rated as **Moderate** for the unmitigated scenario, reducing to **Low** with mitigation.

Tabulated summary of the assessed impact – Spread of alien invasive plants (operational phase)

Mitigation	Intensity	Duration	Extent	Consequence	Probability of Occurrence	Significance
Unmitigated	**H**	**M**	**L**	**M**	**M**	**M**
Mitigated	**L**	**L**	**L**	**L**	**M**	**L**

Management and mitigation measures

- Refer to the EMP, see Section 9.3.1.

8.2 AVIFAUNA

The following sections are extracts from the Avifauna Specialist Report (ACS, 2022) (see Appendix F).

8.2.1 ISSUE: DISTURBANCE OF BIRDS DURING CONSTRUCTION

The impacts of disturbance on plants and residential animals are assessed in Section 8.1. In this section the specific impacts of disturbance on avifauna are assessed.

During construction, vehicle movements and human activity are at a peak and the possibility of disturbance and habitat destruction the highest, albeit short-term, site-specific and of a general lower significance. Disturbance is expected to decrease in the operational phase. In the case of birds, the results from disturbance are mainly indirect – temporary displacement of birds and a reduction in breeding success.

Assessment of Impact

Nature and intensity, duration of impact and geographical extent

Physical / human disturbance from solar developments can potentially impact on birds during both the construction and operational phases, thereby affecting the presence or foraging and / or breeding success of key species.

The results of disturbance may be indirect or direct, and could include:

- Displacement of birds from areas suitable for them before development, either temporarily or permanently; possibly barrier effects to normal movements.
- A reduction in bird breeding success due to displacement (including of territorial bird species).

Further forms of disturbance include road mortality and poaching of birds (and of eggs). Once operational, these sources of mortality should decrease.

The results of this impact are mainly direct, and could include:

- Unnatural mortalities or injuries of birds (adults and chicks), caused by road collisions or poaching.
- Poaching of birds' eggs, resulting in reduced breeding success.
- Indirectly, mortalities of adults could also lead to the mortalities of dependent chicks.

The proposed site for the project is already subject to a certain amount of disturbance, mostly peripheral (see Section 6.2).

Any new forms of disturbance may potentially become cumulative in view of the existing disturbance.

Priority bird species in the study area that may potentially be impacted by disturbance as a result of the construction of the new Solar PV Power Plant and powerline include:

- Gray's Lark (near-endemic to Namibia; positively identified onsite).
- Rüppell's Korhaan (also near-endemic to Namibia).
- Ludwig's Bustard (Endangered).
- Various raptors.

The intensity of potential impacts is rated as moderate as disturbance may cause birds to leave the site and surrounding areas. In the case of territorial species (e.g. raptors) this could create stress. Disturbance to breeding birds can be severe. Individuals could be affected but not populations.

The extent of the impact would be confined to the site and its nearby surroundings (i.e. local).

The duration of impacts is rated as follows:

- PV: Power Plant: medium term; impact can be reversed over time.
- Powerline: Short-term; during construction.

Consequence

The determining consequence of the impact is as follows:

- PV: Power Plant: moderate.
- Powerline: Low.

Probability

The probability that birds will be disturbed is moderate. It is expected that mitigation measures can reduce the impacts.

Significance

The significance of the impact in the unmitigated scenario is rated as **moderate f**or the Solar PV Power Plant and **low** for the powerline. In the mitigated scenario the overall significance of the impact is rated as **low**.

Tabulated summary of the assessed impact – Disturbance of birds during construction

Mitigation	Intensity	Duration	Extent	Consequence	Probability of Occurrence	Significance
Unmitigated: Solar PV Power Plant	**M**	**M**	**L**	**M**	**M**	**M**
Unmitigated: Powerline	**M**	**L**	**L**	**L**	**L**	**L**
Mitigated	**L**	**L**	**L**	**L**	**L**	**L**

Management and mitigation measures

- Refer to the EMP, see Section 9.3.2.

8.2.2 ISSUE: DIRECT AND INDIRECT MODIFICATION / LOSS / DESTRUCTION OF BIRD HABITAT

<u>Assessment of Impact</u>

Nature and intensity, duration of impact and geographical extent

Solar developments can potentially affect birds by destroying or degrading large areas of habitat, displacing sensitive species. In many cases, PV facilities have involved the complete removal of vegetation from the inclusive footprint of the installed plant. It is this tendency to destroy, degrade, fragment or otherwise displace birds from large areas of natural habitat that has stimulated most concern to date about the implications for avifauna of large-scale solar PV development, particularly in relation to species with restricted ranges and very specific habitat requirements.

Any removal or disturbance of natural vegetation will result in a change to the habitat available to the birds in the area, potentially impacting on their ability to breed, forage and roost in the vicinity. The sparsely vegetated drainage lines in the study area are particularly vulnerable to habitat destruction.

A large concentration of solar plant developments may also lead to increased levels of fragmentation and barrier effects to terrestrial species, particularly if the sites are fenced.

The results of habitat destruction / modification may be indirect or direct, and could include:

- Displacement of birds from areas suitable for them before development, either temporarily or permanently.
- A reduction in bird breeding success due to displacement (including of territorial bird species).

- Permanent modification / destruction of sensitive habitats.

Priority bird species in the study area that may potentially be impacted by habitat destruction as a result of the construction of the new solar PV development and powerline include:

- Gray's Lark (near-endemic to Namibia), found mainly in vegetated drainage lines (positively identified onsite).
- Rüppell's Korhaan (also near-endemic) also use sensitive drainage lines.
- Ludwig's Bustard (Endangered) may also make use of the habitats in the area when good rains result in increased vegetation cover.

Habitat destruction may cause displacement, and result in birds leaving the study site. In the case of territorial species (e.g. raptors) this could create stress and barrier effects to movement. Individuals would be affected but not populations. There could be cumulative effects of ongoing habitat loss in the greater area for all three of the above species.

The intensity of impacts is rated as follows:

- Solar PV: Moderate
- Powerline: Low

The extent of the impact would be confined to the project area and its nearby surroundings (i.e. local).

The duration of impacts is rated as follows:

- PV: Power Plant: Permanent (i.e. very high). However, this rating related to the development within the sensitive drainage line habitats.
- Powerline: Short-term.

Consequence

The determining consequence of the impact is as follows:

- PV: Power Plant: moderate.
- Powerline: Low.

Probability

The probability of impacts to the sensitive habitats is moderate. It is expected that mitigation measures can reduce the impacts.

Significance

The significance of the impact in the unmitigated scenario is rated as **moderate f**or the Solar PV Power Plant and **low** for the powerline. In the mitigated scenario the overall significance of the impact is rated as **low**.

Tabulated summary of the assessed impact – Direct and indirect modification / loss / destruction of bird habitat during construction

Mitigation	Intensity	Duration	Extent	Consequence	Probability of Occurrence	Significance
Unmitigated: Solar PV Power Plant	**M**	**M**	**L**	**M**	**M**	**M**
Unmitigated: Powerline	**M**	**L**	**L**	**L**	**L**	**L**
Mitigated	**L**	**L**	**L**	**L**	**L**	**L**

Management and mitigation measures

- Refer to the EMP, see Section 9.3.2.

8.2.3 ISSUE: BIRD COLLISIONS WITH INFRASTRUCTURE SUCH AS SOLAR PANEL ARRAYS, FENCING AND ASSOCIATED POWERLINE INFRASTRUCTURE AND ELECTROCUTIONS WITH THE POWERLINE

Assessment of Impact

Nature and intensity, duration of impact and geographical extent

Bird collisions and electrocutions are a direct and negative impact, usually resulting in injury or mortality. Indirect impacts resulting from such collisions, and / or entrapment in surrounding fences, could include predation if the bird is unable to fly or take off.

Artificial lighting may impact on night-flying or migrant birds, especially in terms of causing disorientation and / or collisions on structures. Flamingos usually fly at night, and fall into this group. New forms of lighting in areas that were previously unlit may exacerbate the problem of collisions, and also affect movement patterns and corridors. It has been found that nocturnally migrating birds (small passerines, in this case) may become attracted to an isolated pool of diffused light. When there is no moon, plus low fog, the birds could also become attracted to an illuminated, reflective array of solar panels; perhaps becoming disorientated because they are used to following visual clues such as the moon.

A collision with a powerline occurs when a bird in mid-flight does not see the overhead cables or structures (including conductors and / or earth / OPGWs) until it is too late to take evasive action. These impacts could take place on any parts of the powerline but are more likely in sections where the line crosses flight paths / corridors or flyways, such as water courses / drainage lines or ridges. The habitat in the eastern part of the proposed powerline servitude is particularly uneven, with deep drainage lines and higher sections.

Collisions may also take place on stay wires, for instance when a bird is flushed from its position on the ground, and on other associated structures. Collisions may occur when birds cross powerlines in their local, daily movements between breeding / nesting or roosting sites, and foraging areas (or between foraging areas); often such regular flights may take place at dawn and / or dusk. High mobility and nomadism, especially in habitats with ephemeral resources, may render bird species prone to powerline interactions. Groups such as bustards are particularly susceptible to collisions due to their nomadic habits.

A further collision risk that applies to the present study is the configuration and close proximity of adjacent powerlines (of different structures and heights) in the same area, e.g. where the proposed 11 kV line will run in parallel, 13 m away from the existing 11 kV line; as the lines are of different heights, the physical barrier to a bird in flight (and thereby, the cumulative impact) is thus increased. The risk is greater when an earth and / or OPGW run above the conductors, as these cables are usually thinner and less visible.

The priority list includes at least five aquatic species that could potentially be impacted by collisions with solar panel arrays in the above way, namely:

- Lesser Flamingo (Vulnerable; Globally Near Threatened; nomadic, [partial] intra-African migrant).
- Greater Flamingo (Vulnerable; nomadic, [partial] intra-African migrant).
- Great White Pelican (Vulnerable; sedentary, nomadic).
- Maccoa Duck (Near Threatened, Globally Vulnerable; resident, nomadic).
- Black-necked Grebe (Near Threatened; resident, nomadic).

The majority of the (larger) priority species are prone to powerline collisions. These include large terrestrial species; and waterbirds; and raptors, e.g.:

- Ludwig's Bustard; Rüppell's Korhaan.
- Lesser Flamingo and Greater Flamingo; Great White Pelican.

- Raptors, in particular Lappet-faced Vulture and Martial Eagle.

An electrocution occurs when a large bird is perched or attempts to perch on an electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and / or live and earthed components. An electrocution could also be caused should a large bird perch on top of a tower and send down a "streamer" of excrement that could hit a conductor, thereby bridging the gap between an earthed and a live component.

Priority bird species in the study area that may potentially be impacted by electrocution in the above way (i.e. by direct contact, or by streamers) include:

- Large raptors, including Lappet-faced Vulture; Martial Eagle; Verreauxs' Eagle; also the smaller Rock Kestrel.
- Perching waterbirds, including Great White Pelican.

Taking the above-mentioned into consideration, the intensity of impacts is rated as follows:

- Solar panel arrays: Low
- Powerline: Moderate

The extent of the impact would be confined to the project area and its nearby surroundings (i.e. local).

The duration of impacts is rated as high (i.e. death or injury to individual birds).

Probability

The probability of bird collisions / electrocutions (i.e. powerline only) occurring in the unmitigated scenario is as follows:

- Collisions with solar panel arrays: Low to moderate.
- Powerline collisions: High - bird collisions of the above species on powerlines have already been reported in the broader area.
- Powerline electrocutions: Moderate.

With mitigation, the probability could be reduced.

Consequence

The determining consequence of the impact is as follows:

- Collisions with solar panel arrays: Low to moderate.

- Powerline collisions: High - bird collisions of the above species on powerlines have already been reported in the broader area.
- Powerline electrocutions: Moderate.

Significance

The significance of the impact in the unmitigated scenario is rated as follows:

- Collisions with solar panel arrays: Low to moderate.
- Powerline: Moderate.

In the mitigated scenario the overall significance of the impact is rated as **low**.

Tabulated summary of the assessed impact – Bird collisions with infrastructure such as solar panel arrays, fencing and associated powerline infrastructure and electrocutions with the powerline

Mitigation	Intensity	Duration	Extent	Consequence	Probability of Occurrence	Significance
Unmitigated: Solar PV Power Plant (collisions)	**L**	**H**	**L**	**M**	**L-M**	**L-M**
Unmitigated: Powerline (collisions)	**M**	**H**	**L**	**M**	**L**	**M**
Unmitigated: Powerline (electrocutions)	**M**	**H**	**L**	**M**	**H**	**M**
Mitigated	**L**	**L**	**L**	**L**	**L**	**L**

Management and mitigation measures

- Refer to the EMP, see Section 9.3.2.

8.3 VISUAL IMPACTS

The following sections are extracts from the Visual Impact Assessment Report (GYLA, 2022) (see Appendix G).

8.3.1 ISSUE: GENERAL VISUAL IMPACTS AND SENSE OF PLACE

The existing visual condition of the landscape that may be affected by the proposed Solar PV Power Plant has been described in Sections 6.2 and 6.6. The area's scenic quality has been rated low to moderate within the context of the sub-region, and the project site is in a low-rated landscape type. Sensitive viewing areas and landscape types have been identified and mapped, indicating potential sensitivity to the project, mainly for motorists using the B2 national road immediately north of the project site.

Impacts on views are the highest when viewers are sensitive to change in the landscape, and the view is focused on and dominated by the change. The project's visual impact will cause changes in the landscape that are noticeable to viewers looking at the landscape from adjacent local roads and the B2 national road. People living in the residential areas of Arandis will not be affected by the project.

Assessment of Impact

Nature and intensity, duration of impact and geographical extent

To assess the intensity of visual impact four main factors are considered.

- Visual Intrusion: The nature of intrusion or contrast (physical characteristics) of a project component on the visual quality of the surrounding environment and its compatibility / discord with the landscape and surrounding land use within the context of the landscape's visual absorption capacity (VAC).
- Visibility: The area / points from which project components will be visible.
- Visual exposure: Visibility and visual intrusion qualified with a distance rating to indicate the degree of intrusion.
- Sensitivity: Sensitivity of visual receptors to the proposed development

Users of the B2 national road

Project components will appear in some foreground views, experienced from the B2 national road, (approximately 800 m from the nearest PV arrays) with the potential for high visual intrusion. However, this perspective would be temporary and last only a few minutes as people travel past the site on the B2 national road. PV arrays would briefly appear in the middle-ground of views at 800 m to 3 km (moderate visual intrusion). Visual intrusion is considered low, i.e. has a minimal to insignificant effect on the visual quality and sense of place of the landscape and contrasts minimally with the patterns or cultural elements that define the structure of the landscape.

A minor loss of or alteration to key elements / features / characteristics of the baseline is therefore expected i.e. pre-development landscape or view and / or introduction of elements that may not be problematic when set within the attributes of the receiving landscape. This would result in low scenic quality impacts.

The residential areas of Arandis, the remainder of the study area

Very minor loss or alteration to key elements / features / characteristics of the baseline is expected, i.e. pre-development landscape or view and / or introduction of elements that is not problematic with the surrounding landscape – approximating the 'no change' situation. This would result in negligible scenic quality impacts.

Night lighting

The negative effect of night lighting caused by the project would be seen against the lights and glow from the RUL Mine. It would not be particularly detrimental to people visiting the area and using the B2 national road. However, they would add to the adverse accumulative effects of mining activities and management measures should be implemented to limit the spillage of light beyond the project's site boundaries (see Chapter 9).

Taking all of the above-mentioned into consideration, the severity, duration and extent are therefore all rated as low in the unmitigated and mitigated scenarios.

Consequence

The determining consequence is low for the unmitigated and mitigated scenarios.

Probability

With reference to the discussions above, the proposed new Solar PV Power Plant infrastructure would likely be visible from the B2 national road for short sections – therefore a moderate rating.

Significance

The significance of impact, without mitigation and based on the worst-case scenario, for the various sensitive receptor areas during the construction and operational phases is low and limited mitigation is required.

Tabulated summary of the assessed impact – General visual impacts and sense of place

Mitigation	Intensity	Duration	Extent	Consequence	Probability of Occurrence	Significance
Unmitigated	**L**	**L**	**L**	**L**	**M**	**L**
Mitigated	**L**	**L**	**L**	**L**	**M**	**L**

Management and mitigation measures

- Refer to the EMP, see Section 9.3.3.

8.3.2 ISSUE: GLINT AND GLARE IMPACTS RELATING TO THE ARANDIS AERODROME

In addition to the potential (general) visual impacts (and sense of place issues) assessed above, the potential of glint and glare can be of concern.

With reference to Section 2.3.3, the NCAA commented that compliance with the regulatory requirements related to aviation safety and specifically the Arandis Aerodrome is essential for this project. The key issues raised are glint and glare, as well as the proximity of potential obstacles limitation surfaces, which may affect aviation safety (see also Section 8.3.3) – relating to the Arandis Aerodrome. The Arandis Aerodrome is currently operated as a 'low volume air traffic facility" (pers comms: Werner Van Wyngarden, Southern Energy General Manager, 1 June 2022).

The South African Civil Aviation Authority (SACAA) obstacle notice 3/2020 *Additional Requirements for Solar Project Applications* states that a glint and glare assessment would not be required if a solar PV facility is not within a 3 km radius of the aerodrome. Using the SACAA guideline and the NCAA note (suggesting 'industry best practice is to be adhered to') and consultation with the NCAA, because the proposed RUL Solar PV plant would mostly occur immediately outside a 3 km radius exclusion zone measured from the eastern end of the runway (97.1% of the proposed project site is outside this exclusion zone), a detailed glint and glare analysis is not required (GYLA, 2022).

The discussion of glint and glare is qualitatively only. A full glint and glare assessment using modelling software was not carried out. Furthermore, based on the qualitative assessment, glare from the proposed project would not significantly affect the operations of the Arandis Aerodrome (GYLA, 2022 - see Appendix G).

The following definitions are provided for both glint and glare by GYLA (2022):

- Glint: A momentary flash of light resulting from a spatially localised reflection of sunlight.
- Glare: The sensation produced by luminance within the visual field that is sufficiently greater than the luminance to which the eyes are adapted, which causes annoyance, discomfort, or loss in visual performance and visibility.

Assessment of Impact

Nature and intensity, duration of impact and geographical extent

There is a concern for the potential of PV glare in aerodrome environments. Part 139.01.13 of the Namibia Civil Aviation Regulations (NAMCARs) of 2001, as amended in 2018, and the NAMCATs – Aerodromes and Heliports, stipulate the requirements for lights that may endanger the safety of aircraft (see Section 3.1 for further details).

PV panel surfaces are designed to absorb the sunlight as much as possible, therefore substantially reducing the potential for glint and glare. The glass layer covering the PV modules is made of high transmission tempered glass with an anti-reflective (AR) coating. Consequently, the percentage of the reflected light from PV modules can vary from 2% to 30% depending on the angle of incidence. However, published guidance shows that the intensity of solar reflections from solar panels are equal to or less than those from water. The specifications of the solar cells for the proposed project indicate external light reflectance of the PV module surface to be on average ~2.0% (TÜV Rheinland Energy GmbH, 2020).

It also shows that reflections from solar panels are significantly less intense than many other reflective surfaces, which are common in an outdoor environment. This amount is low - by comparison, a mirror can reflect a percentage of the incident light above 98%.

However, the panels and other components reflect light that may result in some glinting (but only at minimal angles), and glare depending on panel orientation, sun angle, viewing angle, viewer distance, and other visibility factors. The images in the Visual Impact Assessment Report (Appendix G) illustrate this effect, where the arrays can vary in colour from black, to blue, to a bright silvery sheen. The result can also be distributed across a single project site when differing sky conditions exist, as is illustrated in the images of a solar park near Touwsrivier. The southern section of the solar park is in the sun, causing a silver sheen, while the park's northern area, which is in cloud shade, appears dull grey. The effect of glint (a sharp focus of light) is not generally associated with PV arrays; however, glare can occur with certain climatic and orientation conditions, as has been illustrated (GYLA, 2022).

The effect of glint and glare caused by this project is discussed below with reference made to Figure 11.

The RUL Solar PV Power Plant is northeast of the Arandis Aerodrome. Reflections from the solar panels might occur in the summer months when the sun is north of the east-west axis. Glare from the arrays might be experienced from south of the PV plant during this time. Aircraft approaching the landing strip will do so south of the Solar PV Power Plant along flight paths from the east or west, depending on wind direction. When approaching from the east the RUL project will appear to the right of the airstrip. During summer morning hours when the solar arrays are orientated to the east, there is potential for a solar reflection that could be experienced by pilots.

However, as above, the percentage of the reflected light from PV modules is minimal and the intensity of solar reflections from solar panels are equal to or less than those from water. Research also confirms that reflections from solar panels are significantly less intense than many other reflective surfaces common in an outdoor environment.

A similar effect might occur in the late afternoon summer months when the landing strip is being approached from the west and the solar panels are aligned to the west. The RUL project would appear to the left of the aerodrome.

Potential glare caused by the project would, therefore, not have a significant risk effect on the operation of the Arandis Aerodrome. Figure 11 shows the relative location of the proposed project to the Arandis Aerodrome and the existing Solar PV Power Plant immediately south of Arandis.

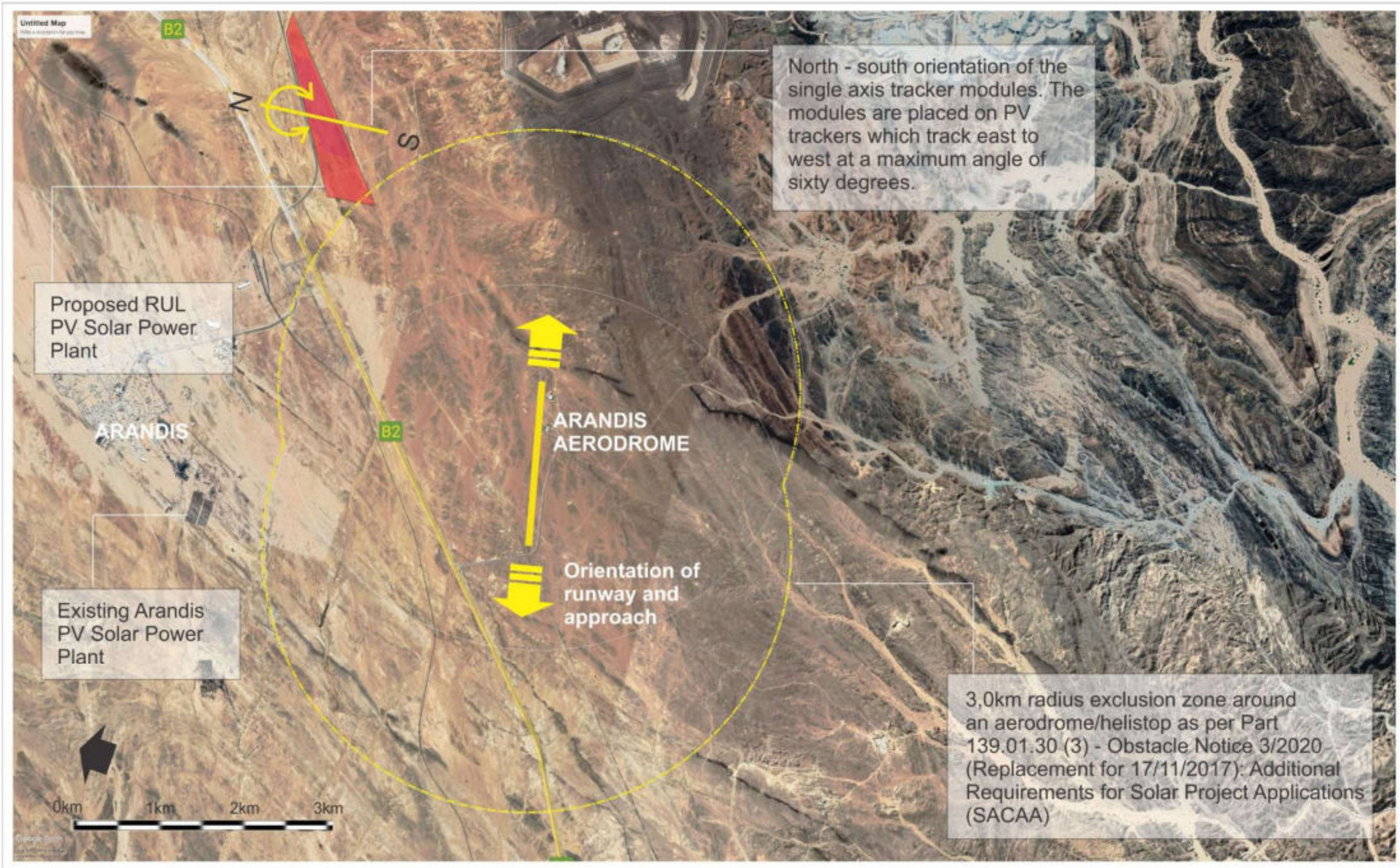

FIGURE 11: GLINT AND GLARE – ARANDIS AERODROME

(Source: GYLA, 2022)

Taking all of the above-mentioned into consideration, the severity, duration and extent are therefore all rated as low in the unmitigated and mitigated scenarios.

With reference to Section 4.5, no flood light or other external lighting is planned.

Consequence

The determining consequence is low for the unmitigated and mitigated scenarios.

Probability

With reference to the above descriptions, depending on the time of day and the exact approach by the pilot at the time, there is potential for a solar reflection that could be experienced by pilots – therefore a moderate rating.

Significance

The significance of impacts is rated low in the unmitigated and mitigated scenarios.

Tabulated summary of the assessed impact – glint and glare impacts relating to the Arandis Aerodrome

Mitigation	Intensity	Duration	Extent	Consequence	Probability of Occurrence	Significance
Unmitigated	**L**	**L**	**L**	**L**	**M**	**L**
Mitigated	**L**	**L**	**L**	**L**	**M**	**L**

Management and mitigation measures

- Refer to the EMP, see Section 9.3.3.

8.4 OBSTACLES IN RELATION TO AVIATION SAFETY

8.4.1 ISSUE: IMPACTS TO AVIATION, SPECIFICALLY THE ARANDIS AERODROME - RELATING TO ADDITIONAL OBSTACLES

With reference to Section 2.3.3, the NCAA commented that compliance with the regulatory requirements related to aviation safety and specifically the Arandis Aerodrome is essential for this project. The key issues raised are glint and glare, as well as the proximity of potential obstacles limitation surfaces, which may affect aviation safety – relating to the Arandis Aerodrome.

With reference to Section 3.1, the Civil Aviation Act, No. 6 of 2016 and Part 139.11.2 of the Namibia Civil Aviation Regulations of 2001, as amended in 2018 states, amongst others that "*no* *building or object higher than 45 m above the aerodrome elevation, or in the case of a water aerodrome, the normal level of the water, maybe erected within a distance of 15 km measured from the aerodrome reference point without the written approval of the Executive Director"*.

Assessment of Impact

Nature and intensity, duration of impact and geographical extent

With reference to Sections 6.2 and 6.6.1, the general area around the project site is dominated by a series of hills and ridges and various activities of RUL - mining, processing and associated infrastructure - that protrude above the flat landscape. The TSF is one such facility and is about 88 m from ground level on the western side (see Figure 12 for the location of the TSF). A series of isolated hills occur north of the B2 national road and east of Arandis. The town of Arandis is also north of the road and approximately 3.5 km north-west of the site.

Many powerlines associated with the mine and Arandis also exist in the area and the proposed new powerline will largely be constructed within the same corridor / servitude as an existing 11 kV powerline, with a new servitude towards the north in the final 2.1 km (see Figure 12). The proposed new powerline (i.e. between 10.0 - 15.0 m above ground) will largely be the same height as the existing powerline (pers. comms: Hennie Lacock, 25 April 2022) except for the section where the new powerline will cross over the existing line. This section of the powerline will therefore have to be increased in height with a few meters to cross over the existing line.

Aircraft approaching the landing strip from the east would fly over the existing and proposed new powerlines (red and green lines in Figure 12).

With reference to Section 4.3, the maximum height of the panels would be ± 1.8 m. This is relatively low in comparison to the other existing infrastructure (and topographical features in the surrounding area (see Figure 12). Aircraft approaching the landing strip will do so south of the proposed Solar PV Power Plant along flight paths from the east or west, depending on wind direction.

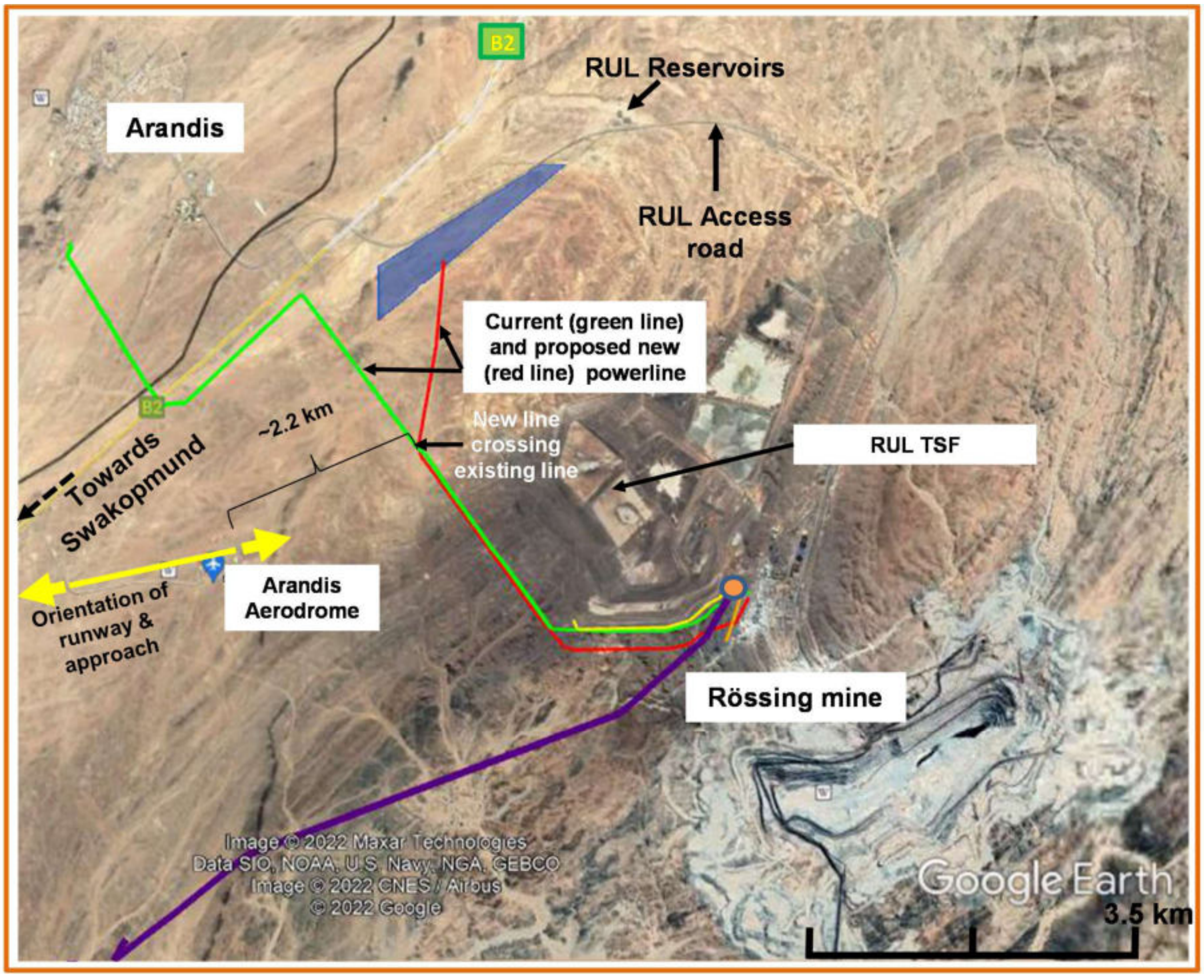

FIGURE 12: EXISTING OBSTACLES AND THE PROPOSED PROJECT INFRASTRUCTURE IN RELATION TO THE – ARANDIS AERODROME

(Source: GYLA, 2022)

Taking all of the above-mentioned into consideration, the severity, duration and extent of additional obstacles and associated impacts to the Arandis Aerodrome are therefore all rated as low in the unmitigated and mitigated scenarios.

Consequence

The determining consequence is low for the unmitigated and mitigated scenarios.

Probability

With reference to the above descriptions, there will be additional infrastructure constructed – i.e. causing additional obstacles – therefore a moderate rating.

Significance

The significance of impacts is rated low in the unmitigated and mitigated scenarios.

Tabulated summary of the assessed impact – Impacts to aviation - i.e. Arandis Aerodrome - relating to additional obstacles

Mitigation	Intensity	Duration	Extent	Consequence	Probability of Occurrence	Significance
Unmitigated	**L**	**L**	**L**	**L**	**M**	**L**
Mitigated	**L**	**L**	**L**	**L**	**M**	**L**

Management and mitigation measures

- Refer to the EMP, see Section 9.3.4.

8.5 SOCIO-ECONOMIC IMPACTS

8.5.1 ISSUE: EMPLOYMENT AND SKILLS DEVELOPMENT

The proposed development would create a number of temporary local employment and business opportunities during the construction phase (±80 people (peak) over a 6-month period) as well as a small number of people that may be permanently employed during the operational phase of the project. Security personnel will be from a contracted company.

Assessment of Impact

Nature and intensity, duration of impact and geographical extent

The proposed Solar PV Power Plant will contribute to the economy in the following positive ways:

- Direct benefits: Direct number of persons employed and their wages and salaries, taxes paid, and profits earned. Skills developed through training.
- Indirect benefits: The provision of products and services to the project, as well more employment opportunities will be created due to the multiplier effects of the (cumulatively) large industry in the region.

The permanent job opportunities are relatively small, when compared to the number of permanent employees at the existing RUL operations.

The severity is therefor considered to be low positive.

In the normal course, the direct positive economic impacts associated with the project will occur for the life of operations.

The impact will be experienced in the region and in other 'economic centres' of Namibia such as Arandis, Swakopmund, etc. The spatial scale is therefore beyond the project site and is classified as moderate.

Consequence

Based on the above assessment the determining consequence is low.

Probability

In the normal course of economic activity, the net positive impacts will definitely occur.

Significance

The significance of this potential impact is moderate positive.

Tabulated summary of the assessed impact – Employment and skills development

Mitigation	Intensity	Duration	Extent	Consequence	Probability of Occurrence	Significance
Unmitigated	**L+**	**M**	**M**	**L**	**H**	**M+**
Mitigated	**L+**	**L**	**L**	**L**	**H**	**M+**

Enhancement measures

- Refer to the EMP, see Section 9.3.9.

8.5.2 ISSUE: INWARD MIGRATION

<u>Assessment of Impact</u>

Nature and intensity, duration of impact and geographical extent

Inward migration could lead to the increased incidence of social ills, including alcoholism, drug abuse, prostitution, gambling, criminality, etc. Alcohol abuse is part of the accepted social norm in Namibia and is often stimulated by cash earnings which increase the likelihood of domestic violence (usually against women and children), unprotected sex and the spread of HIV/AIDS. The influx of job seekers may increase over-crowding which increases the spread of TB.

With reference to Section 6.7.5, inward migration and associated impacts has already started at the central coastal towns of Namibia.

The relatively small workforce requirements and short construction period of the proposed Solar PV Power Plant is, however, unlikely to stimulate a considerable influx of more job-seekers to the region.

Taking the above-mentioned into consideration, the severity (i.e. project specific contribution to the issue) in the unmitigated scenario is considered to be low to moderate for both the unmitigated and mitigated scenarios.

The social issues are expected to relate specifically to the construction phase, which is only ±6 months, therefore short-term.

The impacts would be beyond the site boundary. Inward migration impacts would be felt in Arandis and the central coastal towns. The spatial scale is therefore moderate in the unmitigated scenario and low in the mitigated scenario.

Consequence

Based on the above assessment the determining consequence is low to moderate.

Probability

Minor additional influx of people is possible.

Significance

In the unmitigated scenario, the significance is low to moderate. In the mitigated scenario, the significance of this potential impact is reduced to low.

Tabulated summary of the assessed impact – Inward migration

Mitigation	Intensity	Duration	Extent	Consequence	Probability of Occurrence	Significance
Unmitigated	**L-M**	**L**	**M**	**L-M**	**M**	**L-M**
Mitigated	**L**	**L**	**M**	**L**	**L**	**L**

Management and mitigation measures

- None identified for the project. RUL to continue with existing measures.

9 ENVIRONMENTAL MANAGEMENT PLAN (I.E. EMP ADDENDUM)

RUL has an approved EMP in place. This chapter provide an addendum to the approved RUL EMP relating to the proposed Solar PV Power Plant.

RUL has a wide range of management mechanisms (operational procedures and management plans as parts of the existing Environmental Management System), in place which need to be applied to the proposed site – during the construction as well as the operational phase.

The following aspects and impacts require specific, site-specific accentuation of the management mechanisms:

- Impacts on biodiversity (i.e. flora and fauna) in general.
- Impacts on avifauna.
- Visual Impacts – i.e. sense of place and glint and glare.
- Impacts to aviation (i.e. Arandis Aerodrome - relating to additional obstacles).
- Positive and negative socio-economic impacts, largely during construction.

9.1 AIMS

The aim of the EMP (Addendum) is to detail the actions required to effectively implement management and mitigation measures. These actions are required to minimise or avoid negative impacts associated with the proposed Solar PV Power Plant activities and the associated infrastructure.

In addition to the above, the EMP identifies parties at an early stage of project development to implement management and mitigation measures through all phases of the project from design to operational phase. It is also important to note that RUL has an approved EMP for the RUL Mine (and associated activities) and infrastructure, which his being implemented through an Environmental Management System.

This EMP therefore provides additional / specific management and mitigation measures, specifically relating to the Solar PV Power Plant, however the relevant management and mitigation measures associated with the approved RUL EMP needs to be complied with.

This EMP should therefore be read with the existing overarching EMP for the RUL Mine.

9.2 Environmental Objectives

The following overall social and environmental objectives are applicable to the proposed Solar PV Power Plant:

- To ensure compliance with relevant national legislation and standards, corporate environmental policies and objectives as well as this EMP (Addendum).
- To investigate and exploit measures to reduce resource and energy consumption.
- To minimise, as far as is possible, the unacceptable loss of biodiversity and related functionality through physical destruction and disturbance.
- To monitor the impacts of bird strikes and interactions with the Solar PV Power Plant infrastructure and determine additional suitable management and / or mitigation measures as and where required.
- To limit contaminated effluent discharge into the environment, and to protect soils and surface and groundwater resources through the implementation of measures for spill prevention and clean-up.
- To avoid additional negative visual impacts.
- To minimise cumulative negative socio-economic impacts and enhance positive socio-economic impacts.
- To ensure the appropriate management and disposal of general, recyclable and hazardous waste.
- To prevent and minimise pollution.
- To develop, implement and manage environmental monitoring systems for biodiversity.
- To support and encourage environmental awareness and responsibility amongst all employees and service providers.
- To provide appropriate environmental education and training for all employees and service providers.

9.3 Management and mitigation measures (Action Plans) To Achieve Objectives

The management and mitigation measures (or action plans) to achieve the above-mentioned objectives, relating to the various environmental issues are listed in the sections below.

RUL will have overall accountability for ensuring the EMP gets implemented, through a separate contract, or clause within the engineering, procurement and construction (EPC) contract. However, all members of the project team as well as the contractors are expected to understand the EMP requirements and implement them.

9.3.1 BIODIVERSITY (FAUNA AND FLORA) MMP

OBJECTIVES

The objective is to prevent, as far as is possible, the unacceptable loss of biodiversity, change of habitat and related ecosystem functionality. Also, to minimize impacts on sensitive areas

ACTIONS REQUIRED

Issue 1: Loss of vegetation and associated biota:

- Limit access routes and lay-down areas to already disturbed area, as far as possible.
- Avoid major drainage lines for position of solar plant, powerline and water pipeline. Therefore, implement the proposed layout (as presented in Figure 6 – which allows for the "exclusion zones").
- Where this cannot be avoided (e.g. with linear infrastructure), ensure drainage patterns are not altered.
- Make sure the proposed new powerline follows the existing powerline and maintenance track as close as possible. The new section must follow the shortest distance to the existing servitude.
- In the powerline section that needs to be newly disturbed, avoid areas with denser vegetation, *Aloe asperifolia* and *Commiphora saxicola* plants.
- Where the water pipeline crosses a small hill (near the road), ensure avoiding the *Aloe asperifolia* population.
- House construction staff off-site.
- Ensure RUL environmental staff is regularly present and conduct inspections during construction.
- Develop and implement Environmental Code of Conduct for contractors.
- Rehabilitate areas disturbed by construction.

Issue 2: Change of habitat due to the Solar PV Power Plant infrastructure and restriction of animal movement (operational phase)

- Do not clear vegetation beneath the solar modules, where not absolutely necessary.
- Avoid *Aloe asperifolia* and *Commiphora saxicola* for position of solar module supports, as far as practically possible.
  - Undertake detailed field survey parallel to the detailed design of the solar module positions to avoid *Aloe* and *Commiphora* plants.

- Relocate where *Aloe asperifolia* and *Commiphora saxicola* plants cannot be avoided.
- Rehabilitate areas disturbed during construction.
- Relocation should only be used as a last resort, as its effectiveness is often questionable—questionable because the mode of relocation and aftercare as well as seasonal effects need to be taken into account to increase the chances of success.
- Key point in any relocating efforts is to find suitable disturbed area into which the rescued plants can be relocated. Natural, undisturbed habitat should not be used as a recipient area for relocation, as the planting itself is a disturbance and may alter the habitat thus affecting the naturally established flora.

Issue 3: Spread of alien invasive plants (operational phase)

- Regularly check for leaks.
- Monitor sites for invasive alien plants along water pipeline and
- Eradicate immediately.

Note: Invasive alien plants such as *Argemone*, *Datura Nicotiana*, *Prosopis* and *Ricinus* could be inadvertently encouraged in areas where water is provided. Alien invasive plants are pioneers and establish quickly at water leaks of pipelines.

MONITORING REQUIREMENTS

- Monitor the effect of the solar panels on vegetation and habitats to better understand associated impacts in future.
- Monitor sites where additional water could potentially lead to the establishment of invasive alien plants.

9.3.2 Avifauna MMP

Objectives

The objective is to prevent, as far as is possible, the unacceptable modification, loss or destruction of bird habitats and birds.

Actions required

Issue 1: Physical / human disturbance of birds (resulting in avoidance / displacement); including road mortalities and / or poaching

Construction phase

Avoidance:

- Scheduling: changing the timing of construction activities to avoid disturbing biodiversity during sensitive periods (e.g. during breeding seasons). Before construction starts, the proposed solar PV site and the proposed powerline route should be inspected for any signs of bird nesting activity. Disturbance of nesting birds, in particular Gray's Lark and Rüppell's Korhaan in sensitive wash areas, should be avoided.

Minimisation:

- Abatement controls to reduce noise disturbance created during construction.
- Operational controls to manage and regulate contractor activity, such as exclusion fencing around sensitive areas.
- The existing speed limit of RUL should be strictly enforced.
- No poaching during construction is allowed and this should be emphasised during induction to contractors; offenders should be prosecuted.
- Ongoing awareness should be promoted about the value of biodiversity and the negative impacts of disturbance, especially to breeding birds, and of poaching and road mortality.

Issue 2: Direct and indirect modification / loss / destruction of bird habitat (resulting in avoidance/ displacement)

Project design phase

Avoidance and minimisation:

- Micro-siting: where possible, the unnecessary destruction of habitat or degradation of the environment, including sensitive habitats such as ephemeral drainage systems, should be avoided. The final layout of project infrastructure should avoid designated sensitive areas, e.g. wash habitats as indicated in Figure 6.

Construction phase

Restoration and rehabilitation:

- Repair of degradation or damage to biodiversity features and ecosystem services from project-related impacts that cannot be completely avoided and/or minimised, e.g. by restoration of temporary-use and lay down areas as soon as reasonably practicable after construction activities are complete.

Operational phase

Minimisation:

- Abatement controls to reduce emissions and pollutants (erosion, dust, waste) created during construction; wastewater management and water conservation measures.
- Operational controls to manage and regulate contractor activity, such as exclusion fencing around sensitive areas, designated machinery and lay-down areas, minimisation of vegetation loss and disturbance to soil; managing the timing of vegetation control activities at suitable intervals.
- Ongoing awareness should be promoted about the value of biodiversity and the negative impacts of habitat destruction.

<u>Issue 3: Attraction of novel species to an area by the artificial provision of otherwise scarce resources</u>

Construction phase

Avoidance:

- Ensure strict and effective waste management (including of food) during construction activities, to discourage an unnatural increase in scavenging species such as Pied Crow.

Operational phase

Minimisation:

- Monitoring is essential to identify (potential) problem areas; any movement of hitherto unrecorded species onto or beneath the solar panel structures should be monitored; and any resulting negative impacts result (e.g. entrapment of korhaans in fences; predation), should be addressed accordingly.

- Bird perching or nesting activities on solar infrastructure may become a problem, and adaptive management measures may be required (such as anti-perch measures, see Avifauna Specialist report, Appendix G, for further details). Nesting activities should be discouraged early in the cycle, before any eggs are laid; the MEFT could be contacted for specific guidelines for dealing with such problems.
- Should any nesting or other activity by crows on power supply structures cause disruptions of the power supply, consult with the MEFT for appropriate measures to discourage and manage such activities, e.g. by removing nests at a stage when this is acceptable.

Issue 4: Bird electrocutions on powerline infrastructure

The mitigation measures below are already standard procedure for most poles but are mentioned for the sake of completeness.

Construction phase

Minimisation:

- A standard mitigation for electrocutions in Namibia is to "gap" the earth wire near the top of the pole, i.e. the earth wire on each powerline pole should stop at least 300 mm below the lowest phase to provide an air space safety gap, in order to reduce electrocution risk. However, the proposed 33 kV design will instead be used to increase the Basic Insulation Level (BIL).
- On strain structures where "jumper" wires are used, at least the centre jumper should be insulated, using polyvinyl chloride (PVC) or low-density polyethylene (LPDE) pipe. Jumpers should be offset where possible.
- Transformer/switchgear structures should be designed in such a way that they are not attractive as bird perches/nesting sites; selected live components should be insulated (e.g. using PVC or LDPE pipe; Figure 13).
- The stay wires should also be "gapped" by the use of an insulator.
- A steel perching bar for birds has been proposed as a mitigation for electrocutions. This horizontal bar would be 530 mm long, and fitted onto the top of each steel pole, 220 mm above pole. Additional (high) perches could be fitted above transformer structures.

Operational phase

Minimisation:

- The need for reporting powerline incidents should be stressed, and reporting procedures clarified.

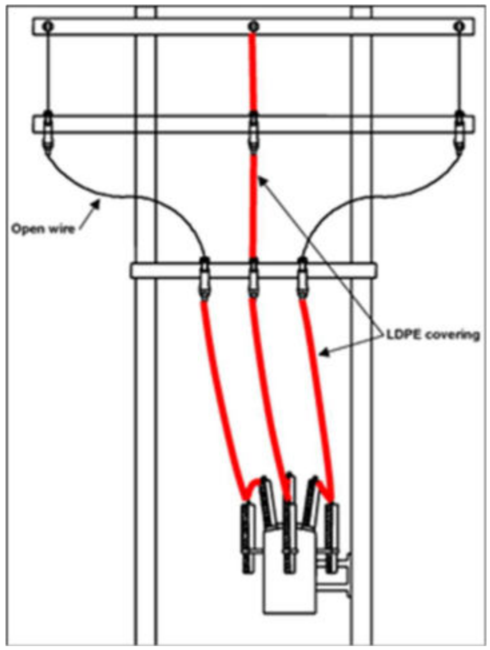

FIGURE 13: EXAMPLE OF USE OF LDPE PIPE ON JUMPERS TO INSULATE SELECTED LIVE COMPONENTS OF TRANSFORMERS AND SWITCH GEARS

Issue 5: Bird collisions with infrastructure such as solar panel arrays, fences, guyed masts and associated powerline infrastructure

Collisions on solar power infrastructure

- Monitoring of any potentially negative impacts is considered essential. Should the results show that such impacts, including injuries and/or mortalities of birds are taking place, adaptive mitigation measures would need to be investigated, if necessary on a species-specific basis.

Project design phase

Avoidance:

- The Solar PV Power Plant should be fenced with predator-proof fencing, to reduce indirect predation of any bird collision species (if injured and still alive), and also to prevent the removal of any carcass material before it is recorded.

- In order to reduce the chances of the panels being mistaken for sheets of water, minor modifications could be made to the panel design (e.g. by means of applying visual cues: see Operational phase: Minimisation, below), but at this stage these should rather be considered as an adaptive mitigation, to be retro-fitted once there is a recorded need.
- Security lighting should be kept to the minimum and directed downward and away from the PV panels if possible.
- The solar PV panels themselves should not be illuminated during the night to ensure that the surfaces of the panels are non-reflective.

Operational phase

Minimisation:

- If monitoring results indicate that bird collisions are taking place on the solar panels, adaptive mitigations could include the retrofitting of visual cues to existing panels. Such minor modifications to the panel design could reduce the chances of the panels being mistaken for sheets of water. These visual cues may include UV-reflective or solid (white) contrasting bands spaced no further than 28 cm from each other. This arrangement has been shown to significantly reduce the number of small passerine birds hitting expanses of windows on commercial buildings. Non-polarising white tape used around panels can also minimise reflection, which can attract aquatic insects, as it mimics reflective surfaces of waterbodies.

<u>Issue 6: Collisions on powerline infrastructure</u>

Project design phase

Avoidance and minimisation:

- To address the collision risk on the proposed transmission line, the marking of the more sensitive section of the line to increase visibility is recommended, as precaution (also see Figure 14 below):
  - Start (A): 22.469547S 15.020231E
  - End (B): 22.432446S 15.008813E
- The top horizontal cables (OPGW and earth / ground wire) should be marked, for the full length of each span. The design should be alternating, marking both cables.
- Recommended marking devices include the following, both made by Preformed Line Products (see Figure 15):

- Large SWAN-FLIGHT Diverter; alternating with
- Viper Live Bird Flapper ("Viper").

- The marking distance between devices on each line should be 10 m and the design / colours offset where possible (e.g. black and white).
- At this stage, no nocturnally visible marking is recommended, but it should become mandatory should monitoring results indicate the necessity (e.g. repeat collisions of any nocturnal fliers such as flamingos on powerlines).
- The need for fitting any mitigation for collisions on stay wires (e.g. marking with vibration dampers) should also be based on monitoring results.

Operational phase

Minimisation:

- The need for reporting powerline incidents should be stressed, and reporting procedures clarified. Should monitoring indicate that collisions are still taking place despite the above marking, further mitigation would need to be investigated.

FIGURE 14: SECTIONS OF THE PROPOSED 11 KV POWERLINE RECOMMENDED FOR THE FITTING OF MARKING DEVICES (MARK A TO B, 4.6 KM), AS A MITIGATION FOR BIRD COLLISIONS

(Source: ACS, 2022)

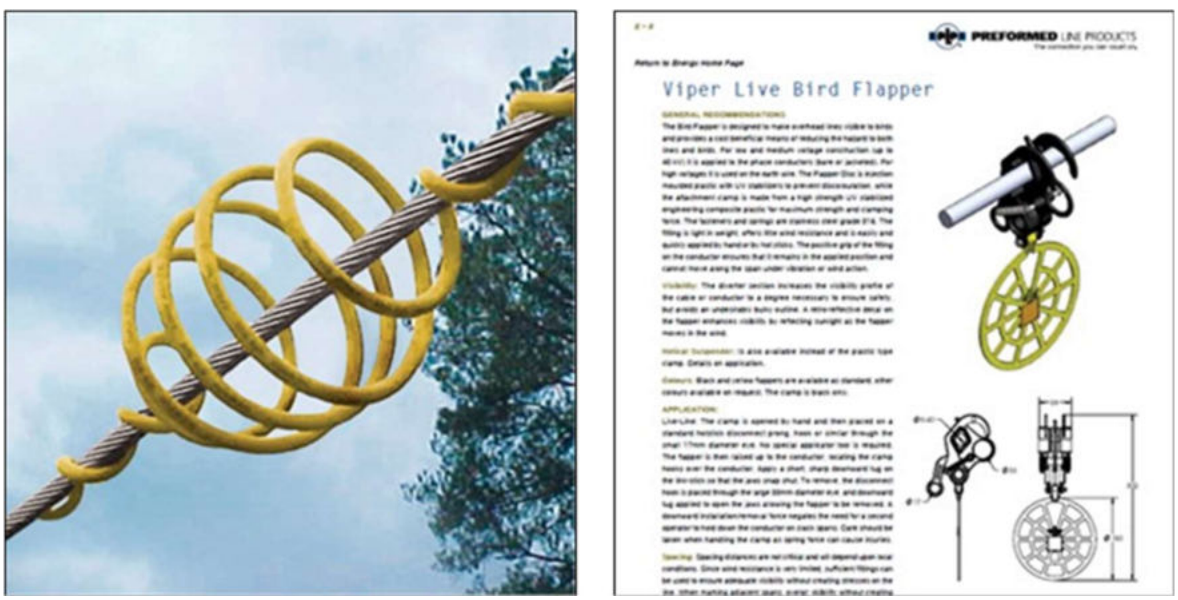

FIGURE 15: EXAMPLES OF POWERLINE MARKING DEVICES, USED AS A MITIGATION FOR BIRD COLLISIONS (BOTH MADE BY PREFORMED LINE PRODUCTS): A. SWAN-FLIGHT DIVERTER; AND B. VIPER LIVE BIRD

(Source: ACS, 2022)

MONITORING

The following monitoring initiatives should be conducted by RUL in collaboration with and with the support of the avifauna specialist, and any other relevant partners.

- A post-construction monitoring programme is regarded as essential, and should take the form of a repetition of the above pre-construction monitoring protocols, covering a one-day period, repeated six times over one year, and including carcass searches. Interim carcass searches could also be conducted, at a frequency indicated by the need, and also taking the possible occurrence of scavengers such as black-backed jackal (*Canis mesomalas*) into account. The results should be reviewed periodically, and also compared with the results of the pre-construction monitoring.
- The Solar PV Power Plant should be monitored in the form of searching the ground between arrays of solar panels and checking on the panels themselves. The searches should be done on foot.
- The powerline surveys should include the two existing 11 kV lines (as surveyed in the pre-construction monitoring) and the new 11 kV line (which will run in parallel, in parts, with the 11 kV Arandis-Rössing line). The methods should follow the existing protocols for powerline surveys.
- Both mortalities and live birds should be monitored; these would include any species that appear to be attracted to the area. If there is a need, camera traps could be used to document the occurrence of sensitive species, such as waterbirds and / or raptors.
- The need for reporting any incidents should be stressed, and reporting procedures should be clarified. All bird mortalities should be recorded on a standardised form, with the GPS coordinates and structure involved and other details, and photographs of the carcass (including head and beak), structure and point of impact if possible. For any collision incidents on the solar panels, the presence / absence of (low) fog the night before, and the moon phase should be noted, to investigate any climatic patterns. Monitoring results should be discussed with the avifauna specialist on a quarterly basis, or more frequently if required.

9.3.3 VISUAL MMP

OBJECTIVES

The objective is to prevent, as far as is possible, the change to the visual landscape as a result of the project for receptors in the area.

ACTIONS REQUIRED

Issue 1: General visual impacts and sense of place

Planning and site development

- With the preparation of the land within the full extent of the Project site onto which activities will take place, the minimum amount of existing vegetation and topsoil should be removed.
- Construction activities should be limited to daylight hours, in conjunction with the ECO.
- Adopt responsible construction practices that strictly contain the construction / establishment activities to demarcated areas (see Waste Management MMP).
- Building or waste material discarded should be undertaken at an authorised location, which should not be within any sensitive areas (see Waste Management MMP).

Earthworks

- Earthworks should be executed so that only the footprint and a small 'construction buffer zone' around the proposed activities are exposed. In all other areas, the naturally occurring vegetation should be retained, especially along the periphery of the sites.
- All cut and fill slopes (if any) and areas affected by construction work should be progressively top soiled and re-vegetated as soon as possible.
- Disturbed soil must be exposed for the minimum time possible once cleared of vegetation to avoid prolonged exposure to wind and water erosion and to minimise dust generation.

Structures and associated infrastructure

- Avoid contrasting colours of paint on the structures (structural support for the arrays); instead colours that reflect and compliment the colours of the surrounding landscape are recommended.

Good housekeeping

- "Housekeeping" procedures should be developed for the project to ensure that the project site and lands adjacent to it are kept clean of debris, garbage, graffiti, fugitive trash, or waste generated onsite; procedures should extend to control of "track out" of construction dirt on vehicles leaving the active construction site and controlling sediment in stormwater runoff.
- During construction, temporary fences surrounding the material storage yards and laydown areas should be covered with 'shack' cloth (khaki coloured) or shade cloth.
- Operating facilities should be actively maintained during operation.

Lighting

- Install light fixtures that provide precisely directed illumination to reduce light "spillage" beyond the immediate surrounds of the site i.e. lights are to be aimed away from adjacent residential areas.
- Avoid high pole top security lighting along the periphery of the site and use only lights that are activated on illegal entry to the site.
- Minimise the number of light fixtures to the bare minimum, including security lighting.

<u>Issue 2: Glint and glare impacts relating to the Arandis Aerodrome</u>

With reference to Section 8.3.2, the severity, duration and extent of the potential glint and glare impact are rated as low – even under the unmitigated scenario. Mitigation is not feasible and would not lower the already rated low significance rating of the impact (GYLA, 2022). However, the following managements, mitigation and monitoring, and design requirements are implied:

- During the implementation of the project RUL must liaise with the NCAA and the Arandis Aerodrome officials to monitor and record incidents when glare affected pilots at the Arandis Aerodrome. The date and time of day should be recorded to determine whether glare proves to become an issue.
- This information would be communicated to the RUL personnel operating the Solar PV Power Plant so that the automated tracking system can be adjusted to avoid glare during the times reported.

- In this respect, the tracking system must be designed to track the sun according to the sun's position above the horizon. However, and if necessary, temporary interruption of the automated tracking system is possible to reduce and eliminate glare optimally (see below).
- Design requirements:
    - The reflectivity of the solar panels must be restricted to be as low as possible and not exceeding 5 % measured on the front-side of the panel.
    - The Tracker Control system must allow to receive commands, either for an individual tracker, a specific block/s or the complete plant. The Supervisory Control and Data Acquisition (SCADA) System may schedule such commands to move in and out of normal tracking when necessary.

MONITORING REQUIREMENTS

- Carry out visual inspections of the above-mentioned requirements.
- RUL to liaise with the NCAA and Aerodrome officials regarding their monitoring of glint and glare (see above).

9.3.4 OBSTACLES IN RELATION TO AVIATION SAFETY

OBJECTIVES

The objective is to prevent impacts to aviation safety, relating to additional obstacles near the Arandis Aerodrome.

ACTIONS REQUIRED

Issue 1: Impacts to aviation - i.e. Arandis Aerodrome - relating to additional obstacles

- RUL must engage with the NCAA and Arandis Aerodrome prior to the implementation of the project to share information on the "as build" (i.e. final design) layout and height of the Solar PV Power Plant as well as the route and height of the new powerline. This relates to the requirements that an application for the erection of permanent and / or temporary structures must be made prior to the project's implementation. The respective application forms, FSS-AGA-FORM-032 and FSS-AGA-FORM-033 are of relevance.

9.3.5 ARCHAEOLOGY MMP

OBJECTIVES

The objective of the measures is to prevent the unacceptable loss of archaeological sites and related historical information.

ACTIONS REQUIRED

Issue 1: Damage to archaeological sites and landscapes from the proposed project

- In the unlikely event that archaeological resources are discovered during construction, a chance find emergency procedure will be implemented.
- No activities / contractors allowed near the dolerite ridge, west of the Solar PV Power Plant site.

CHANCE FINDS

- If there are any chance finds of archaeological sites that have not been identified and described in the current EMP a chance find procedure shall be followed. The key component of which is to ensure that the site remains undisturbed until a specialist has assessed the site, assessed the potential damage, advised on the necessary management steps, and advised on the requirements for authority consultation and permitting.

9.3.6 SURFACE WATER AND GROUNDWATER MMP

OBJECTIVES

The objective of the management measures is to prevent pollution of surface water run-off and groundwater

ACTIONS REQUIRED

Issue 1: Pollution of surface water and groundwater

Design and construction phase

- Engineered containment (contained areas with impermeable floors) of process areas, sewerage facilities, wastewater, waste storage areas, concrete works, painting areas and hydrocarbon storage areas.
- Prevent pollution through education and training of workers (permanent and temporary).
- Prevent pollution of the drainage lines.
- Cement and concrete mixing directly on the ground shall not be allowed and shall take place on impermeable surfaces.
- Used cement bags shall be stored in weatherproof containers to prevent windblown and disposed appropriately.
- The contractor shall submit a Method Statement / Procedure detailing cement storage, concrete batching areas and methods, method of transport of cement and concrete, storage and disposal of used cement bags, etc. for each concrete batching operation. The RUL Environmental Section to sign-off on the approved documentation.
- All excess concrete shall be removed from site on completion of concrete works and disposed of in line with the RUL Waste Management Plan and relevant procedures. Washing of the excess concrete into the ground is prohibited.
- All hydrocarbon (e.g. fuel, oils and contaminated soil / materials) and other hazardous waste (e.g. paint, bitumen, tar, etc.) resulting from spills, shall be disposed of at a licensed hazardous waste site or, where possible, sold to an approved used-oil recycling company. The contractor shall keep records of disposal certificates onsite.
- In the event of a hydrocarbon spill, the source of the spillage shall be isolated, and the spillage contained.
- Any hydrocarbon and other hazardous substance spills will be cleaned up immediately.
- Reporting of spills to occur immediately to the Project Manager and Environmental Section.

- Spill kits or adsorbent materials will be kept on hand to clean up spills. Once used, this material will be treated as hazardous waste and disposed of accordingly.
- Only minor repairs and maintenance to machinery, vehicles and equipment shall be allowed on the project site. All major repairs and maintenance shall be done off-site.
- Dispensing of petroleum products to take place over a drip tray or within a lined and bunded area.
- All hazardous substances to be stored in lined and bunded areas (110% of volume). The floor and wall of the bund area shall be impervious to prevent infiltration of any spilled / leaked fuel, oil or hazardous substance into the soil.
- The relevant Material Safety Data Sheets (MSDS) for all hazardous chemical substances (as defined in the Regulations for Hazardous Chemical Substances) shall be submitted to the RUL Project Manager. The contractor shall have a copy of the MSDS readily available and ensure that he / she or his / her employees who are required to use such substances are fully conversant with the safe handling precautions, protective equipment to be used and storage precautions to be taken.
- Maintain all vehicles free of leaks (oil, hydraulic fluid etc.). Daily Inspections and regular planned maintenance programmes to be enforced.
- Refuelling to take place over a drip tray or within a lined and bunded area.
- Ensure good housekeeping and proper sanitation and treatment of wastewater during construction and operations.
- The contractor shall ensure suitable sanitary facilities are available – in liaison with RUL. There should be one toilet for every 15 workers onsite. Toilets must be easily accessible.
- The contractor shall be responsible for ensuring that all ablution facilities are maintained in a clean and sanitary condition. The emptying of toilets will be conducted in line with the contract agreement with RUL (and the existing RUL Procedures).
- The sub-contractor shall ensure that there is no spillage when the chemical toilets are cleaned and that the contents are properly removed from site to a registered municipality facility in either Swakopmund or Walvis Bay.
- Safety certificates / records to be provided of the disposal.
- The contractor shall be responsible for enforcing the use of these facilities. Performing ablutions outside of established toilet facilities is strictly prohibited
- Only use the allocated volumes of water and ensure this covers for dust suppression.
- Minimise water consumption by every practical means, including recycling, selection of equipment and appliances, and tar / gravel access and services road surfaces.

Design and operations phase

- RUL shall protect areas susceptible to erosion by installing necessary temporary and permanent drainage works and by taking preventative measures.
- Avoid major drainage lines for position of solar plant, powerline and water pipeline. Therefore, implement the proposed layout (as presented in Figure 6 – which allows for the “exclusion zones”).
- Ensure that the water volumes required for cleaning is adequately accounted for.

9.3.7 AIR QUALITY AND NOISE MMP

OBJECTIVES

The objectives of these measures are to prevent unacceptable air quality related pollution impacts and to limit excessive noise pollution.

ACTIONS

Issue 1: Air pollution and noise pollution

- The contractor shall be familiar with and adhere to RUL policies and procedures regarding working hours.
- The contractor shall avoid construction activities outside of “normal working hours”.
- Maintain machinery, vehicles and equipment in good condition to prevent unnecessary noise outputs. The contractor shall ensure that workers do not create unnecessary noise such as hooting.
- Work should be restricted to the daylight hours.
- The contractor shall ensure that the generation of dust is minimized and shall implement a dust control programme, with reference to the measures provided below, to maintain a safe working environment and minimise dust nuisance.
- RUL and their contractors shall ensure that areas (i.e. access routes within the project area), where movement of vehicles and machinery is adequately water sprayed (where relevant) to minimize excess dust.
- In this regard, RUL to determine through the existing dust monitoring programme whether there is any increase in dust levels as a result of the construction phase of the PV power project.
- Construction vehicles shall comply with the RUL speed limits, at all times.

9.3.8 WASTE MANAGEMENT MMP

OBJECTIVES

The objectives of these measures are to prevent pollution, environmental degradation and associated impacts.

ACTIONS

Issue 1: Waste management and pollution impacts

- All hydrocarbon (e.g. fuel, oils and contaminated soil / materials) and other hazardous waste (e.g. paints, bitumen, tar, etc.) resulting from spills, refuelling and maintenance activities shall be disposed of at a licensed hazardous waste site or, where possible, sold to an approved used-oil recycling company. Hydrocarbon contaminated soil can also be treated at a dedicated bioremediation treatment area onsite. This shall be done in liaison with the RUL Environmental Section.
- When the soil is clean (after treatment), the location for disposal of material to be agreed with the RUL Environmental Section.
- No hydrocarbon and hazardous waste shall be burnt or buried onsite. The spoiling or burial of tar or bituminous products shall not be allowed onsite.
- Solid waste includes all construction waste (rubble, cement bags, old cement, tags, wrapping materials, timber, cans, wire, nails, PPE, etc.), recyclables and domestic waste (surplus food, food packaging, organic waste, etc.).
- Where possible, RUL must give preference to suppliers who minimizes the usage of plastic / Styrofoam packaging of the PV infrastructure.
- The contractor liaises with the RUL Environmental Section to ensure the solid waste control and removal system is in line with the RUL Waste Management Plan and relevant procedure.
- Prevent the spread of waste in, and beyond, the construction area. An integrated waste management approach shall be used, based on the principles of waste minimisation, reduction, reuse and recycling of materials. Containers for glass, paper, metals and plastics shall be provided.
- The contractor to prepare a Method Statement / Procedure to include procedures relating to the management of waste, in line with the RUL Waste Management Plan and procedures for sign-off by the RUL Environmental Section, prior to the start of construction.
- The contractor shall provide bins (with lids) of sufficient number and capacity to store office waste produced on a daily basis. The lids shall be kept firmly on the bins at all times.

- Arrange with the Waste Management Contractor to provide wheelie bins and skips. These shall be located at eating areas and construction areas where there will be a concentration of labour. Bins shall be emptied on a weekly basis or more frequently as required. The general cleanliness of the site shall form part of the site management, (Health, Safety and Environment (HSE) Representative and RUL inspections.
- All solid waste may be temporarily stored onsite in a demarcated area, which meets the satisfaction of the RUL Project Manager and the Environmental Section. All solid waste shall be disposed of off-site at a licensed landfill site. No waste material or litter shall be burnt or buried onsite.
- Damaged materials will be handled as hazardous waste, if classified so, otherwise as general waste.
- Mobile toilets will be provided by the contractor during the construction period, and it is the responsibility of the contractor to manage the toilets during this phase.
- Waste management onsite will be done according to the standards of RUL – the necessary protocols and procedures exist and will be applied to all kinds of waste management, including the cleaning and removal / safe disposal of hydraulic oil spills, hazardous waste, etc. as well as safe disposal certificates (where relevant).
- Where possible, the use of Styrofoam food packaging, etc., danger tape and snow netting should not be encouraged onsite.

9.3.9 Socio-Economic MMP

Actions

Issue 1: Employment and skill development (enhancement of positive economic impacts)

- The recruitment process, job opportunities, contact details, etc. must be made available to the local people in the area.
- Recruitment of Namibian nationals, in particular local people from Arandis, Swakopmund and Walvis Bay must be prioritized.
- Support to small and medium enterprises (SME) development must be promoted wherever possible.
- Wherever possible, small-scale contractors must be used.
- Wherever possible, the tender selection criteria must include preference of local suppliers of goods and services – in line with RUL procurement practices.
- Conditions of employment must be in compliance with the legal requirements applicable in Namibia.
- Local procurement must be encouraged, wherever possible.
- Wherever possible technical training and skill development of local and regional contractors must be encouraged, in line with the practices at RUL.
- Training of local employees should continue throughout the life of the operation.
- Employees must be supported to continue learning and developing skills so they too benefit from being able to offer labour flexibility and productivity.
- The government policy of improving gender equality and the empowerment of women will be supported where possible.

9.4 RESPONSIBILITIES

This section describes the roles and responsibilities for implementing the different parts of the EMP. The implementation of the EMP will involve the following parties including their scope of responsibility.

9.4.1 RUL PROJECT MANAGER

The RUL Project Manager shall ensure compliance to this EMP. The EMP will be part of the contract with all contractors working on the project. The RUL Project Manager shall also ensure that contractors have a copy of the approved RUL EMP and relevant site documentation to familiarize themselves with other relevant management and mitigation measures. Wherever possible, the contract with a contractor should include conditions of adherence to environmental performance and stipulate corrective measures, retentions / penalties, environmental close-out / audit and conditions for the issuing of an Environmental Completion Certificate.

9.4.2 RUL ENVIRONMENTAL SECTION

The RUL Environmental Section has overall responsibility for all environmental related matters on the RUL tenement. The section will assist the RUL Project Manager for ensuring contractors comply with all the management and mitigations measures stipulated in this EMP as well as conditions listed in the Environmental Authorization (Environmental Clearance Certificate), should the project be approved.

The RUL Environment Section shall perform random site inspections to check compliance with the EMP. A site close-out audit shall also be conducted at the end of the project phase and an Environmental Completion Certificate issued if environmental performance and closure is found satisfactory.

9.4.3 EPC OR CONSTRUCTION MANAGER

EPC / Construction Manager shall address any site problems pertaining to the environment at the request of RUL's Environmental Section and / or RUL Project Manager.

The EPC / Construction Manager shall oversee the planning, design and construction phases of the project and report to the RUL Project Manager.

The EPC / Construction Manager shall address any site problems pertaining to the environment at the request of the HSE Representative.

The EPC / Construction Manager has the responsibility to ensure that responsibilities are executed in compliance with the EMP. Any onsite decisions regarding environmental management are ultimately the responsibility of the EPC / Construction Manager. The EPC / Construction Manager shall assist the HSE Representative where necessary and shall have the following responsibilities in terms of the implementation of this EMP:

- Reviewing and approving the sub-contractor(s)' Method Statements / Procedures with input from the HSE Representative where necessary.
- Monitoring and verifying that the EMP and Method Statements / Procedures are adhered to at all times and taking action if specifications are not followed.
- Keeping a photographic record of construction activities onsite.
- Assisting the sub-contractor(s) in finding environmentally responsible solutions to problems with input from the HSE Representative and the RUL Environmental Section where necessary.
- Ordering the removal of person(s) and/or equipment not complying with the EMP specifications.
- Transgressions must be handled in compliance with legislation applicable to Namibia.
- Delaying any construction activity if he / she believes the environment has been or is likely to be seriously harmed / impacted.
- Communicating environmental issues to the HSE Representative.

9.4.4 SUB-CONTRACTOR(S)

The sub-contractor(s) shall have the following responsibilities:

- To implement all provisions of the EMP. If the sub-contractor(s) encounters difficulties with specifications, he / she must discuss alternative approaches with the EPC / Construction Manager and / or the HSE Representative prior to proceeding.
- To ensure that all staff are familiar with the EMP.
- To make personnel aware of environmental issues and to ensure they show adequate consideration of the environmental aspects of the project.
- To prepare required Method Statements / Procedures indicating how the requirements of the EMP will be implemented.
- To report any incidents of non-compliance with the EMP to the EPC / Construction Manager and / or the HSE Representative and to correct them.

- To rehabilitate any sensitive environments damaged due to the sub-contractor(s)' negligence. This shall be done in accordance with the HSE Representative specifications, in liaison with the RUL Environmental Section.

Failure to comply with the EMP may result in fines through legal persecution and reported non-compliance may result in the suspension of work or termination of the contract if not rectified or monitored to ensure no future adhesive impacts may arise.

9.4.5 HSE REPRESENTATIVE

An HSE Representative will be appointed by the EPC / Construction Manager. The HSE Representative's duties shall include, inter alia, the following:

- Reviewing Method Statements / Procedures.
- Advising the Project Manager (and sub-contractors) on environmental issues within defined construction areas.
- Undertaking regular (preferable daily) site visits to ensure compliance with the EMP and / or Method Statements / Procedures and verifying that environmental impacts are kept to a minimum throughout the contract.
- Completing environmental checklists during site visits.
- Monitoring and verifying that the EMP and / or Method Statements / Procedures are adhered to at all times and taking action if specifications are not followed.
- Monitoring and verifying that environmental impacts are kept to a minimum.
- Keeping a photographic record of progress onsite from an environmental perspective.
- Assisting the Project Manager (and sub-contractors) in finding environmentally acceptable solutions to construction problems.
- Recommending additional environmental protection measures should this is necessary.
- Giving a report back on any environmental issues at site meetings and during monthly reports.
- Reporting any incidents that may or have caused damage to the environment or breaches of the EMP to the RUL Environmental Section.
- Prepare an environmental audit report at the conclusion of the construction phase.
- Provide training to personal / contractor staff.

The HSE Representative shall communicate directly with the Project Manager and the RUL Environmental Section. Should problems arise onsite that cannot be resolved between the HSE

Representative and the Construction Project Manager, the HSE Representative shall take the matter up with the RUL Project Manager or the RUL Environmental Section.

9.5 Internal Review and Auditing

An internal review process and procedure shall be established by EPC / Construction Manager to monitor the progress and implementation of the EMP. Where and when necessary, method statements / procedures that require modification shall be changed to improve the efficiency of the EMP. Different forums will be used for the ongoing training / awareness. As a minimum, training / awareness shall include in liaison with the RUL Environmental Section. RUL will conduct regular inspections and audits, throughout the various PV project phases.

9.6 Environmental Awareness Training

Before the commencement of any work onsite the EPC / Construction Manager and all sub-contractor' staff should attend the RUL induction, which includes an environmental awareness-training course.

Different forums will be used for the ongoing training / awareness by the HSE Representative. As a minimum, training / awareness shall include:

- Explanation of the importance of complying with the EMP and / or Method Statements / Procedures.
- Discussion of the potential environmental impacts of construction activities.
- Explanation of the management structure of individuals responsible for matters pertaining to the EMP.
- Employees' roles and responsibilities.
- Explanation of the mitigation measures that must be implemented when carrying out their activities.
- Explanation of the specifics of the EMP and / or Method Statements / Procedures and its specification.

The Project Manager shall keep records of all environmental training sessions and RUL inductions, including names of attendees, dates of their attendance and the information presented to them. Records of environmental training sessions shall be submitted to the HSE Representative.

9.7 PERMITS

- Protected plants that need to be removed as part of the project development require a permit from the Forestry Directorate in the Ministry of Environment, Forestry and Tourism. The necessary management process to administer the application and obtaining of the necessary permits must be implemented, in line of the practices at RUL.
- Prior to the implementation of the proposed project, RUL will engage with the NCAA regarding the application for the erection of permanent and / or temporary structures. The respective application forms, FSS-AGA-FORM-032 and FSS-AGA-FORM-033 are of relevance.

10 WAY FORWARD

The way forward is as follows:

- MME and MEFT review the final report and provide record of decision.

11 ENVIRONMENTAL IMPACT STATEMENT AND CONCLUSION

It is Namisun's opinion that the environmental aspects and potential impacts relating to the proposed PV Power Project and associated activities and infrastructure (include the overhead powerline) have been successfully identified. The following environmental aspects and their potential impacts associated with project development, as well as the cumulative impacts, (i.e. taking the current/approved facilities/activities and the proposed project into consideration) have been assessed:

- Biodiversity (Loss of biodiversity from physical destruction (i.e. removing and killing of vegetation and killing of fauna).
- Avifauna (Disturbance, injury and killing of birds).
- Visual aspects (including glint and glare).
- Obstacles in relation to aviation safety.
- Positive and negative socio-economic impacts, largely during construction.

The assessment found that the proposed project present the potential for minimal additional risks and related impacts in the mitigated scenario. One of the key requirements is to avoid major drainage lines for position of solar plant, powerline and water pipeline. Therefore, implement the proposed layout (as presented in Figure 6 – which allows for the "exclusion zones").

Namisun therefore believes that all environmental aspects and potential impacts associated with the proposed amendment were identified, described and appropriately assessed.

It is recommended that, if MEFT provides a positive decision on the application for the proposed project changes, they should include a condition to the clearances that RUL must implement all commitments in the EMP (Amendment).

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APPENDIX A – CURRICULUM VITAE

APPENDIX B – INFORMATION SHARING

APPENDIX C – MINUTES OF MEETINGS

NAMISUN

APPENDIX D –STAKEHOLDER DATABASE

APPENDIX E – VEGETATION SPECIALIST REPORT

APPENDIX F – AVIFAUNA SPECIALIST REPORT

APPENDIX G – VISUAL SPECIALIST REPORT

Rössing Uranium Limited

Environmental Management Plan

Effective Date:	**06 September 2024**	
Status:	**Revision**	
Version No:	**1.4**	
Document No:	**JE20/MMP/011**	
Custodian(s):	**Specialist Environment**	
Reviewed by:	**S Gaeseb**	**Original signed**
Authorised by:	**J Mwenze**	**Original Signed**

Executive Summary

When mining activities at Rössing commenced in the 1970s, no environmental assessment was required. Despite this the early operations took due cognisance of the sensitive environment in which the mine was established. Consequently, pro-active and responsible management measures were set as voluntary operational standards since the design and planning phases of the mine.

Built on the early commitment, all present operations at Rössing – from the planning to the decommissioning stages – are governed through applicable national legislative and regulatory frameworks and are managed through an integrated Health, Safety and Environment Management System (HSE MS). The HSE MS conforms to the International standards ISO 14001:2015, ISO 45001:2018 and ISO 9001:2015, of which Rössing is certified to ISO 14001 since 2001. Based on an understanding of potential health, safety and environment hazards / aspects, the HSE MS allows Rössing to identify key aspects and impacts, guide operating procedures and attain to continual improvement in managing these. All potential impacts are listed on a risk register, coupled to mitigating and operational controls guided by the Rössing internal HSE Performance Standards. An audit programme evaluates the HSE MS periodically.

Ultimately, environmental management at Rössing aims at achieving the following:

- Assess environmental impacts of mining activities throughout the design and planning, construction, operational and decommissioning phases
- Develop, implement and manage monitoring systems to ensure maximizing of avoidance, mitigating and rehabilitation of adverse environmental impacts
- Comply with all environmental regulatory and legislative frameworks during all phases of the mine's operations through approved Environmental Management Plans
- Investigate and exploit measures to reduce usage of non-renewable resources
- Maximize positive environmental impacts
- Avoid, mitigate and rehabilitate adverse impacts
- Limit contamination through prevention measures (escapes into aquatic and atmospheric pathways), appropriate containment, recycling and removal measures
- Protect, conserve and enhance cultural, heritage and archaeological resources
- Keep communities informed and involved in decision making about mining activities
- Ensure the health and safety of employees, contractors and surrounding communities through agreed performance criteria
- Support and encourage awareness, training and responsibility of environmental management

This document contains a description of the current environmental management practice and plans at Rössing. The document is organized as five chapters with four appendices and references. Chapter 1 provides brief background information about Rössing; Chapter 2 describes the environment within which Rössing operates; Chapter 3 describes the current operational activities; Chapter 4 summarizes the Environmental Impact Assessments conducted over time and Chapter 5 describes the current management of environmental impacts at Rössing.

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1 BRIEF BACKGROUND INFORMATION

1.1 CONTACTS OF MINE

1.1.1 NAME

Rössing Uranium Limited

1.1.2 ADDRESS

Postal address: Private Bag 5005 Swakopmund Namibia

Registered address with the Ministry of Trade and Industry: 360 Sam Nujoma Drive, Klein Windhoek, Windhoek

1.1.3 TELEPHONE AND FAX NUMBERS

Telephone:	+264 (64) 520 9111
Fax:	+264 (64) 520 3017

1.2 MINE OWNER

1.2.1 RESPONSIBLE PERSON / MANAGER

CNNC is the majority shareholder of Rössing Uranium Limited and owns 69% of the shares. The Namibian state has a 3% shareholding, and a 51% majority vote when it comes to issues of national interest. The Iran Foreign Investments Company (IFIC) owns 15%. The Industrial Development Corporation (IDC) of South Africa owns 10% while local individuals own a combined 3% of Rössing shares. The minority shareholders have no rights to production take-off.

1.3 CONTACTS OF MINERAL RIGHTS HOLDER

1.3.1 NAME

Rössing Uranium Limited

1.3.2 Address

Private Bag 5005 Swakopmund

1.3.3 TELEPHONE AND FAX NUMBERS

Telephone:	+264 (64) 520 9111
Fax:	+264 (64) 520 3017

1.4 CONTACTS OF APPLICANT

1.4.1. NAME

Rössing Uranium Limited

Original application was done in 1959. In 1985 the Mining Grant M46/4/17 in the name of G P Louw (Pty) Ltd was consolidated with Rössing Uranium Limited's mining grant M46/4/5 to form Mining Grant M.46/4/28 and then converted to Mining Licence No. 28 in 2006.

1.4.2. ADDRESS

Postal address: Private Bag 5005 Swakopmund Namibia

Registered address with the Ministry of Trade and Industry: 360 Sam Nujoma Drive, Klein Windhoek, Windhoek

1.4.3. TELEPHONE AND FAX NUMBERS

Telephone: +264 (64) 520 9111
Fax: +264 (64) 520 3017

1.5 CONTACTS OF LAND OWNER

1.5.1 NAME

State-owned

1.6 LOCATION AND REGIONAL SETTING

Rössing Uranium Limited mines a large-scale low-grade uranium ore body in the Namib Desert, in the sparsely populated Erongo Region of Namibia (Figure 1.1).

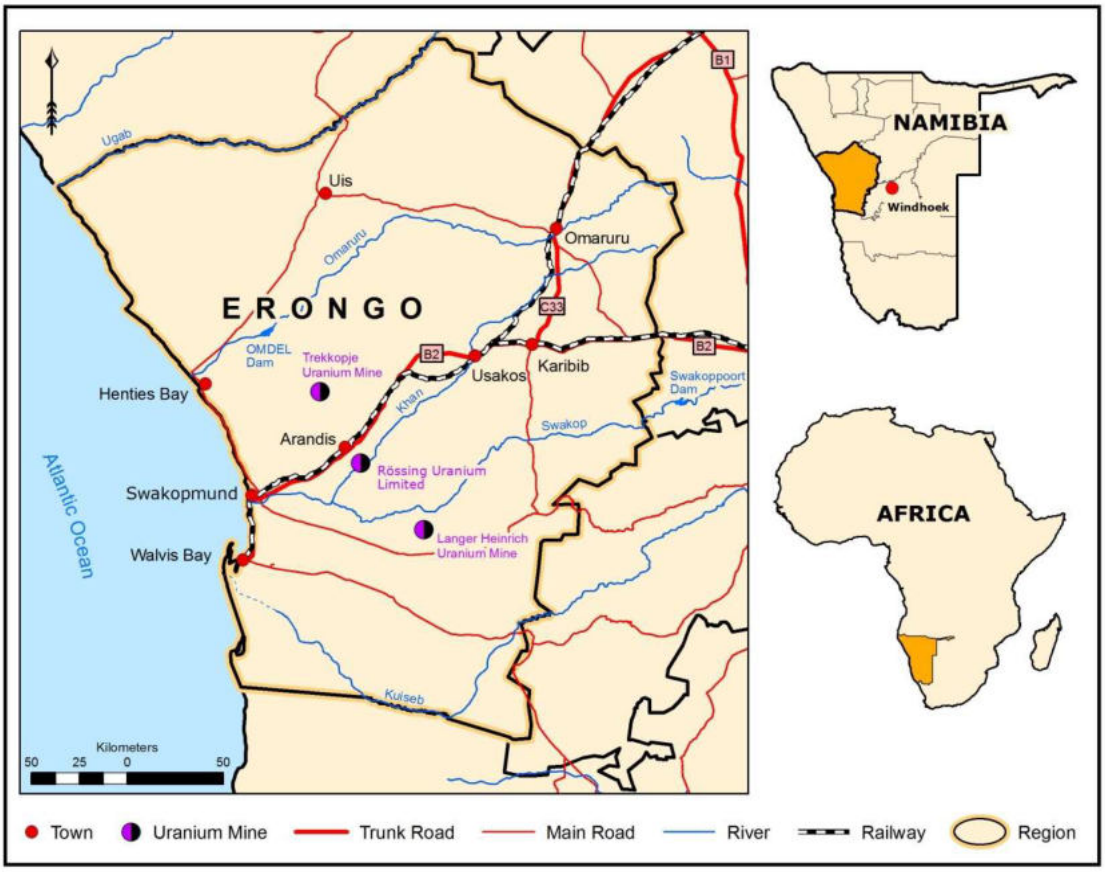

Figure 1.1: Location of Rössing Mine

1.6.1. DIRECTION AND DISTANCE TO NEIGHBOURS

Rössing is part of the Arandis Constituency, one of the seven political constituencies that make up the Erongo Region. A section of the northern boundary of Rössing's

Accessory Works Area borders overlaps Arandis Townlands (Figure 1.2). Arandis is situated less than 10 km from the mine's main entrance gate.

The coastal town of Swakopmund is about 70 km away and Walvis Bay is located 30 km south of Swakopmund (Figure 1.1). To the east, the nearest town to Arandis is Usakos – about 80 km away.

The #Gaingu Conservancy is one of the immediate neighbours of the Mining Licence area. The largest part of communal and state land that forms part of this conservancy is totally uninhabited. The closest commercial farmland is about 15 km to the east of the Mining Licence area while the rural settlements of the conservancy are much further away from the mine – near Spitzkoppe (more than 60 km to the northeast).
An Exploration Prospecting Licence (EPL) 3138 is bordering Rössing's Mining Licence (ML 28) to the south and has been granted to Swakop Uranium. This EPL covers the Husab uranium deposit. To the east ML 28 is bordered and the Accessory Works Area of Rössing overlapped by EPL 3602, which is granted to Zhonghe Resources (Namibia) Development (Pty) Ltd., a Chinese exploration company exploring for uranium occurrences. EPL 3624 overlaps with Rössing's Accessory Works Area to the northwest and has been taken out by the Namibian company Creative Enterprises to explore for base and rare metals, industrial minerals, precious metals and dimension stone.

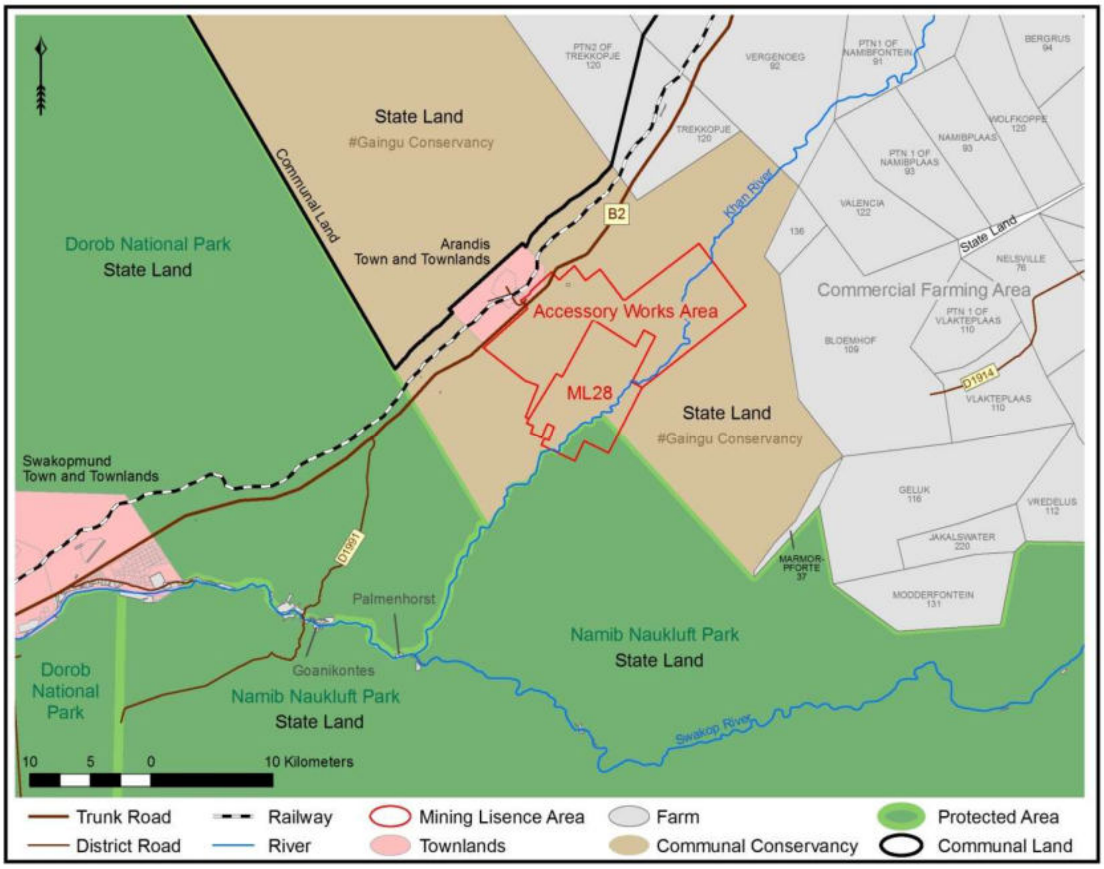

Figure 1.2: Rössing's Mining Licence and surrounding land

1.6.2. LAND TENURE AND USE OF IMMEDIATELY ADJACENT LAND

The Namibian state manages state land uses directly through the line ministries of the present government. The Ministry of Environment, Forestry and Tourism controls conservation areas, the Ministry of Works and Transport administers infrastructure on governmental land. Water management is mandated through the Ministry of Agriculture, Water and Land Reform which is also the custodian of surveyed and unsurveyed state land. Mining activities are regulated by the Ministry of Mines and Energy and the Ministry of Urban and Rural Development regulates the management of urban settlements.

Before Namibia's Minerals (Prospecting and Mining) Act, 1992 (No. 33 of 1992) came into force, Rössing Uranium Limited was granted a Mining Licence (ML28) on 8 May 1985, which is valid until 11 July 2036. Permission to extend the licence area with an Accessory Works Area was granted in February 1972 (15 A and B), March 1973 (17 A and B) and March 1977 (19), in terms of Section 50 of the Mines, Works and Minerals Ordinance 1968 (Ordinance no 20 of 1968).

The licensing arrangement was confirmed in May 1994 under the post-independent Minerals (Mining and Prospecting) Act 1992 (Act 33 of 1992). Extensions were also granted in December 1994 and July 1996 under Section 31.3 (a) and (e) as well as 57.1 (a), (d) and (e) of the Minerals (Mining and Prospecting) Act 1992.

Together, the current ML28 area and accessory works cover 13,003 ha, of which 91% is located on the northern bank of the Khan River (Figure 1.2), on relatively hilly terrain. By the end of 2023, the Rössing Mine complex covered 2,640ha. Thus, the total footprint of the mine is about 20% of the land under Rössing auspices, and consists of the open pit, waste rock dumps, the processing plant and tailings facility, offices, and infrastructure such as power lines, pipelines and roads. In 2024, construction of a 15MWe Photovoltic Solar Plant commenced on 115 ha of the RUL Acessory Works Area (AWA).

In the southwest about 720 ha of the ML28 area overlaps with the Namib-Naukluft National Park (NNNP) on the southern bank of the Khan River. The portion overlapping the NNNP is bordered to the south by ML171 (Swakop Uranium Mine). The Dorob National Park is a near neighbour with its eastern border about 10 km to the west of the Mining Licence area (Figure 1.2). The overlap with the Namib-Naukluft National Park secures rights for Rössing to mine potential minable uranium occurrences in a thin stretch of land parallel to the river. The ML28 area is otherwise bordered by the #Gaingu Conservancy in the west and south-east. The rest is bordered by the accessory works area, which in turn is overlain by the #Gaingu Conservancy except for the northern part that borders, and partly overlaps, the town of Arandis and its Townlands. In 1997, the accessory works area was extended to include portions of the Khan River where an aquifer recharge scheme was planned by the mine. Although the construction of the scheme did not go ahead, the area was retained.

Arandis Airport is situated southwest of Arandis. A Rössing plane was operated from the airport until 2000, after which the airport infrastructure was sold to a private company.

1.6.3. RIVER CATCHMENT IN WHICH THE MINE IS SITUATED

Virtually the whole of the Central Namib Desert is drained by four river systems, from north to south the Omaruru, Khan, Swakop and Kuiseb rivers. The Omaruru, Swakop and Kuiseb rivers flow westwards to the Atlantic Ocean while the Khan forms a major branch of the Swakop River. Each of the rivers originates on the high interior plateau of Namibia.

Rössing is situated about 25 km upstream of the Khan / Swakop River confluence (Figure 1.3). The Khan River, which flows for a distance of about [1]) of the larger Swakop River catchment. Both the Khan and Swakop rivers are classified as episodic ephemeral drainage lines, which mean that they only contain discharge for a brief period after sufficient downpours in their catchments on the higher interior.

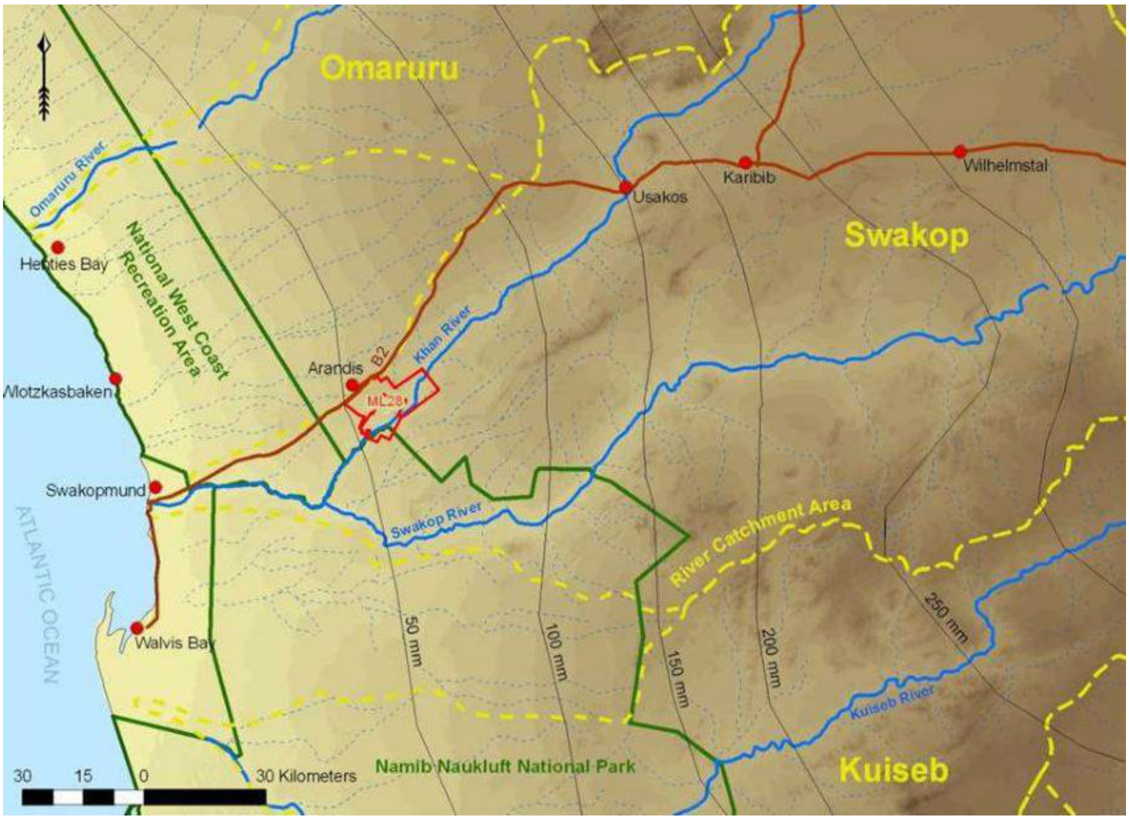

Figure 1.3: River drainage systems, average rainfall and topography

Surface floods in the Khan River below Dome gorge have been recorded on six occasions during a 26 year period (1966-1992). Further flood events occurred in 1995, 1997, 2000, 2010-11, 2017-18, and 2022. Recharge to the aquifer, as well as movement and deposition of alluvium and silt occurs during these high flow events. During the dry season the water flow down the rivers is sub-surface. Surface run-off partly infiltrates

[1] Aurecon, (2011)

and recharges the groundwater in the alluvium or fractured bedrock, so that a continuous flow is maintained.

The Khan River originates in central Namibia, near Okahandja at an elevation of about 1,500 metres above mean sea level (mamsl) and joins the Swakop River 45 km from the mouth at Swakopmund. The sharp decrease in rainfall totals from east to west, combined with the erratic nature of run-off and the increase in evaporation potential from east to west, results in highly episodic functioning of central Namib rivers and give them distinct convex longitudinal profiles. The average gradient of the Khan between its origin and the point where it joins the Swakop River at an elevation of 190 mamsl is approximately 1:180. In the Rössing area the Khan River forms a deeply incised, steep-sided gorge. Three tributaries, from east to west Dome, Pinnacle and Panner Gorge, traverse the mine area and discharge into the Khan River.
The Khan River contains appreciable quantities of groundwater that sustains riparian vegetation in spite of its brackish quality. Rössing abstracts water from the Khan River for dust suppression in the open pit. The sediment fill of the tributaries is about 5-10 m thick, and can be very permeable in the lower stretches of the gorges.

No farming activity takes place and no people live along the Khan River downstream from Rössing.

In the second half of the 1990s the possibility to establish an aquifer recharge scheme in the Khan River was investigated by Rössing. Several in-depth technical studies were conducted and in the end it was decided not to develop this scheme.

1.6.4. SURFACE INFRASTRUCTURE AND SERVITUDES

A number of parastatal enterprises are mandated to provide infrastructure of national importance in Namibia: TransNamib (railways); NamPower (bulk electricity supply); NamWater (bulk water supply); Telecom (telecommunication) and Roads Authority (roads). In many cases the linear infrastructure provided by TransNamib, NamPower, Telecom, NamWater and Roads Authority are concentrated within developed ribbons, often parallel to a main road.

With regard to Rössing the railway line between Usakos and Swakopmund, the Telecom line and water pipelines are located within the narrow strip on both sides of the main road (B2) north of the Accessory Works Area. Near the turn-off to Arandis, the infrastructure branch-off from the main networks, to follow a corridor of linear infrastructure along a private roadway, which enters the Rössing Mining Licence area from the north (Figure 1.4.).

In short, existing service infrastructure connected to Rössing includes the following:

- A 10 km long tarred private roadway from the main Swakopmund–Usakos national road (B2).
- A full-gauge railway line linking the mine's service areas with the main Windhoek–Usakos–Swakopmund–Walvis Bay railway line from the Arandis siding.
- A water supply pipeline and storage reservoirs; four (4) with capacity of 80 000m^3 and additional six (6) with combined capacity of 60 000m^3 storage.
- A link to the NamPower 220 kV power line supplying electricity to Swakopmund and Walvis Bay and Telecommunication networks.

- Fibre-optic communication line connecting the mine with the Swakopmund office which runs parralel to the railway line.
- 15MWe Photovoltaic Solar Power Plant (with 18MWA peak capacity) and connecting 11kV power line to the RUL substation, which are under construction on the RUL accessory works area, to be commissioned by end 2024.

District road D1911 provides access from the B2 national road to Arandis, partly running over the Accessory Works Area. The private road that provides access to Rössing turns off from the D1911. A right-of-way servitude was surveyed in April 1994 over the Arandis Townlands to secure access to Rössing's railway line and private access road to the mine. This servitude was, however, not registered with the Registrar of Deeds.

The main road towards the mine leads to the main entrance gate. On site this road forms the spine of a network of various bitumen and gravel access and haulage roads and tracks with a total distance of more than 30 km.

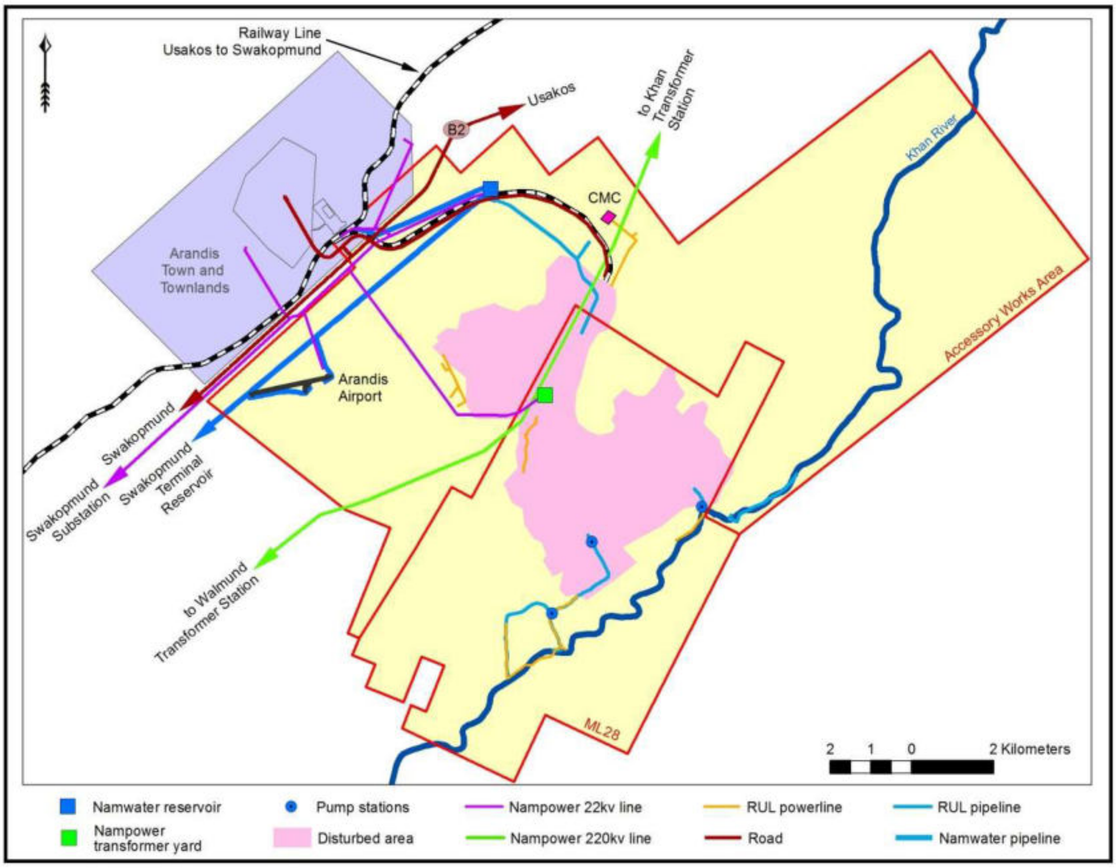

Figure 1.4: Lay-out of linear infrastructure at Rössing

The railway line is connected to four branched sidings. Main supplies brought in by rail include sulphuric acid, diesel, ammonia, manganese, and ammonium nitrate with drums of U_3O_8 product loaded into containers and railed to Walvis Bay for export.

Water for the central coastal region is provided by the parastatal bulk water supplier, NamWater, which sources fresh water from the Desalination plant at Wlotzkasbaken. NamWater distributes the water via a network of pump stations, reservoirs and pipelines to Henties Bay, Swakopmund and Walvis Bay, Langer Heinrich Uranium Mine, Husab Mine, Rössing Mine, and Arandis.

Water to Rössing is supplied through a mounted pipeline with three booster pumping stations from a main water reservoir near Swakopmund. This 600-mm pipeline runs parallel to the B2 on its southern side. The pipeline's positioning allows secure and easy access for maintenance purposes. Fresh water is supplied to NamWater's Rössing terminal reservoir and additional six (6) reservoirs which Rossing commissioned in 2022, these are all located south of the B2, close to the linear infrastructure corridor that enters the mining area from Arandis. The conduit system serving Rössing from the terminal reservoir has a capacity of 8,000 m^3 a day. Water to Arandis is also supplied from this reservoir with a pipeline.

Power to the mine is supplied from the national grid by NamPower, from the line between the Khan Transformer substation and Walmund transformer substation (close to Swakopmund) via a 220 kV overhead transmission line. A ring feed exists via the Kuiseb close to Walvis Bay, linking it to the Walmund Substation. NamPower's current supply capacity to Rössing consists of two 40 MVA transformers in parallel, with a declared maximum demand of 35 MVA, fed from the 220 kV supply.

Rössing is a large user of electricity and an agreement between Rössing and NamPower in this context exists since 1973. An addendum to this agreement was signed with NamPower in 1997. NamPower owns and operates all 220 kV equipment up to and including the 220/11 kV transformers and 11 kV metering.

Rössing secured regulatory approval to construct a 15 MWe Photovoltiac (PV) solar plant on the RUL accessory works area. Construction on the PV plant is scheduled for completion in 2024.

For internal and external landline telecommunication, Rössing uses a grid of copper lines connected to Telecom in Arandis. Telecom operates the use and maintenance of a grid of landlines on-site, while the mobile telecommunications operator MTC has been contracted since 2002 to provide a base station with a mast, four global system for mobile communications antennas, one microwave antenna with a co-axial cable, and antenna brackets.

1.7 BACKGROUND ABOUT THE MINING OPERATION

During its early years, and after Namibia's independence, prospecting for uranium elsewhere in the Erongo Region was at a relatively low intensity. This has changed markedly over the past few years. Global concerns about the security of uranium supplies and sharp increases in uranium prices triggered renewed interest in uranium exploration in Namibia, and 2005 to 2007 saw a sudden scramble for prospecting rights in the central Namib. In 2007, when the State placed a moratorium on further uranium prospecting licences, 36 exploration licences for nuclear fuels had already been granted in the central Namib.

1.7.1. HISTORICAL OVERVIEW OF THE DEVELOPMENT OF THE MINE[2]

People have known about the presence of radioactive mineralisation in the Rössing area since the beginning of the 1900s. The first significant discovery of radioactive mineralisation was made in 1928, when prospector Captain Peter Louw and his wife conducted an autoradiograph test on a supposed sample of pitchblende. Over the years they tried to interest major mining groups in investigating the potential of the area. Only in the late 1950s was the potential confirmed by the Anglo American Corporation of South Africa after intensive exploration. The company's geologists concluded, however, that the mineralisation was of an erratic occurrence and of a very low grade. The poor economic prospects for uranium at that time induced the company to abandon the search. It was only in the 1960s that a renewed interest in uranium motivated the Rio Tinto Zinc Corporation (RTZ) to reinvestigate the Rössing deposit intensively.

Rössing Uranium Limited (RUL) was formed in 1970 to develop the deposit. RTZ was its leading shareholder, with 41.35% of the equity; other shareholders included Rio Algom, the Industrial Development Corporation of South Africa, and Gencor. In 1972, Rössing awarded a management contract for the design, engineering, procurement and construction of the project to a joint venture of Arthur G McKee Western Knapp Engineering Division and Davy Powergas.

Mine development commenced in 1974 and commissioning of the plant and the initial production commenced in July 1976. The original production target was 2,500 short tons (2,268 t) of uranium oxide (U_3O_8) per year. Forward sales contracts were arranged to assure a market for the product. The United Kingdom Atomic Energy Authority was initially an important customer for Rössing's product, as was the French Total Compagnie Miniere et Nucleaire.

The objective was to reach full design capacity of 5,000 short tons (4,536 t) per year of uranium oxide during 1977. In 1979, the target production figure of 5,000 short tons (4,536 t) of uranium oxide was reached. The significance of weaknesses in the plant and the abrasiveness of the ore were not apparent during the pilot stage and the plant was extensively modified. The process plant – after a year of extensive modification in 1978 and total reconstruction of one of the two solvent extraction sections that was destroyed by fire in May 1978 – was operating effectively at the rated throughput of 40,000 t of ore per day.

Production between 1980 and 2004 fluctuated in response to the volumes required by the long-term sales contract portfolio. Contract prices were in turn influenced by market price and exchange rate fluctuations. The drop in the uranium price in the early 1990s necessitated a reduction in production to a minimum of 2,800 t per day in 1998. The drop in price also caused other significant changes at Rössing. Consequently, Rössing was forced to reduce production and withdraw from many external developmental initiatives.

The grim economic outlook of the 1990s was followed by regained flexibility to respond to changes in uranium price and exchange rates. Production was increased to above

[2] The exploration history (Section 3.1 on p 43), the investigation of the Rössing deposit (Section 3.2 on p 44 – 45) and the project outline and schedule (Section 3.3 on p 45) is well documented in Ashton, *et al.,* (1991) and could be read in addition.

3,000 t per day and, in July 2004, a study was completed into the feasibility of extending mining operations. The study indicated that profitability could be extended until the end of 2009. A second phase of mining with an additional 8 years of operation was foreseen, subject to a number of sales contracts being ratified and the parent company – that had since become simply Rio Tinto – approving the proposed expansions, including the replacement of mining equipment, a tailings extension, and plant upgrade. From the mid 2000s the grim economic outlook of the 1990s was finally something of the past. As a result of the upward trend in uranium prices on the international market, Rössing considered possible expansions to extend the Life of Mine plan beyond 2020.

1.7.2. CURRENT SHAREHOLDING

After acquiring shares from Rio Tinto in 2019, CNNC is the majority shareholder of Rössing Uranium Limited, holding 69% of the shares. The Namibian Government has a 3% shareholding, yet has the majority (51%) when it comes to voting on issues of national interest. The Industrial Development Corporation of South Africa owns 10%, while local individual shareholders own a combined 3% shareholding. The Iranian Foreign Investment Company owns 15%, a stake that was acquired during the set-up of the company in the early 1970s, prior to the revolution in Iran, i.e. when the Shah was still in power. In 2010, the United Nations (UN) Security Council passed Resolution 1929 (UNSCR 1929), which prohibits UN member countries – of which Namibia is one – from allowing Iran to acquire an interest in a commercial activity involving uranium mining or to obtain access to nuclear technology. The two shareholder representatives of the Iranian Foreign Investment Company have not attended Board meetings and have not received Board material since the beginning of 2010, in compliance with UNSCR 1929.

The minority shareholders have no uranium product off-take rights.

1.7.3. CURRENT SCALE OF OPERATION

In 2023, Rössing produced 6.4 million pounds of U3O8, and sold 6.9 million pounds of U3O8. Around 1.8 million pounds were shipped to western converters and sold to customers in North America, Asia (excluding China) and Europe, Middle East and Africa ("EMEA"). A total of 3.7 million pounds were shipped and sold to China. An additional 1.4 million pounds were sold to non-utility customers (traders and funds) on the spot market, capitalising on the sudden price spike during the year. Rössing has benefited from the spot prices under CNNC sales agreement.

1.7.4. CURRENT LIFE OF MINE

Piloting to start mining the SJ Pit started in 1974, and after commissioning in 1976, full production was reached in 1979. Originally prepared for closure in 2009, an increase in long-term uranium market prices in 2005 allowed the extension of the Life of Mine plan to 2016. As mine planning continues to adapt to changing internal and external conditions, the Life of Mine plan developed in 2015 foresees the end of mining activities in 2025.

The piloting of the expansion – known as *Phase 2* – started in the north-western part of the pit in 2006. The Phase 3 also referred to as Phase 2B pushback on the southern side of the pit commenced in 2007 in mainly waste rock.

At the end of current mining activities in 2026, the final depth of the open pit will be reached at Bench 36, about 30 mamsl.

The Rössing Uranium Life-Of-Mine Extension Project (LoME) from 2027 to 2036 was approved by the Rössing Board in February 2023. One month later, a 13-year contract was signed with Beifang Mining to commence with a full contract mining service from 2024 to 2036. By the end of 2023, Beifang had mobilised a new fleet of heavy mining equipment ("HME") to site, together with an experienced workforce trained to operate this equipment. The first blast was taken in the new Phase 4 pushback, ahead of schedule, on 21 December 2023. The upper benches of the Phase 4 pushback will be mined concurrently with the final benches of the Phase 2/3 pushback at the bottom of the pit. The latter will supply most of the ore until the end of 2026, while mining waste in Phase 4 to expose more ore from 2027 onwards. To enable this, funds were allocated for the execution of various infrastructure projects in the mining area. The largest of these is the construction of a high-energy rock-fall catch fence on Trolley 11 that will protect mining activities in the bottom of the pit from rockfalls arising from Phase 4 mining above. This project is still under construction and will be completed by mid-2024. Smaller infrastructure projects included the removal of power lines from the Phase 4 mining area, as well as the allocation of facilities to Beifang. While mining continues in both areas until the end of 2026, Rössing will continue to operate its remaining HME, after which Beifang will take over all mining from 2027 onwards.

2. DESCRIPTION OF THE ENVIRONMENT

2.1 GEOLOGY[3]

The Rössing uranium deposit lies within the central part of the late-Precambrian Damara orogenic belt that occupies an area of approximately 50 km wide and extends northeast for over 100 km in west-central Namibia.

The Damara lithology consists mainly of folded, steeply dipping meta-sediments (gneiss, schist, quartzite and marble) arranged in a northeast-southwest striking belt (Table 2.1).

Table 2.1: Stratigraphy and rock types at Rössing

Period	Formation	Lithology
Recent		Alluvium and scree
Damara System	Intrusives	Dolerite dykes
		Alaskite
		Red granite-gneiss
	Karibib Formation	Metasediments
	Chuos Formation	Meta-tillite
	Rössing Formation	Feldspathic quartzite
		Upper cordierite gneiss
		Upper marble
		Lower cordierite gneiss
		Lower marble
	Khan Formation	Amphibole schist
		Upper banded gneiss
		Mottled gneiss
		Amphibolite
		Lower banded gneiss
	Etusis Formation	Biotite gneiss
		Feldspathic quartzite

Several tectonic phases caused intensive folding, shearing and jointing of the Damara rocks, especially around the Rössing Dome, but open fractures are rare due to the predominantly compressive nature of the tectonic stress. The closed nature of the fractures causes the generally low hydraulic conductivity of the meta-sediments. Younger fractures were often intruded by post-Karoo dolerite dykes, which often act as barriers to groundwater flow. The youngest sediments in the area are the alluvial fills of the Khan River and its tributaries, as well as other quaternary deposits.

The geology of the mining area at Rössing is associated with a dome structure and occurs in pegmatitic granite known as alaskite, which intruded into the meta-sediments.

[3] The regional geological setting as well as the geological origin, local setting and structure and the mineralogy of uraniferous deposits is described by Ashton, *et al.,* (1991), Section 2.3 (p 9 – 14).

The Rössing ore body is unique in that it is the largest known deposit of uranium occurring in granite. The nature and grade of uranium ore is extremely variable and can be present as large masses or narrow inter-bands within the barren meta-sediments. All of the primary uranium mineralisation and the majority of the secondary uranium mineralisation occur within the alaskite. However, the alaskite is not uniformly uraniferous and much of it is unmineralised or of sub-economic grade.

Uraninite is the dominant ore mineral (55%); secondary uranium minerals constitute 40%, while the refractory mineral betafite makes up the remaining 5%. Ore grades at the mine are very low, averaging 0.035%. The uranium ore consists of 70-90% alaskite and is subdivided into four ore types according to the composition of the host rock.

2.2 CLIMATE[4]

The climate of the central Namib Desert is hyper-arid with an average precipitation of less than 50 mm per annum over the greatest part. Rainfall is episodic and highly erratic with a variation coefficient of more than 90%, which means that the average might be obtained from single showers, with years of minimal rainfall recordings in between. The effect of these enormous variations may extend over decades.

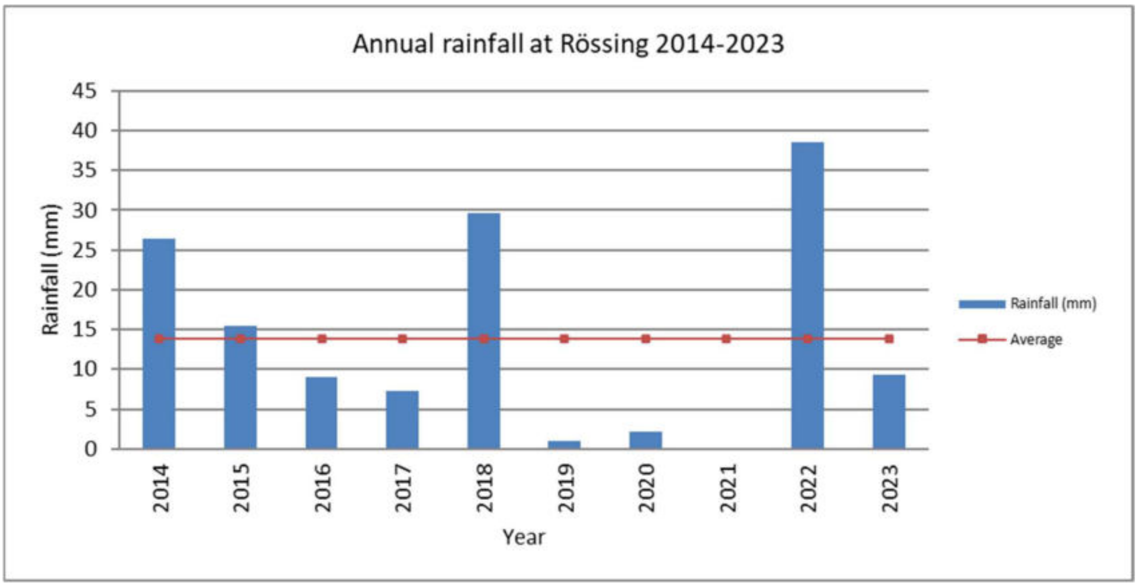

Figure 2.1: Variation in annual rainfall at Rössing

At Rössing rainfall measurements indicate an average rainfall of about 14mm, over the past 10 years (Figure 2.1). Much of the rainfall occurs as an episodic late summer thunderstorm of high intensity and short duration with virtually no rainfall recorded in the winter months. Rainfall increases inland from Rössing (See also Figure 1.3).

[4] Although outdated, additional information about climatic aspects at Rössing is contained in Ashton, *et al.,* (1991), Section 2.2 (p 3 – 8).

Advection fog is a highly significant source of precipitation over the central Namib Desert, especially close to the coast, but its effect decreases rapidly the further it moves away from the coast. Fog occurs more often than rain over the coastal Namib. The frequency differs spatially and between seasons. Biota has adapted miraculously to utilize this form of precipitation and the fog is a significant source of moisture for some of the species, especially those that occur on higher terrain, also at Rössing. Besides providing precipitation, the fog can ameliorate the otherwise torrid temperatures of the Namib Desert up to 100 km inland.

Associated with the cold Benguela Current and the occurrence of fog is the presence of high humidity along the coast. Even when fog is absent, the humidity along the coast remains the highest in Namibia with night values of more than 80% not unusual. Further away from the coast the humidity drops sharply while temperatures rise steeply. Extending inland for a distance up to 60 km during many nights, the fog is densest at an elevation of between 300 and 600 m. This phenomenon creates a foggy and cool coastline, followed by a zone between 30 and 60 km inland from the coast where fog and high humidity is common during the morning, but disappears before noon when the temperatures rise. Rössing is thus located in a zone of extremes, experiencing great diurnal fluctuations in temperature and humidity.

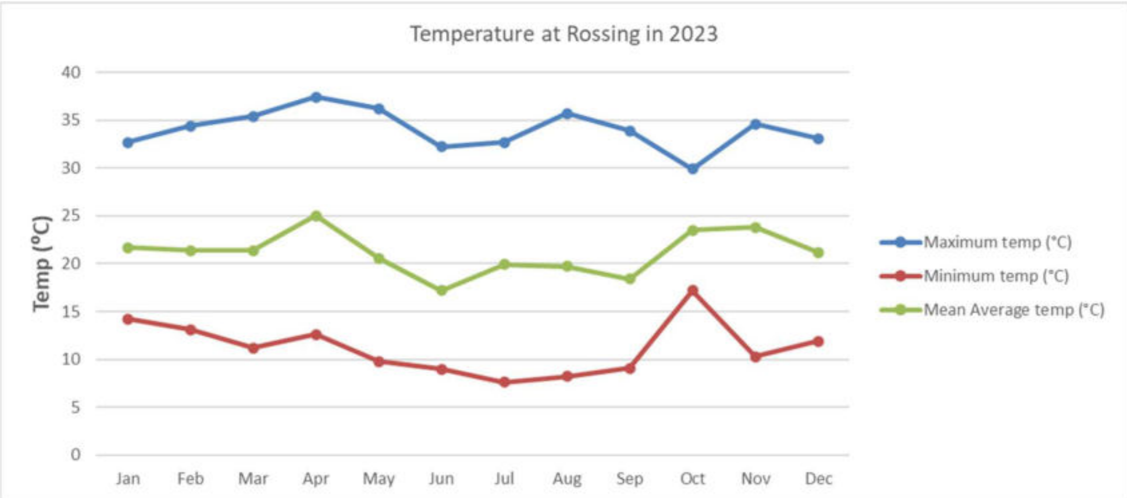

Figure 2.2: Temperature ranges at Rössing during 2023

2.3 TOPOGRAPHY

Generally, the surface of the Namib Desert has a slow rise towards the escarpment but does not exceed an altitude of more than 1,000 m above sea level (Figure 1.3). Consisting of broad gravel peneplains (open outwash plains) with a low relief, the central Namib Desert is also known as the Namib Desert Pavement.

At a mean altitude of 575 m above sea level, most of the Rössing tenement in the west, north and northeast consists of broad peneplains[5]. The flat terrain is traversed by shallow drainage lines and stormwater gullies that aim at the Khan River. Close to the Khan

[5] The topography at Rössing is also described in Ashton, *et al.*, (1991), Section 2.1 (p 3).

River the undulating plains change to an increasingly rugged terrain, which further increases towards the Swakop River, as illustrated in Figure 2.5.

Several dissected gorges coalesce as dry tributaries from both sides to the dry Khan River before its confluence with the Swakop River 25 km to the southwest of the mine property. The gorges are separated by steep-sided ridges, which give the terrain a hostile and impassable appearance.

The peneplains are also traversed by sporadic dykes and intrusions, mostly of a low altitude. A steep-sided ridge of dolerite hills stretches from southwest to northeast between Pinnacle Gorge and Dome Gorge, rising to a peak of 707 m above sea level. To the north and west of the ridge the landscape is less hilly and rugged, the plains more dominant and the gullies less pronounced. To the east and south the landscape is dominated by rolling hills, the plains are absent, and the gullies clearly defined.

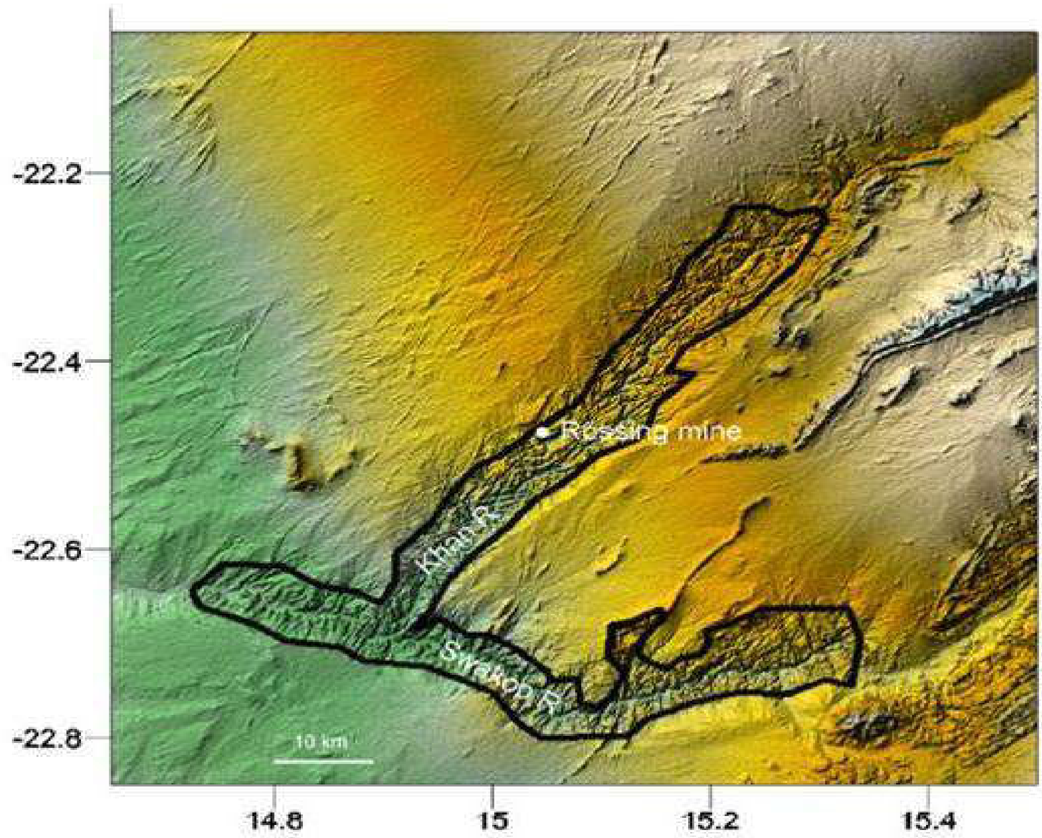

Figure 2.3: Satellite image showing the dissected terrain of the Khan and Swakop Rivers

On the southern side of the Khan River the rugged landscape dissipates abruptly giving way to the gravel plains of the Welwitschia Plains. These plains cover almost the entire area between the Khan and Swakop Rivers, down to their confluence, and are called like this because of the many Welwitschia plants that occur here.

Despite the low elevations over a large part of the tenement, sporadic flash floods of a high intensity have the potential to cause extensive erosion. This is even more pronounced in areas where topographic features have been impacted by mining (for example excavations in the sand borrow pits and steep slopes on the tailings facility and waste rock dumps) and waste disposal sites. Stabilisation of these features against water erosion is an important management aspect in maintaining the environmental and aesthetic integrity of the landscape.

2.4 SOILS

Soils in the vicinity of Rössing could be described as shallow (<25 cm), greyish or ochre leptosols and petric calcisols, with a large proportion of coarse fragments and occasional calcium carbonate or gypsum concretions[6]. Solid material is broken down first by physical weathering processes, after which chemical decomposition processes transform the fragments to progressively finer particles. The predominance of chemical weathering processes is accentuated by the dry climate and the occasional deposition of wind-blown salt of marine origin.

The soils are characterized by high soil pH-values. Hard surface and near-surface crusts, due to calcrete or limestone deposits, are common and these soils are known as "Schaumboden" or "foam soils"[7]. Sometimes the surface crusts are bound by an overlying layer of blue-green algae (cyanobacteria), like in the case of soils in lower Panner Gorge. The crusts reduce rainfall infiltration rates and enhance run-off.

Aeolian sand deposits of varying depth are found in sheltered areas in the upper gorges and are particular prominent on the leeward (wind protected) slopes of Rössing Mountain. These sands are a mixture of dark to light brown grit, quartz and feldspar fragments, and biotite flakes. Colluvium is present on the slopes of some hills. Thickness varies, but may reach a depth of up to about 1.5 m. The material consists of grey-brown silty sands with an open, angular pebble layer and the consistency varies from medium-dense to dense.

Despite the low elevations over a large part of the tenement, sporadic flash floods of a high intensity have the potential to cause extensive fluvial erosion. Fluvial erosion causes an accumulation of unconsolidated alluvium, mainly sand and gravel, in the drainage lines. These deposits up to a few meters thick fan the valley bottoms horizontally, in laminated layers of coarse sand mixed with angular gravel and sorted pebbles. The plains are also exposed to wind erosion, which constantly removes fine material and enhances the soilless appearance of the gravel plains.

The deepest soil is thus confined to the drainage lines, comprising of mainly infertile – almost sterile – alluvium, that vary in thickness. Moreover, topsoil is shallow, poorly developed, infertile and even absent over the largest part of the hill slopes and gravel plains of the mine tenement.

2.5 LAND CAPABILITY

Much of the Erongo Region is occupied by the Namib Desert, which runs parallel to Namibia's entire coastline. As the average annual rainfall increases and the altitude elevates to the escarpment in the east, the Namib Desert gradually transforms to the

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[6] Soils are also described in Ashton, *et al.,* (1991), Section 2.5 (p 15 – 19).
[7] Aurecon, (2011)

savannah-like landscapes of the interior. In general, land capability in the Erongo Region is marginal and land use is of a low intensity.

About two-thirds of the total area in Erongo is owned by the State. One third is under state conservation management, which includes protected areas such as the Namib-Naukluft Park and Dorob National Park, while the other third is made up of communal land, most of which is under communal conservation management[8] (Figure 1.2).

Much of the communal land is of very low agricultural potential and cannot support formal farming activities. As the agricultural potential increases towards the east, small-scale subsistence livestock farming is practised. On commercial farmland a mixture of livestock and game farming is practiced and some land owners secure additional income through tourism and professional hunting.

Although tourism is regarded as an important economic mainstay of Swakopmund, the town becomes increasingly important as a location of mining-support businesses. More than 60% of Rössing's workforce resides in Swakopmund. Walvis Bay, on the other hand, is Namibia's only deep-water harbour and the town is an important hub for the fishing, shipping, storage and transporting industries of Namibia. About 19% of the workforce at Rössing resides in Walvis Bay. In Arandis, where 21% of the workforce resides, economic activities are restricted to local supplies and retail.

Mining activities have affected Swakopmund where all of the corporate offices of the mining companies are located, and most of the employees also reside here. Arandis, to a lesser extent, is home to some of the employees and the town has witnessed some signs of development during the last few years.

2.6 LAND USE

Rössing's Mining Licence area encompassed the open pit, rock dumps and processing plant, whereas activities related to tailings disposal, sand mining, seepage control around the tailings facility, the Arandis Airport and other infrastructure including power lines, pipelines and roads are situated in the accessory works area.

Apart from Arandis, there is no active land use in the proximity of Rössing's Mining Licence area[9]. Around Rössing water is severely limited, meaning that agriculture is of marginal potential only, even along the ephemeral water sources of the Khan and Swakop River. The closest commercial farmland is about 15 km to the east, and the border of communal land is about 15 km to the north. Along the lower Swakop River, close to the coast, commercial farming is undertaken on several smallholdings. Production aims to supply the needs of Swakopmund and Walvis Bay and includes asparagus, olive, mushroom and vegetable farming, as well as tourism- and leisure-oriented activities.

Both the Rössing mining license area and the Accessory Works Area lay within the #Gaingu Conservancy area (Figure 1.2). The #Gaingu Conservancy was registered in 2004. Not many people reside within the #Gaingu Conservancy area south of the main

[8] Rössing Land Use Management Plan, (2008)
[9] Rössing Land Use Management Plan, (2008)

road. The Khan Mine is located on the unoccupied land of the #Gaingu Conservancy southwest of Rössing's operational area. Game migrates freely between the various parts of the conservancy, the proclaimed conservation areas and the properties of Rössing in response to pasture and water availability.

About 720 ha of the Mining Licence area overlaps with the Namib-Naukluft Park on the southern bank of the Khan River. The Dorob National Park, about 10 km to the west of the Mining Licence area, is a near neighbour of the mine. Both parks fall within Category 2 of the International Union for Conservation of Nature (IUCN).

With an overall size of almost 50,000 km^2 in surface cover, the Namib-Naukluft Park is Africa's largest game park. Originally established in 1907, the park is an amalgamation of three previous conservation areas, of which the boundaries were finalised in 1978. The Dorob Park was proclaimed in 2010 and incorporates the old National West Coast Tourist Recreational Area, which was proclaimed in 1968, as well as adjacent areas that were previously unprotected. Dorob Park links the coastal Skeleton Coast Park (north) with the Namib-Naukluft Park (central), which is connected to the Sperrgebiet (south) to ensure that the entire Namibian coast is protected.

2.7 VEGETATION

On the gravel plains at Rössing vegetation is dominated by sparsely scattered dwarf shrubs and ephemeral grasslands[10]. This is also the case for the undulating hills and mountains, but grass is less. Sparse riparian vegetation marks the drainage lines, in particular the Khan River.

In 2003 Rössing decided to assess the vulnerability of the area adjacent to the tailings facility when extensions were proposed. Dr Antje Burke, a Namibian specialist of arid ecology was consulted in this regard. The presence of *Adenia pechuelli* and *Lithops ruschiorum* was found and a follow-up study was recommended. Subsequently a plant red list[11] assessment was carried out by the National Botanical Research Institute (NBRI). More populations of *Lithops ruschiorum* were found in further work in the same area under a Rio Tinto – Kew Botanical Gardens Partnership[12].

In 2004 it was realized that biodiversity management at Rössing requires a systematic approach and a biodiversity assessment was commissioned in 2005[13]. The aim was to delineate ecologically homogenous units, with a specific emphasis on floral biodiversity, reconstruct pre-mining conditions and provide a biodiversity assessment of these mapped units. In this way the "biotope method" was adapted to the local conditions at Rössing[14]. The methodology was developed and tested over two years[15] and applied to assess extensions of the mining lease in 2007[16] and south of the Khan River in 2009 for exploration work[17].

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[10] Although outdated, more information about the vegetation at Rössing is also contained in Ashton, *et al.*, (1991), Section 2.8.1 (p 28 – 34).
[11] Red list status refers to the International Union for Conservation of Nature (IUCN) categorization of species under threat as *vulnerable*, *near threatened* or *threatened with extinction*.
[12] Loots, (2006)
[13] Burke, (2005a)
[14] Burke, (2005b)
[15] Burke, *et al.*, (2008)
[16] Burke, (2007)
[17] Burke, (2009)

It was decided to use plant species as practical indicators for overall biodiversity management at Rössing for several reasons:

- Plants are the key component of most terrestrial ecosystems, providing food, shelter and habitat for many other living components of an ecosystem.
- Plants are the basis for all terrestrial food chains delivering primary production without which very little other biodiversity can thrive.
- Plant species in Namibia can be identified within a reasonable time frame (before the next season starts).
- The conservation status of individual plant species is known and has been assessed nationally and internationally.

Certainly this does not mean that other components of biodiversity are not important, and one cannot assume that all trends shown by plants will be the same for other biodiversity components (e.g. reptiles or insects), but on the current knowledge base plants prove a powerful proxy for biodiversity in most situations. There is no question that the diverse habitats encompassed in Rössing's licence area have resulted in very high plant species richness in this arid environment and make it an important sanctuary for the maintenance of biodiversity in the region. However, quantifying Rössing's contribution is difficult, as readily available and published information on plant species distributions in this area reflects a significant sampling bias, meaning that the plant inventory at Rössing now stands out as the most comprehensive in the central Namib Desert[18].

In addition to the key perennial plant species *Arthraerua leubnitziae* (pencil bush), *Aloe asperifolia* (Sand paper aloe) and *Zygophyllum stapffii* (Dollar bush) on the plains, and *Euphorbia virosa* (Milk bush) and various *Commiphora* species (Kanniedood[19]) on the hillsides, other common species include *Asclepias buchenaviana*, *Salsola tuberculata, Pelargonium otaviense, Adenolobus pechueli, Aizoanthemum membrumconnectens, Sarcocaulon marlothii*, *Trichocaulon pedicellatum, Euphorbia virosa* and *Hereroa puttkamerana.* A few tree species, *Acacia erioloba* (Camel thorn), *Acacia reficiens* (Red umbrella thorn) and *Parkinsonia africana* (Green-hair tree) dominate along the drainage lines while *Faidherbia albida* (Ana boom), *Tamarix usneoides* (Tamarisk) and thickets of *Salvadora persica* (Mustard tree) are more common along the Khan River. Two endemic plant species of particular importance to Rössing are the cryptic rock plant *Lithops ruschiorum* (Stone plant) and the larger succulent *Adenia pechueli*, or Elephant's foot.

Biological soil crusts, comprising lichens, micro-fungi, algae and blue-green algae (cyanobacteria) at Rössing are present in a somewhat reduced form compared to their occurrence in other Namib Desert habitats. Lichens are largely absent, while hypolithic organisms are abundant[20].

The ephemeral flooding of the Khan River provides an important source of water to its riparian vegetation. In general vegetation relates strongly to the frequency, intensity and duration of flooding events. A few species dominate – Ana boom, Camel thorn, Tamarisk

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[18] Burke, (2011)
[19] The Afrikaans word *Kanniedood* literally means *cannot die*, which describes the appearance of these succulent-stemmed plants that only show signs of life after it has rained, remaining leafless for most of the year.
[20] EEAN, (2008)

and thickets of Mustard tree. The relative more dense riparian vegetation provides food and shelter to many animal species and sustains important migration and dispersal routes as a result.

2.8 ANIMAL LIFE

While specialist work has, since 2004, increasingly focused on floral biodiversity, it was realized that faunal biodiversity at Rössing deserves more specialized investigation as well. From work done in the 1980s it was known that unnamed or undescribed taxa, and known only from a few localities, could be present at Rössing. Accordingly, eight invertebrate species were regarded as Critical, nine as Endangered and one as Vulnerable, using the IUCN categories. The list includes four spiders of critical conservation priority.

The Dome area was identified as particularly critical in terms of faunal biodiversity conservation because of single finds of species during the 1980s. In 2007, therefore, the Environmental Evaluation Association of Namibia (EEAN) was contracted to conduct a biodiversity survey. Unlike floral biodiversity, which requires spatial division at a fine resolution (biotope scale), faunal biodiversity at Rössing could be adequately described according to broad demarcations. EEAN argued that habitats at Rössing could broadly be divided into the following[21]:

- Rocky hillsides with loose surface rocks and no soil or soil that is very shallow, and having the least vegetation, relatively speaking
- Open plains with deeper soil and scattered bushes and shrubs. The plains are interrupted with rocky outcrops of varying dimension, and
- Ephemeral watercourses marked by having more bushes and scattered trees along their length than in other areas, and having a substrate that is usually sandy and unconsolidated.

The abundance and diversity of spiders is relatively lower than expected, and the numbers of solifuges is exceptionally low, in contrast to the central Namib which is known as a world hotspot of solifuge diversity. Fourteen scorpion species are known to inhabit the Rössing licence area, of which three are classified as threatened. A total of 271 species of ground-living insects are recorded from Rössing, and this excludes flying groups such as moths and lacewings. Of the 271 species, 20 are classified as threatened.

The Namib Desert is known for its reptile diversity, particularly of lizards and geckos. At Rössing 33 reptile species are expected to occur. Of these, one (a tortoise) is classified as threatened but it prefers moister habitat and its occurrence in the area is very marginal. The Namib chameleon (*Chamaeleo namaquensis*) is more common. Information about the endemic Husab Sand Lizard (*Pedioplanis husabensis*) is limited. Only small numbers of this species and relatively small areas of occurrence – rocky terrain along the lower Khan and Swakop Rivers – are recorded. By the precautionary principle the species is classified as threatened.

Three species of frogs are known to occur at Rössing, none of which are classified as threatened. The Namib Desert has relatively low avifauna species diversity, but does

[21] Ibid

have a relatively high occurrence of endemics and near endemics[22]. From a local perspective the Khan River has the highest bird species diversity, indicating the importance of water availability and consequent supported plant life as well as the diversity of cliff habitats. Two species are classified as threatened.

According to EEAN the rocky hillsides, in particular those located in Lower Dome and along the Khan River are regarded as the most important habitats of the scarce invertebrates at Rössing. EEAN also concluded that it would be possible but unlikely, that the identified species would be extinct by a new mining development and that the apparently high level of endemism might be real or it might be from the sampling bias of earlier research[23].

Mammal diversity at Rössing is not very high, as is typical in the central Namib. Climatic variation is closely coupled with marked changes in the abundance of animal species[24]. Many of the animal species that occur around Rössing use a wide range of habitats, or may cross a wide range in the course of migrating from one habitat to another. Short-lived annuals dominate the plains after local showers of rainfall and provide a vital source of pasture to opportunistic grazers. Large mammal species occur occasionally because they are nomadic and use three main migration routes[25]. Watering points like the pools of the Khan River and the springs are particularly important in attracting animals and serve as orientation guides along migration routes. Common animal species include Klipspringer, Springbok, Ostrich, Kudu, Hartmann's zebra, dassie (Rock hyrax), Black-backed jackal, Baboon and rodents (particularly gerbils).

2.9 SURFACE WATER

Open surface water in the Namib Desert is a rarity and may occur only ephemerally during the rainy season. Flowing surface water on the Mining Licence area only occurs after heavy rainfall. Run-off in the drainage lines is an episodic, brief event and peaks and periods of run-off vary widely. At Rössing[26] average flow rates of the Khan River recorded over three decades vary between 2 m^3/s and 100 m^3/s, indicating the formidable (but highly infrequent) transportation potential of the river.

The many drainage lines that originate on the higher elevations to the north of Rössing form part of the Panner, Pinnacle, Boulder and Dome Gorge drainage systems. These smaller drainage lines function even more episodically than the Khan River, many of them are dry for decades before they may carry torrent flash floods for brief periods.

The local drainage patterns in the vicinity of the Rössing mine site are particularly well defined by lithological and structural features, generally directed towards the Khan River. The regional flow pattern shows a gradient from northeast to southwest in accordance with the local topography. Flow in the alluvial aquifers follows the course of the dry riverbeds, which are aligned roughly north-south.

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[22] Stacey, (2006)
[23] Brett, (2009)
[24] Although outdated, more information about animal life at Rössing is also contained in Ashton, *et al.*, (1991), Section 2.8.2 (p 34 – 40).
[25] Campbell, (1998)
[26] Although outdated, aspects relevant to the hydrology and surface water quality at Rössing is described in Ashton, *et al.*, (1991), Section 2.6 (p 19 – 23).

The watershed of Pinnacle Gorge is characterised by an intensely dissected drainage, reflecting the local fracture density. Pinnacle Gorge has its catchment to the southern part of the tailings facility and flows along the south western side of the open pit. The Panner Gorge watershed area, to the west of the tailings facility, is characterised by a strong linear dendritic pattern reflecting structural and lithologic controls in the underlying strata. Panner Gorge is orientated in a southerly direction and drains to the west of the mine. The drainage lines of Dome Gorge flow in a south easterly direction and captures run-off east of the tailings facility. The drainage lines of Boulder Gorge contain the run-off from the mine plant and the watercourse to the east of the plant.

Due to the alluvium the tributaries of the Khan River contain subsurface water flow for most of the year. Permeability of the alluvium is high – as much as 10^{-3} m/sec, resulting in subsurface flows between 4 and 8 m per day. The alluvium has also a high storage capacity with the water table being within 2 to 3 m of the surface. In the Khan River alluvial deposits may reach a depth of several meters, where they act as an important subsurface aquifer. The aquifer is recharged fairly frequently by run-off from its headwaters in the interior. Recharge rates depend on factors such as flood size, flood frequency, silt load, and local surface conditions.

Seasonal springs and small pools may occasionally form in the Khan River and in the gorges that drain into the Khan River. Pools relate to bands of impervious rock that traverse the river bed beneath the alluvium, forcing the subsurface water to the surface. Ephemeral springs may last for a short period after local rainfalls. Their flows are insignificant and persist for short periods after local rainfalls only. Many of them are saline, but provide important sources of drinking water for animals, despite their salinity.

Insignificant occurrences of permanent natural surface water can be found at small springs in the vicinity of the mine. These occurrences vary from areas of wet soil to small puddles. The water is normally very saline, but the springs are frequently used by wildlife for drinking. Only one natural perennial spring occurs in the Rössing area and is located in a side-arm of Panner Gorge.

2.10 GROUNDWATER[27]

Local geological formations show extensive patterns of folding, jointing and cracking, trending predominantly in a northwest-southeast or north-northwest-south-southeast direction at Rössing. This direction is perpendicular to the strike of the regional fold structures, which influences the geo-hydrology strongly. Consequently, groundwater flows and rainfall seepage at Rössing is mainly along the fractures and thus focused towards the gorges that drain into the Khan River (Figure 2.6).

[27] Aspects relevant to the geohydrology and groundwater quality at Rössing are also described in Ashton, *et al.*, (1991), Section 2.7 (p 23 – 26).

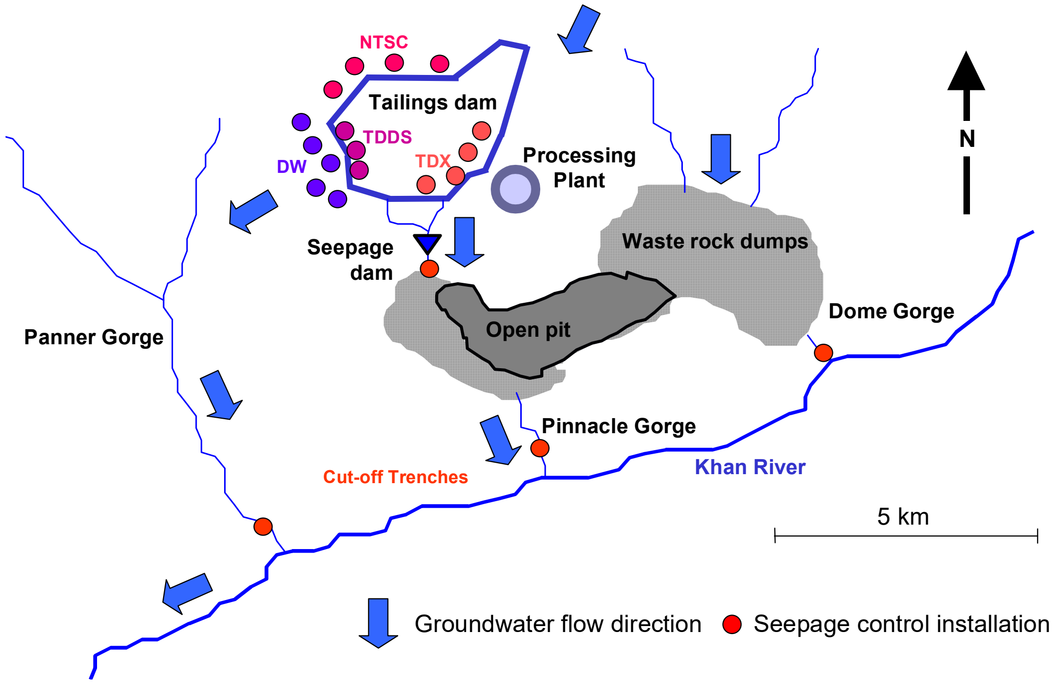

Figure 2.4: General groundwater flow directions and control at Rössing

In general, fracturing in the gneiss-like rocks is highly developed, with joint planes exhibiting well-defined blocks and rectangular patterns. In the schistose rocks, fracture density is more intensive. Many of the fracture zones in the latter type of rock intersect valley walls; this causes groundwater to be collected in the fractures; thus providing potential pathways for seepage flow. In the bedrock, groundwater flow is mainly along fractures.

Superimposed on the natural groundwater system are sources and sinks created by mining. The open pit, more than 300 m deep presently, crosscuts the hydrogeological connection between the existing processing plant situated above the Boulder Gorge fracture system and the Khan River receiving environment (Figure 2.6). It acts as a cut-off trench thus and enables the interception and subsequent evaporation of potentially contaminated water moving downstream from the plant area. Furthermore, it creates a cone of groundwater table depression that cuts off groundwater flow through bedrock and alluvial channels. Around the open pit hydrogeological parameters of storage and permeability are very low; permeability of the bedrock ranges between 1 x 10-8 cm/s and 4 x 10-6 cm/s; porosity is less than 0.01 m per day. The amphibole schist horizon and the SJ Fault are two thin but substantial features of higher permeability (0.2 m per day compared to 0.005 m per day of the surrounding rocks) that cut the pit longitudinally. They connect the void to the bounding fracture systems of the Pinnacle Gorge to the west and Dome Gorge to the east. The two horizons cause a redirection of groundwater flow towards the pit void cone of depression, away from the Khan River. Thus, these features act as natural drains for potential fracture flow of tailings seepage water from underneath the gorges into the pit, passively assisting long-term seepage control.

The current elevation of the bottom of the pit is substantially lower than the level of the Khan River – 3 km to the south, and the regional water table – about 20 m below ground. The Khan River is also separated from the pit by a low-permeability rock mass and the possibility of water from the Khan River entering the pit void is significantly reduced this way.

The natural groundwater quality in the vicinity of Rössing is very saline with Total Dissolved Solids (TDS) concentrations of 20 000-40 000 mg/L on the desert plains in the north-west. The water quality improves gradually to TDS <10 000 mg/L in a south-easterly direction towards the Khan river. The tailings facility creates an anomaly of more saline water (20 000-40 000 mg/L) in an area of naturally intermediate salinity (10 000-20 000 mg/L). The tailings solution itself is highly saline (>40 000 mg/L), but it is reused in the process and not allowed to interact with the environment.

Table 2.2: Typical Khan River quality (in 2023) compared with Namibian stock-water guidelines

Determinant	Stock-watering standard	Khan River borehole (BH 1.6A)
Conductivity (mS/m)	3500	696
Sodium (mg/ℓ)	2000	1180
Calcium (mg/ℓ)	1000	452
Magnesium (mg/ℓ)	500	227
Chloride (mg/ℓ)	3000	3150
Sulfate (mg/ℓ)	700	557
Nitrate (as N mg/ℓ)	400	4.7
Fluoride (mg/ℓ)	6	0.2

Groundwater quality data for the Khan and Swakop rivers indicate a variable composition that improves after floodwater recharge, but generally deteriorates with distance downstream.

Khan groundwater in the vicinity of the mine is brackish with an average TDS concentration around 5000 mg/L. The lower courses of the Khan and Swakop rivers contain brackish to saline groundwater that is not suitable for human consumption.

The only groundwater potentially suitable for agricultural use near Rössing is found in the Khan River. This water is brackish and only suitable for livestock watering[28]. Table 2.2 shows typical selected analyses of Khan River water abstracted from boreholes in the river bed, compared with Namibian guidelines for stock watering.

As a result of the high salinity of the water in the Khan River the only beneficial uses of the water are for industrial purpose, such as for dust suppression. Despite its salinity, the very hardy natural vegetation along the river depends on this water and abstraction is closely coupled to monitoring of the water table. Current groundwater use of the Khan River is limited to environmental use downstream of the mine and there is no danger of an adverse effect on the primary use potential of this resource.

[28] SRK, (2010)

2.11 AIR QUALITY[29]

The arid climate at Rössing is typified by daily temperature ranges that often exceed 20°C, an average annual rainfall of around 14 mm and evaporation potential is about 6,784 m3/day. Under these conditions air quality is prone to airborne dust and other impurities, a situation which is enhanced by atmospheric movements. Average daily wind speed is 4.35 m/s with the highest maximum wind speed over a one-hour period recorded at 17.20 m/s. These velocities usually occur during the winter and gusts of up to 34.90 m/s have been known to occur. The mean maximum gust is 26.17 m/s. Predominant winds are southwest in direction, or alternatively, east to northeast.

Potential for the transport of dust and other impurities via atmospheric pathways towards inhabited areas is dependent on the direction of receptor points relative to wind direction. Table 2.3 summarizes localities relevant to wind direction at Rössing.

Table 2.3: Geographical position of localities relative to wind direction

Locality	Distance	Direction	Relative to wind direction
Arandis Town	5 km	Northwest	Does not lie in the direction of E, NE, or SW winds
Arandis Airport	6 km	West	Lies in the direction of E wind
Swakopmund small holdings	50 km	Southwest	Lies in the direction of NE wind at a distance
Swakopmund Town	60 km	Southwest	Lies in the direction of NE wind at a distance
Walvis Bay	75 km	South-southwest	Lies in the direction of NE wind at a distance
Henties Bay	88 km	Northwest	Does not lie in the direction of E, NE, or SW winds
Husab (Swakop Uranium)	44 km	South	Does not lie in the direction of E, NE, or SW winds

Occasionally during winter, wind blows from the interior, mainly from the east or the east-northeast. These sometime high-velocity winds (average of 11.9 m/s with peaks exceeding 34.2 m/s) are accompanied by marked increases in temperature and sharp decreases in humidity, which causes the anomaly that the west of Namibia frequently experience the highest temperatures, lowest humidity figures and strongest wind during winter. These winds, known as *Bergwinds*, can carry large quantities of dust and can prevail from a few hours to a few days.

Generally deposited dust is not a health hazard, but because it is visible it is the cause of most complaints. While dust is in suspension, particulates with a diameter of less than 10µm might be inhaled, causing lung function disorders. If the dust contains silica, lead or radio-nuclides for example, it can present an additional health risk in the form of silicosis, lead poisoning or irradiation respectively. The degree of hazard is determined by the dust concentrations and the period of exposure. It is not only human health that can be adversely affected by dust: The fall-out of heavy metals onto soil and the foliage of plants also results in an adverse impact on the environment. The metal is either taken

[29] Additional information is contained in the Rössing Dust Management Plan, (2012)

up directly from the dust deposits on the foliage, or it is taken up by plants and concentrated in the leaves of the plants. This can result in the bio-accumulation of heavy metals and radio-nuclides in the food chain, with severe adverse impacts in some cases.

It is important to distinguish between total dust, which includes all fractions, and inhalable dust, i.e. particles with a diameter of less than 10μm (PM10). The sources of dust are divided into two: particulates and fugitive dust. Particulate dust is derived from controlled sources such as emissions and other point sources. Fugitive emissions refer to those air pollutants that enter the atmosphere without first passing through a stack or duct designed to direct or control their flow. Fugitive dust sources therefore can be considered as uncontrolled, or non-point sources which are mobilised by the forces of the wind or machinery acting on exposed materials. Examples of fugitive dust sources at Rössing are the tailings dam, the crushing circuit and the open pit. Furthermore, dust sources are classified as localised (from blasting, loading trucks, crushing ore or transfer by conveyor); diffused (from waste rock dumps or areas of disturbed ground) or linear (from roads, for example).

While most of the dust generated in the pit at Rössing is of a fugitive nature, blasting activities can be considered as a point source of particulates, from where dust is dispersed into the surroundings of the mine. The exact size of the blasting plume is unknown at present, but it is unlikely to increase in size because as the pit deepens, the effects of blast dust will become less. The dust plumes from the smaller blasts tend to disperse along the length of the pit and the dust settles on the benches and roads within the pit, only to be remobilised again by wind action and vehicles.

From the primary crushers coarse ore is loaded onto an open conveyor which feeds to the coarse ore stockpile. The ore on the conveyor is moist and therefore the potential for dust generation from the coarse ore conveyor is low. Once it is tipped onto the stockpile, the material dries out to and the fines becomes susceptible to wind action. There can be up to 20% fine particles (<45μm) by mass in the primary crusher feed, especially when weathered ore is being processed.

Of the eight (8) common air impurities identified, five (SO_2, CO, NO_x PM10 and dust deposition) are released at Rössing. However, only two are recognized as significant i.e. particulate matter smaller than 10 microns in diameter (PM10) and dust deposition, which are regularly monitored. Rössing conducts annual monitoring of SO_2, CO and NO_x that could be emitted as a result of the yellow cake roasting at the Final Product Recovery (FPR). Gas emissions sources include stacks, process fugitives and mobile equipment. Only the stack emissions gases from the final product recovery are currently quantified annually. In addition, greenhouse gas (GHG) emissions are estimated as carbon dioxide equivalent (CO_2-e) on a monthly basis, deduced from fuel consumption, electricity usage and explosives used for blasting.

Noise and vibration arising from exploration and operations, including mining, mineral processing, materials handling, infrastructure and on-site transport may have significant impacts on employees, communities and the surrounding environment. Noise, ground vibrations and air blasts can have an adverse impact on the general living conditions of species and / or lifestyle of its neighbours and need to be monitored in order to mitigate adverse impacts. For this purpose spot-checks, specific surveys and investigations and regular risk assessments need to be conducted. Air blast and ground vibration are monitored to provide information for geo-technical purposes as well, specifically to assess stability of man-made landforms.

2.12 SITES OF ARCHAEOLOGICAL AND CULTURAL INTEREST[30]

An assessment conducted in 2007 documented a total of 49 archaeological and historical sites at Rössing, mainly outside the mining operational areas, meaning that it is unlikely that important archaeological and historical sites were destroyed in the course of mining activity. Although there is some evidence of upper Pleistocene occupation, most of the archaeological sites date to within the last 5,000 years. Historical sites relate to the narrow gauge railway that operated between Khan Mine and Arandis siding until about 1918.

Many of the archaeological sites were confined to Panner Gorge and date between 2800 BC and AD 380. The third millennium BC, in climatic terms the mid-Holocene, was a period of above average rainfall in the Namib. This cluster of sites relate to the high quality chert for stone artefact manufacture and the strategic use of Panner Gorge as a hunting area. The chert artefacts mainly came from the prominent dolerite dyke striking in a SW-NE direction in the northwest corner of the mine tenement (Figure 2.7). Fragments of ostrich eggshell were also found at some sites in this cluster.

A second cluster of sites relates to grass seed digging activities in well-drained soils derived from weathered granite, estimated to post-date AD 1000. These sites occur mainly in the northern and north-eastern parts of the mine tenement (Figure 2.7) and relate to the seed-digging activities that still exist among Damara-speaking Namibians today. The seed digging sites are concentrated around a number of low-lying granite outcrops associated with shallow depressions, which may contain water after rain, in between. Two shelters and some coarse-tempered pottery as well as a pestle were found in this area, indicating that the possible ephemeral water supplies were used as base camps during the seed digging activities.

Thus, the Rössing tenement is not an area of outstanding archaeological importance and does not have the dense site clusters which are characteristic of some parts of the escarpment and ephemeral river systems of the Namib. The areas of highest heritage value lie outside the main focus of mining activity and the mining area and related high disturbance locations have a rather low heritage value. The sites also show a low vulnerability potential to disturbance. In general the archaeological and historical sites are mainly of a low individual significance.

[30] Further information is contained in a specialist report conducted for Rössing by Quaternary Research Services, (2007)

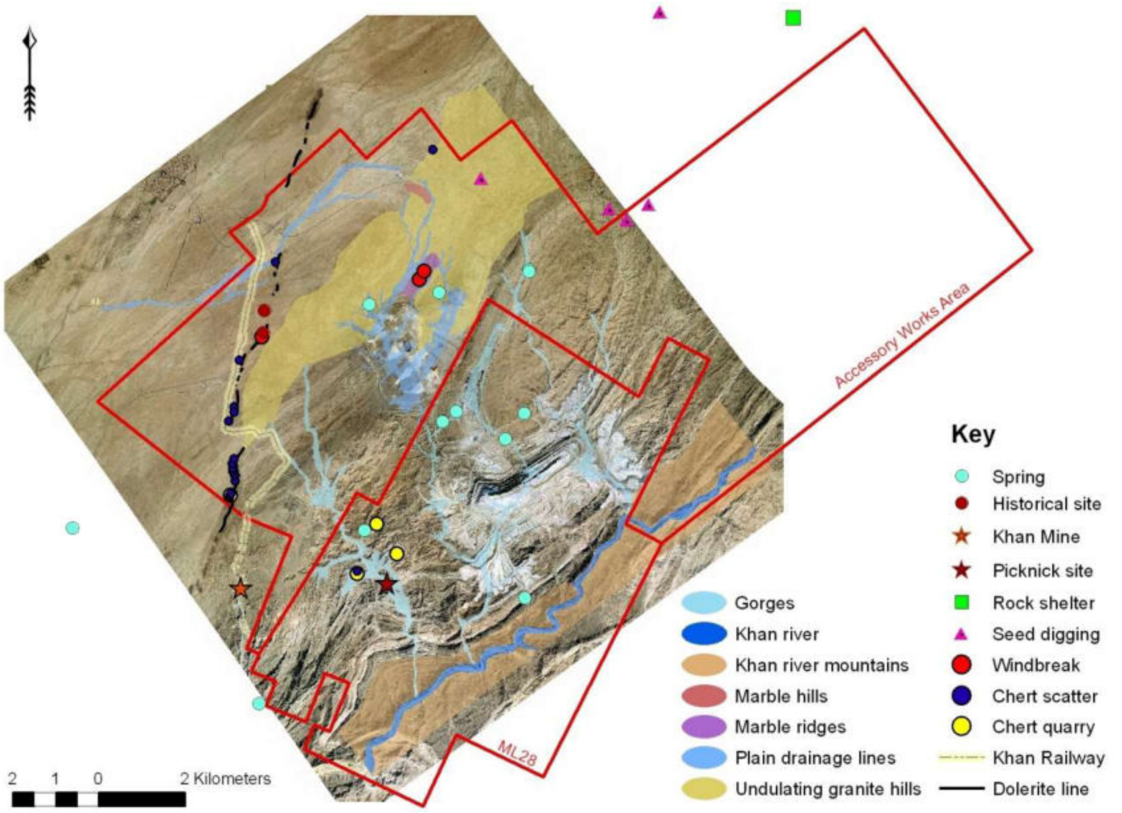

Figure 2.5: Archaeological and sensitive sites at Rössing

2.13 SENSITIVE LANDSCAPES[31]

Sensitive landscapes encompass a wide variety of site-specific points of interest as well as zonal areas, ranging from critical habitats or habitats occupied by threatened or endangered species to areas of historical (legacy), cultural and heritage importance. Sometimes the boundaries are well defined and the features clearly discernible (e.g. national parks), but sometimes the boundaries are uncertain, varying or vague (e.g. habitats). Sensitive features may also be located on adjoining land or include undefined aspects of a perceived value such as an ecosystem, landscape aesthetics or sense of place.

The Khan River and its associated rugged flanks are particularly scenic and have touristic potential. Places of archaeological and historical importance such as the former Khan Mine and the remnants of the old German railway line built in the early 1900s are part of this landscape (see also Figure 2.7). The naturalness, remoteness and cultural-historical importance of these landscapes are collectively known as their *sense of place*. Rössing highly respects sense of place and believes that maintaining this natural sense of place throughout the mine's life will result in a positive legacy after closure.

[31] Additional information is contained in the Rössing Land Use Management Plan, (2008)

Access to the Khan River and its associated mountains is limited. Its northern bank is part of the Rössing Mining Licence and its southern bank is part of the Namib-Naukluft Park. Along the Khan River and within the gorges several ephemeral springs occur, mostly after local rainfalls. From all the studies done by Rössing and others, these parts have shown biodiversity of high significance, especially within the wider landscape context. Several scarce plant species occur here; many animal species, especially invertebrates, are confined to the rocky hillsides; and the availability of water in the drainage lines create important ecological corridors, providing water, food, shelter and migration routes. Although vulnerable, because the river is relative inaccessible, the Khan River and its associated mountains enjoy implicit protection. In combination, the inaccessibility of hilly and mountainous terrains, the tourism potential and the conservation status of the zone south of the Khan River qualifies the area clearly as a sensitive landscape that needs protection and wise management.

2.14 VISUAL ASPECTS

At Rössing the visual impacts of man-made landforms such as the tailings facility and the waste rock dumps can have an adverse effect on the landscape aesthetics. Moreover, the appearance of man-made landforms has a definite cumulative impact, often centred on visual contrast, which needs to be understood and managed. In addition to visual contrast, visual absorption capacity needs to be considered when determining impact significance. This refers to the capacity of the receiving environment to absorb the visual intrusion and typically relates to colour, shape, form and texture.

Objectives of minimising the visual impacts of the final heights and shapes of man-made landforms thus need to be set, requiring maintaining the characteristics and attractiveness of the surrounding, wider landscape. Although the design of mitigation measures and the evaluation of options need to take the visual aspects of surrounding landforms into consideration, the ultimate goal is to maintain or create a sense of place that is characteristic of the environment and valued.

Sense of place at Rössing has already been significantly impacted due to the long period the mine has been operating. To the contrary, the landscape character of some surrounding areas such as parts of the Khan River and the Welwitchia Plains remain intact due to the stark skylines constituted by the rugged terrain.

Higher levels of visual intrusion as a result of the vertical rise of the tailings facility are possible. Height of the tailings beyond 680 mamsl can have higher levels of contrast created by massing and scale. Waste rock dump heights have reached levels that are about the same elevation as the surrounding topography and visual impacts of these man-made landforms are restricted to a small number of viewing points outside the Mining Licence and accessory works areas.

2.15 REGIONAL SOCIO-ECONOMIC STRUCTURE[32]

The Erongo Region, located in west-central Namibia and measuring nearly 64,000 km² in size, is sparsely populated. Just over 240,000 people, or about 9% of Namibia's total population, live in the region. More than 80% of these people live in the urban areas. Three of the region's eight towns are located along the coast and includes the major towns of Walvis Bay and Swakopmund with the latter as the capital of the region. In addition to mining-support businesses, tourism is regarded as an important economic activity for Swakopmund while Namibia's only deep-water harbour is located at Walvis Bay, which makes the town an important hub for the fishing, shipping, storage and transporting industries. Mining and Agricultural are key drivers for the micro and macro economy with agriculture limited to stock farming and mostly located in the more arable eastern parts of the region and operating mines delving for uranium, gold granite, marble, semi-precious stones and salt.

Erongo has a well-developed infrastructure, second to the Khomas Region. Mining, fishing, tourism, transportation and storage comprise the principal economic activities in Erongo, with most of these taking place in the western and coastal parts of the region.

Based on the National Census of 2023, the Region's population was pegged at 240,206 (from 150,809 in 2011). In the 12-year period from 2011 Erongo's population grew by 58%. Much of this occurred in the three constituencies of Swakopmund and Walvis Bay, which had a combined growth of 67%. The high growth figures are suggestive of high in-migration to the region and specifically to Walvis Bay and Swakopmund.

There are 96 schools in the region, which are made up of primary schools, combined and senior secondary schools and additional schools that are run privately. There are 24 public health facilities in the region comprising 4 public hospitals, 2 health centres and 18 clinics. Privately operated facilities also exist, but mainly cater for individuals with medical insurance and the wealthy.

2.16 INTERESTED AND AFFECTED PARTIES

The following stakeholder groups were identified as key interested and affected parties consulted in engagement processes, related to Environmental Impact Assessments, at Rössing:

- The Namibian State, specifically the following ministries:
  - Mines and Energy,
  - Health and Social Services,
  - Labour and Social Welfare,
  - Environment, Forestry and Tourism,
  - Agriculture, Water and Land Reform,
  - Education, Arts and Culture,
  - Urban And Rural Development, and
  - Ministry of Finance and Public Enterprises

[32] Additional information relevant to this section is contained in the Rössing Closure Management Plan, (2011), updated from the preliminary results of the 2011 Population and Housing Census by the National Planning Commission, (2012).

- Regional and local authorities:
    - Erongo Regional Council,
    - Swakopmund Municipality,
    - Walvis Bay Municipality, and
    - Arandis Town Council;
- Parastatal service providers
    - NamPort;
    - NamWater;
    - NamPower;
    - TransNamib;
    - Roads Authority;
- Other service providers
- The !Oe#Gan Traditional Authority;
- Other uranium mines in the Erongo Region;
- Rössing Uranium;
- The Rössing Foundation;
- Organised labour;
- The media;
- The farming community, both small-scale and commercial;
- Economic sectors which may be affected by mineral exploitation, e.g. tourism;
- Community groups and social institutions in Swakopmund, Walvis Bay and Arandis.

3. DESCRIPTION OF THE CURRENT OPERATION

Although the extent of linear infrastructure at Rössing is comparable with that of a small Namibian town, it does not cover a large surface area. Including the linear infrastructure, the total surface area of land disturbance at Rössing according to man-made landforms, i.e. the direct footprint, is about 2,640 ha in 2024. This area represents about 20 % of the total land of 13,003 ha under Rössing auspices. The footprint did not increase substantially over time.

To portray the footprint better, the production and extraction process at Rössing is briefly described below. It is followed by a description of the main components of the mining activities that caused the direct footprint, followed by a brief description of components of the socio-economic footprint of the company.

3.1 PRODUCTION PROCESS

The current mining sequence is a conventional drill, blast and load operation on a large scale. Mining is done by blasting, loading and hauling from the main open pit, referred to as the *SJ Pit*, before the uranium-bearing rock is processed to produce uranium oxide.

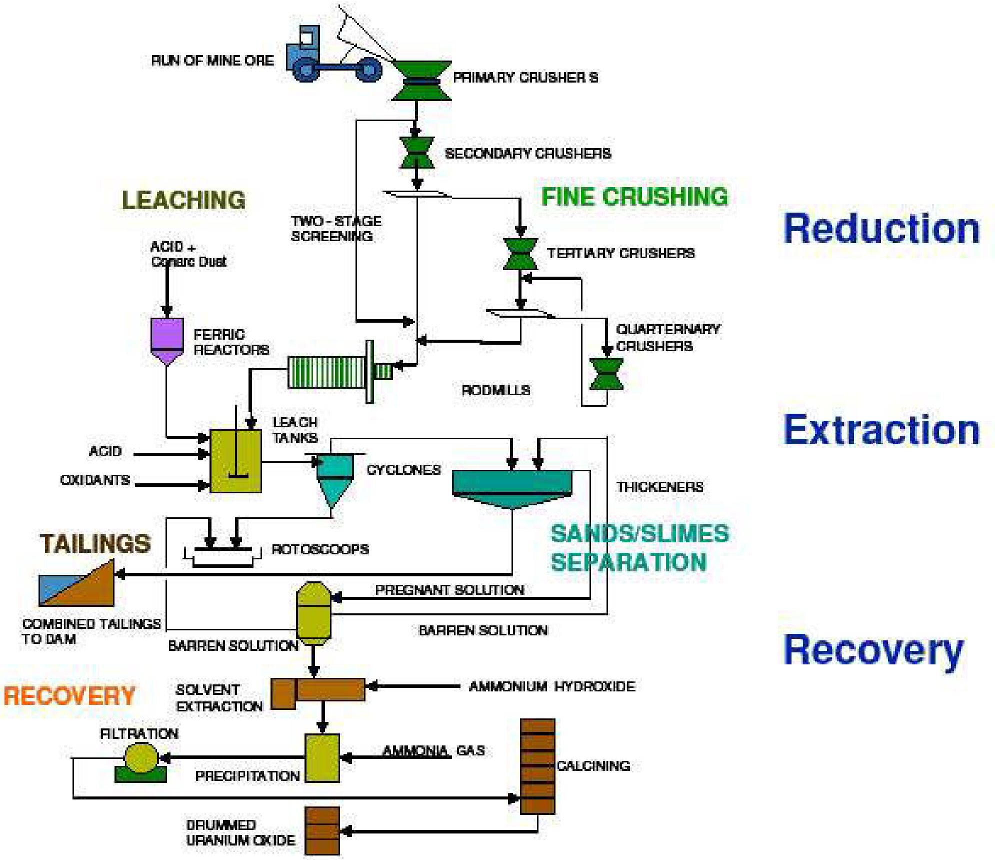

Figure 3.1: A simplified flow diagram of the production process at Rössing

The run of mine material from the open pit is fed through primary and secondary crushers to the processing plant. The metallurgical process is a conventional acid leach with ion exchange solution concentration and solvent extraction purification, followed by the precipitation of ammonium diuranate and roasting to produce uranium oxide. The final product, U_3O_8 concentrate, is of a low radiation level and loaded into steel drums, containerised and dispatched via Walvis Bay for export to conversion and enrichment facilities in other parts of the world, to be processed as nuclear fuel for use in power plants. Figure 3.1 simplifies the production process at Rössing as a flow diagram.

The stages of processing and extraction are described in more detail in the following sections[33].

3.1.1 MINING

Ore is extracted from the hard rock by blasting. The explosive used is a mixture of 60% Emulsion (E6000HR) and 40% Ammonium Nitrate Prills (Expan 200), this explosive mixture is well known as High Energy Fuel (HEF) 260. Blasting takes place on average once a week, using approximately 200 tonnes of explosives per blast. A total of 10 000 tonnes of explosives is consumed per year.

3.1.2 CRUSHING

Ore from the open pit is delivered in 100, 140 and 180 tonne haul trucks to the primary crushers, where two gyratory crushers reduce the ore to less than 160 mm in size. A conveyor belts transports the crushed ore to a coarse ore stockpile with a live capacity of some 80,000 tonnes (see Figure 3.2).

Coarse ore is withdrawn from the stockpile by vibrating pan feeders, feeding directly onto a coarse ore reclaim conveyor. This conveyor discharges the ore to a pre-screening plant where all fines are removed and the coarse material returned to the surge bin ahead of the secondary crushers. The ore is further processed through secondary, tertiary and quaternary stages of crushing and screening, delivering a final product of less than 19 mm in size to the fine ore stockpile. The crushing circuit is equipped with an adequate system of dust extraction and collection into covered lugger bins. There are, in total, ten collection systems that provide extraction points from the reclaim tunnel to the fine ore storage bin.

[33] See Section 3.4 (open pit mining operations, p 46 – 53), Section 3.5 (processing operations, p 53 – 59), Section 3.6 (waste disposal, p 59 – 72) in Ashton, *et al.*, (1991). Recent information relevant to this section was also obtained from Rössing's Radiation Management Plan (2012)

Figure 3.2: The coarse ore stock pile at Rössing

3.1.3 MILLING AND LEACHING

The final stage of size reduction employs four (4) Marcy rodmills operating in parallel. This milling stage comprises two modules that can be operated independently. Each module consists of two rodmills which feed into six leach tanks respectively. Grinding in the rodmills is a wet process, with feed water that can be any one or a combination of fresh water, return dam solution from the tailings impoundment and seepage water from the seepage dam. The final particle size leaving the rodmills is 1.1 mm in diameter on average.

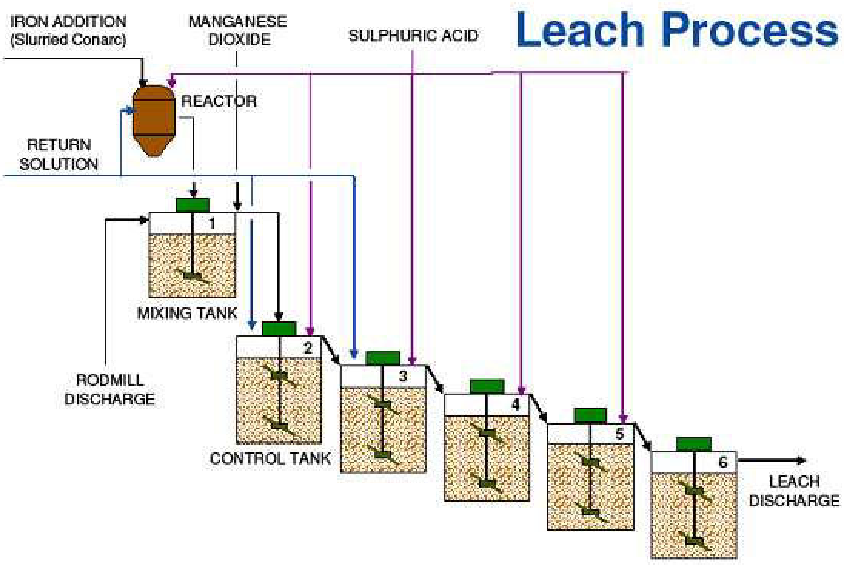

Figure 3.3: The leach process at Rössing

The resulting slurry is pumped from the rodmills to the leaching section where it is mixed with sulphuric acid, ferric iron and manganese dioxide in a series of six leach tanks (see Figure 3.3). The first tank in the series (290 m^3 capacity) is considerably smaller than the other five (1,450 m^3 capacity), thus ensuring adequate mixing of reagents and leach feed.

The steel leaching tanks are rubber-lined and mechanically agitated. Retention time in the leaching section is 8−9 hours at a temperature of 35°C, with uranium extraction of 85−90%. Gases and fumes generated during the leaching process are captured on top of the leach tanks by means of scrubbing units. The reagents used for leaching are:

- Ferric iron to oxidise the uranium from a tetravalent to a soluble hexavalent state. Ferric iron is obtained by reacting iron oxide with 93% sulphuric acid in special Rössing designed reactor vessels. Iron oxide (haematite) is brought in by truck in 1 m^3 mega bags.
- 93% sulphuric acid for extraction. Sulphuric acid is imported through the harbour in Walvis Bay, railed to site and stored in large acid tanks prior to being delivered to the leach tanks.

- Manganese dioxide to oxidise ferric iron to ferric. Manganese dioxide ore is delivered to the harbour in Walvis Bay by ship and then railed to site and stored in a storage bunker. It is transported by front end loader to a crushing, grinding and thickening plant adjacent to the leach modules where a finely ground slurry is produced and delivered to the leach tanks as part of the extraction process.

3.1.4 THE SANDS / SLIMES SPLIT

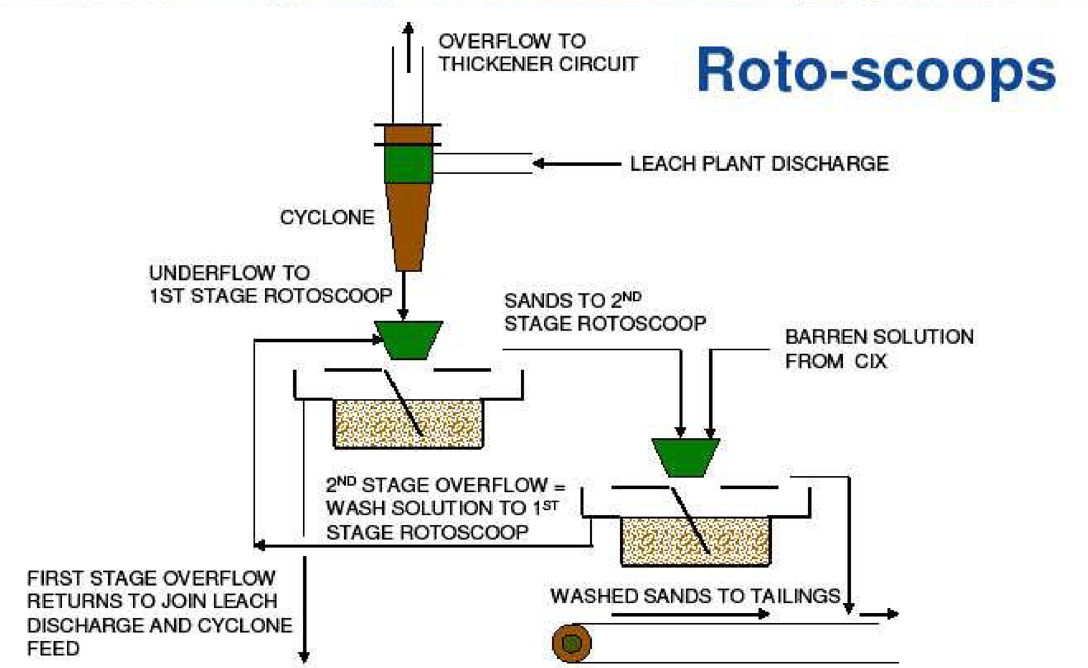

Figure 3.4: Washing circuits

Pulp leaving the final leach tanks flows into a ten-way motorised pulp distributor and thence to 10 hydro cyclones. A sand/slime split occurs here with the slime fraction (cyclone overflow) directed to a counter current decantation (CCD) thickener circuit (see Figure 3.4). The coarse sand fraction (cyclone underflow) reports to one of ten primary rotoscoops. There are 20 rotoscoops in each module arranged as 10 discrete pairs, a primary and secondary unit each, providing a two stage sands washing circuit. Barren solution from the continuous ion exchange plant is used as the wash medium on all second stage units. Washed sands are removed from the second stage rotoscoops by a conventional conveyor belt.

3.1.5 THE SLIMES WASHING – CCD THICKENERS

Slimes (cyclone overflow) washing is carried out using a five stage CCD thickener circuit (see Figure 3.5). The first stage consists of four identical thickeners with the slimes fraction distributed equally to two of them. The third and fourth thickeners are used as clarifiers. First stage thickener underflows are re-combined and progressively pumped through four further stages of thickening and re-pulping, thus five washing stages are achieved. Continuous ion exchange (CIX) barren solution is introduced into the fifth washing stage. This runs counter current to the slime flow, and provides the wash medium taking up the uranium. First stage thickener overflow, called “pregnant solution”, contains uranium (uranyl sulphate), at a concentration of 0.180 g/L.

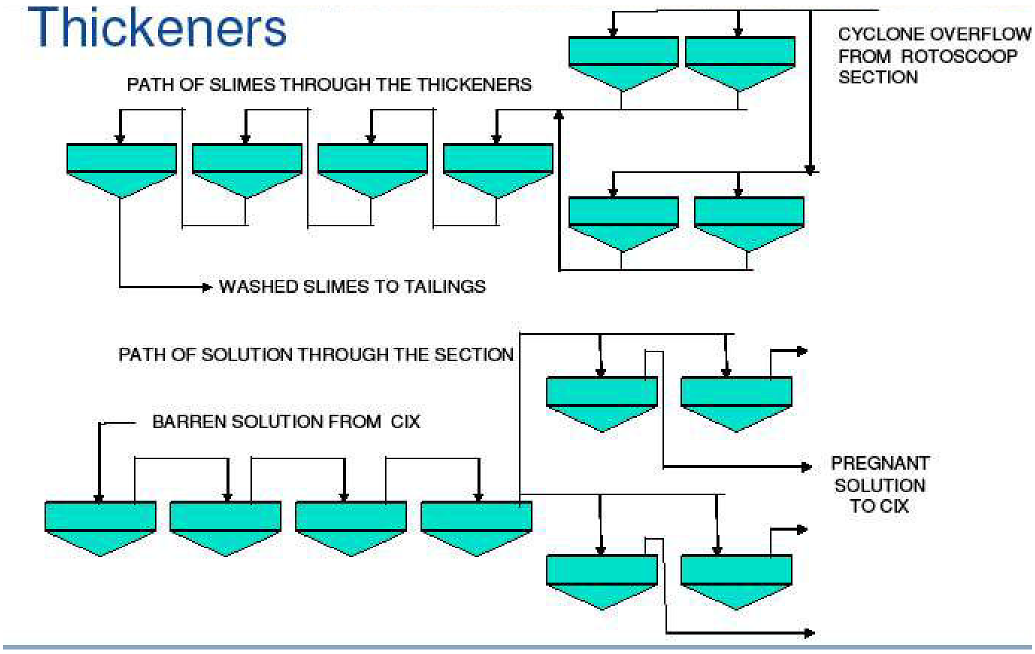

Figure 3.5: CCD Thickeners

3.1.6 TAILINGS DISPOSAL

The slimes from the fifth thickening stage are pumped to the tailings facility to the mixing and tailings pumping station at Paddy X via a pipeline, while sands and the coarse material from the second stage rotoscoops are sent to the station via the sands conveyor. The slimes and sands are re-combined prior to disposal. The solids settle out while the effluent (return dam solution) is pumped back to the processing plant for re-use at the rodmills.

3.1.7 CONTINUOUS ION EXCHANGE

First stage CCD thickener overflow (pregnant solution) is pumped to a pregnant solution storage tank situated near the CIX plant (see Figure 3.6). Tank discharge is by four pumps, each delivering to one line of the CIX contactors. The Rössing CIX plant is built on the Porter system, which uses the upward flow of pregnant solution to fluidise a bed of ionic resin beads in a series of six contactor chambers per line. The flow of pregnant solution is counter current to the resin movement. There are four lines of CIX contactors with six chambers in each line. Resin transfer from one contactor to the next is carried out by air lifter units of which there are six per contactor. Loaded resin from contactor 1 in each line is transferred to the elution columns. Three elution columns per line of contactors are provided; these take the form of fibreglass lined mild steel pressure vessels. Sulphuric acid (at 10% concentration) is passed through the resin bed, stripping the uranium from the resin beads during its passage. Stripped resin is then returned to the contactor line and the uranium rich concentrated eluate is pumped to solvent extraction. The eluate has a uranium concentration of 4 – 5 g/L.

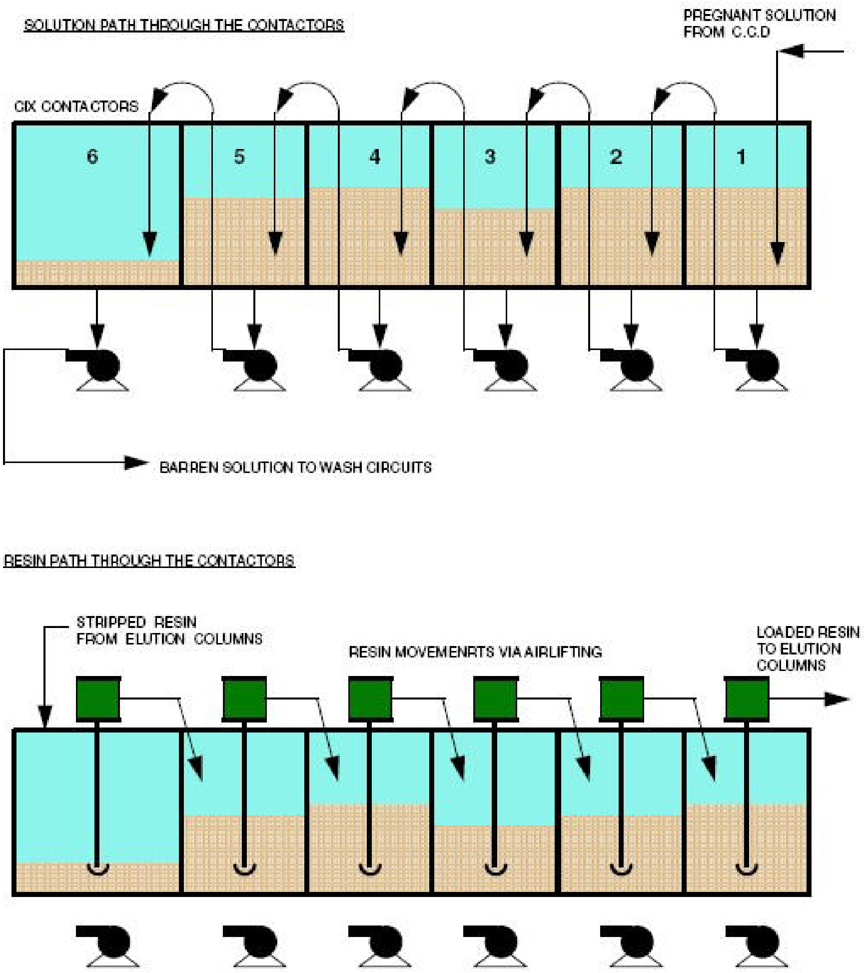

Figure 3.6: Continuous Ion Exchange (CIX)

3.1.8 SOLVENT EXTRACTION

Concentrated eluate containing 4 to 5 g/L uranium is pumped to solvent extraction as the aqueous phase of the extraction process (see Figure 3.7). The organic phase is Shellsol, containing alamine 336 and isodecanol. Extraction, i.e. transfer of uranium from the aqueous to the organic phase, is carried out in five stages of counter current contact using Davy Powergas mixer settler units. The loaded solvent is then passed through a two unit clean water scrubbing stage prior to a four unit stripping stage where the loaded solvent (organic) is mixed with a 7% ammonium sulphate (aqueous) solution under pH control with aqueous ammonium hydroxide. Uranium is stripped into an aqueous phase and is pumped to the final product recovery plant as OK liquor (concentrated uranium diuranate solution) containing 8 to 20 g/L uranium. The stripped solvent returns to the extract mixer settlers to repeat the process as described above.

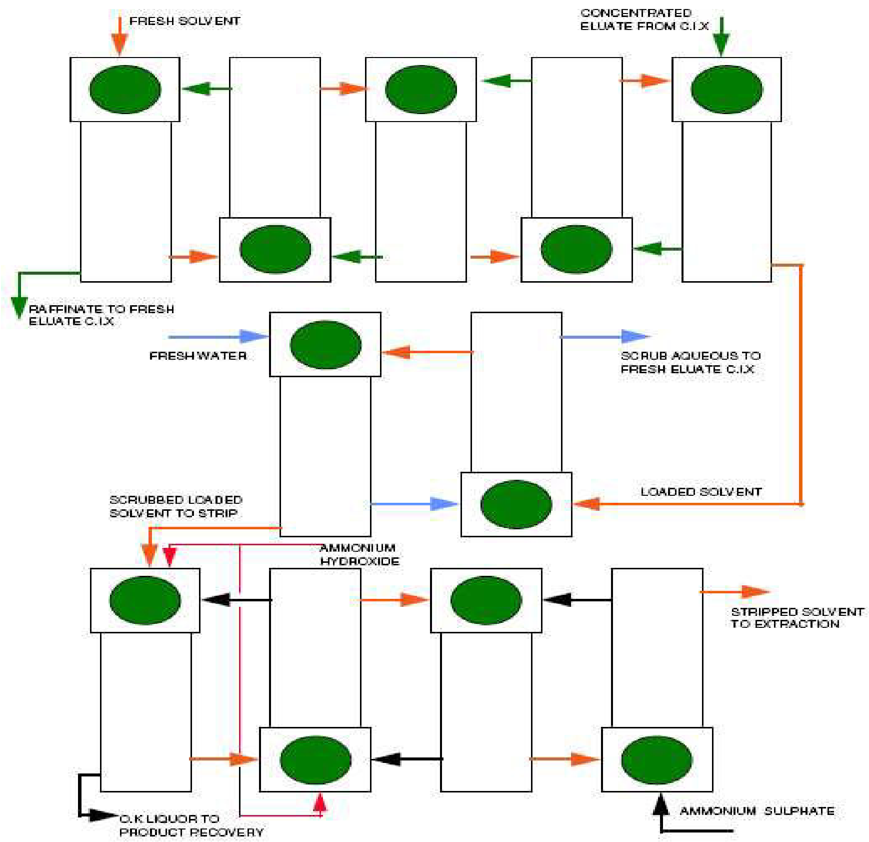

Figure 3.7: Solvent extraction

Strict fire protection procedures are in force at the Solvent Extraction (SX) plant. These include:

- Restricting access to area;
- Annual induction for all personnel who enter the SX area for any reason;
- Prohibition of matches, cigarette lighters or any other combustible material within the designated area.
- Regulation of hand tool types such that the possibility of creating a spark is minimised.
- A comprehensive fire protection system attached to and serving all mechanical equipment and storage tanks. This system comprises fixed water sprays on the outside of all mixer settler units and storage tanks.

Mixer settler units are also equipped with an internal foam injection system. The system is activated manually on receiving a signal from sensing devices located inside and outside the various items of equipment. Automatic initiation of the systems will activate the water sprays only.

3.1.9 FINAL PRODUCT RECOVERY

OK liquor, the chemical solution containing uranium trioxide, is pumped to the Final Product Recovery (FPR) building from the SX plant. The first stage of final recovery is the precipitation of ammonium diuranate (yellowcake) from the OK liquor. This is carried out in an agitated precipitation tank. Gaseous ammonia is added to raise and maintain the pH of 7.3. Precipitation tank discharge gravitates to a yellowcake thickener. Thickener overflow (ammonium sulphate) is returned to the SX strip mixer settlers while underflow material is pumped to a two-stage washing section. Washing is carried out by two drum filters in series equipped with overhead water sprays. Filter cake from each stage of washing is re-pulped with process water. Re-pulped second stage filter cake is fed into one of the two multi-hearth calcining furnaces. Each furnace has six hearths and is heated to 700°C on the final hearth. The yellowcake feed is calcined to uranium oxide and is discharged via a hammer mill to an automatic drum filling plant. Final product at ± 98.5% U_3O_8 is dispatched in sealed drums, each drum automatically washed and dried and weighing ± 450 kg.

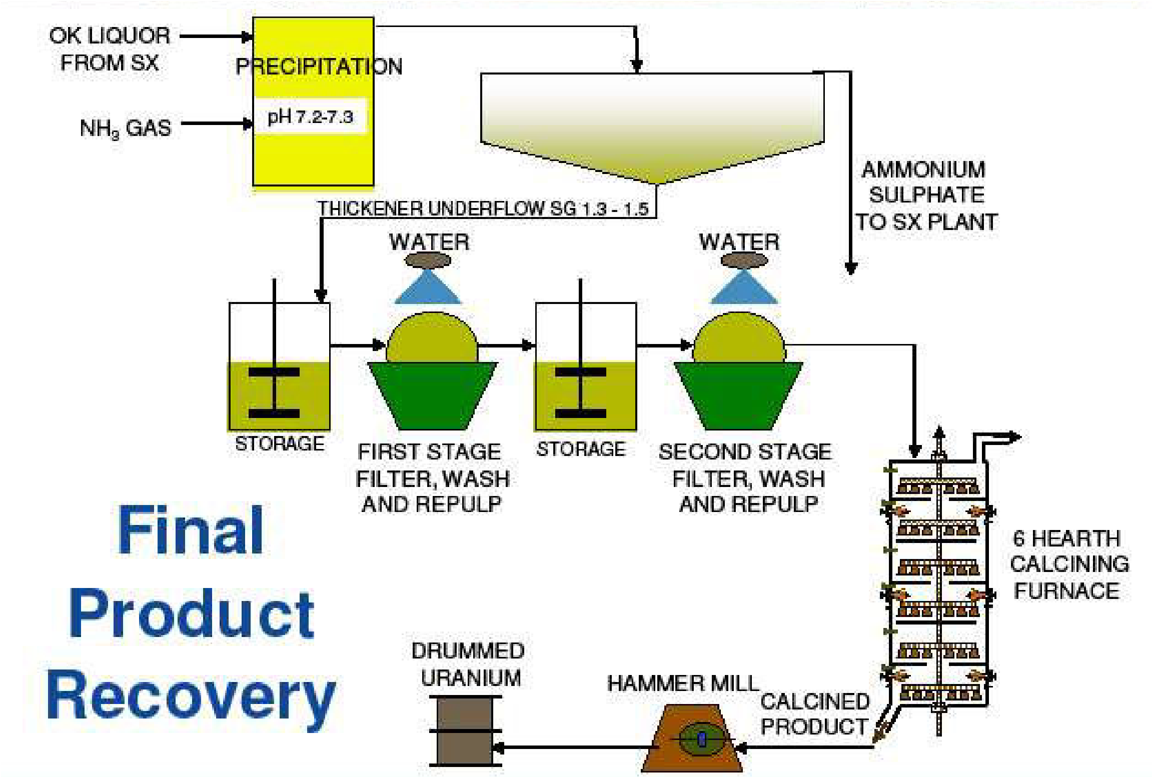

Figure 3.8: Processes of the Final Product Recovery

Gases and calcine particulates generated and emitted from the process are prevented from entering the atmosphere by means of an extraction and dust collection system and two wet venturi type scrubbers.

A summary of the processes at the FPR is shown in Figure 3.8.

3.2 COMPONENTS OF THE CURRENT LAND FOOTPRINT

As a large-scale open pit operation, the majority of Rössing's land footprint comprises of huge man-made landforms which include the open pit, the waste rock dumps, the tailings facility and the processing plant, offices and administrative buildings. These man-made landforms are clearly visible from air (see Figure 3.9) and in combination with the linear infrastructure on site, account for almost 90% of Rössing's current land footprint. The linear infrastructure and man-made landforms are described below.

Figure 3.9: Aerial view of Rössing

3.2.1 LINEAR INFRASTRUCTURE

Linear infrastructure at Rössing is connected to buildings for workshops, laboratories, medical, personnel and administrative use, gardens, security facilities, a dormant landfill site, parking lots, domestic and industrial waste demarcated areas and storage facilities for fuel, consumables, explosives and chemicals. Linear infrastructure connections to Rössing are indicated in Figure 1.4.

Road and rail infrastructure

The D1911 district road branches off from the B2 national road between Swakopmund and Usakos to connect Arandis with the national road network. A 10 km-long double-lane tarred road from the Arandis turn-off provides access to the mine. This latter road consists of the short D1905 and the private road section.

On-site, the infrastructure consists of a main tarred road with a network of various tarred and gravel access and haulage roads and tracks, with a total distance of around 30 km. From the B2, uncontrolled access to the site is possible on the gravel track via the Arandis Airport to the Khan River and, hence, the Welwitschia Plains in the Namib-Naukluft Park. This track is partly situated on the mine accessory works area.

A full-gauge railway line link connects the mine site to the main TransNamib railway line between Swakopmund and Usakos from the Arandis siding. On-site, the railway line has four branched sidings.

Water infrastructure

NamWater's Rössing terminal reservoirs (60 000m^3) are connected to the mine with a 600-mm pipeline. The water infrastructure on site exists furthermore of a network of water supply pipelines and storage reservoirs, a series of borehole pumping stations in and along the Khan River and a network of monitoring boreholes scattered over the mining tenement as well as an extensive system of sewerage and effluent pipes that drains to an activated sludge treatment plant near the open pit. In 2022, RUL commissioned six (6) additional water reservoirs to collective capacity of 60 000m^3.

As a result of the drive that began in the late 1980s to reduce water consumption at Rössing, today about 60% of plant solution utilised at the mine is recycled by means of a closed water system. An extensive water infrastructure network exists on site.

The Department of Water Affairs (DWA) of the Ministry of Agriculture, Water and Land Reform permits Rössing to extract brackish water from the Khan River aquifer for industrial use. Power lines and pipelines connect the abstraction system to the mine's water distribution network. Water from the Khan is mainly used for the suppression of dust in the open pit with minimal use routed to exploration drilling projects on ML28.

Power infrastructure

Power is supplied from the national grid by NamPower. Rössing itself has a switching substation, from where power is distributed to the mine, to Arandis, to the NamWater booster stations along the pipeline, and to the Arandis Airport. At Rössing the 220 kV power supply is stepped down to 11 kV into a network of overhead and underground cables. The power line supplying power to the external sites partly runs along the southern slope of the tailings facility.

Rössing's main 11 kV substation distributes power to the various areas via overhead and underground cabling. Furthermore, equipment is fed from 6.6 kV, 3.3 kV or 550 V lines, which are stepped down by transformers at various substations.

Trolley assist technology is utilised in the open pit to increase the energy efficiency of haul trucks. The haul trucks can be operated by diesel fuel or electricity. Overhead lines are erected on haul truck runs which are economically viable, upon which haul trucks engage trolley assist mode in order to operate on electrical power. Shovels in the open pit use power via portable 6.6kV transformers.

In 2024, Rössing commenced construction of a 15MWe Photovoltaic Solar Power Plant. The plant is scheduled for commissioning towards end 2024 and envisaged to supply power to the mine via a 11 kV powerline.

Telecommunication infrastructure

A total of 624 landlines exist on-site. Rössing also makes use of a 20 Mbps Telecom Metro ethernet network to enable information technology (IT) network functioning on-site and at the Corporate Offices in Swakopmund.

On-site, the IT network consists of a fibre-optic backbone connecting four distribution points to two data centres. The fibre-optic cable is mostly trenched across the mine site, but several aerial fibre cable lines also exist. From the distribution points, fibre-optic cables branch out to the relevant buildings.

Off-site, the IT network consists of a fibre-optic backbone connecting the mine with the Swakopmund corporate office. The fibre-optic cable runs above surface along the railway line.

3.2.2 THE OPEN PIT[34]

The open pit at Rössing is the longest-running and one of the largest open pits in uranium mining in the world (see Figure 3.10), measuring about 3,5 km by 1,5 km. The depth from the pit rim, to the currently lowest operating bench is approximately 420 m, about 180 m below the level of the Khan River alluvial aquifer situated 3 km to the south.The pit is roughly rectangular in shape with the longest axis oriented approximately east–west, cross-cutting a north-easterly trending ridge which is bounded to the southwest by Pinnacle Gorge and the northwest by Dome Gorge.

The pit void is mined by a conventional truck-and-shovel operation, with mining being conducted in 15 m benches. Pit ramps are 40 m wide and established at a maximum 10% gradient. The central benches of the pit are generally in excellent condition – a result of good pre-split blasting techniques. The upper and lower benches are in poorer condition as a result of over-blasting, potentially affecting the stability of the pit rim. Nevertheless, the rocks making up the pit walls, despite being heavily jointed, have high strength values. There is also little seismic activity in the area. Sudden rockfalls and failures are thus rare.

Production at Rössing between 1980 and 2004 fluctuated in response to the volumes required by the long-term sales contract portfolio. Development of the open pit fluctuated accordingly. Mining had reached Bench 20 in 2004, when a decision had to be taken whether to close the mine in 2009 or extend operations to 2016. During 2005, RUL Board approvals were obtained for extending the life of the mine, by introducing the concepts of mining two separate pushbacks, named Phase 2 and Phase 3. The Phase 1 extension was completed in 2010, when mining in the centre of the pit was stopped at Bench 29 because of limited mining space and rockfall hazards. The piloting of Phase 2 mining started in the north-western part of the pit in 2006 while the Phase 3 push-back on the southern side of the pit commenced in 2007. The final depth of the open pit, within the

[34] Additional information relevant to this section is contained in the Rössing Closure Management Plan (2011)

context of the currently approved Life-of-Mine plan, will be reached in 2026 at Bench 34, approximately 60 metres above mean sea-level (amsl).

Figure 3.10: The pit void at Rössing, looking northeast from the current viewpoint.

Mining activities in the lower part of the pit have been abandoned towards the end of 2010 and have been refocused on the higher lying benches of the next set of push-backs, located in the south, west and northwest of the existing excavation. As the new pit walls cut their way through severely folded geological domains, constant monitoring and assessment of pit limits and haul roads is taking place, in order to ensure that potential high wall failures won't put the business at risk.

Infrastructure in the pit consists of a trolley-assist with power cables and transformers, installed in 1986, as well as water distribution pipelines. Radiometric scanners are used to measure the grade of truckload material in order to direct allocation to the crusher or at the low-grade stockpiles and waste rock disposal areas. As the new ramps are starting to evolve, the existing trolley-assist infrastructure is being relocated. As such, trolley 13 has very recently been commissioned and will be the waste conduit for the next four years to the eastern stockpiles. Furthermore, Trolley 12 is in the process of being commissioned and will be the main ore conduit from the pit to the primary crushers and stockpiles, until end of the current mine life.
Due to the inaccessibility of the Khan Mountains and the steep slopes of the waste rock dumps, access to the pit void from the south, south-east and east is restricted, and can be regarded as impossible. Access from the west is restricted and the only permitted access is from the north, by coming from the main entrance of the mine.

Mining of the small satellite pit known as *SK4*, and situated 1,200 m to the east of the SJ Pit, commenced in 2010 and was completed in 2011. The 97.5 m-deep SK4 Pit void has a final volume of 164,000 m³, a footprint of 4.03 ha, and a depth of 442.5 m above mean sea level at the bottom of the pit.

The Rössing Uranium LoME from 2027 to 2036 was approved by the Rössing Board in February 2023. One month later, a 13-year contract was signed with Beifang Mining to commence with a full contract mining service from 2024 to 2036. By the end of 2023, Beifang had mobilised a new fleet of heavy mining equipment ("HME") to site, together with an experienced workforce trained to operate this equipment. The first blast was taken in the new Phase 4 pushback, ahead of schedule, on 21 December 2023.

The upper benches of the Phase 4 pushback will be mined concurrently with the final benches of the Phase 2/3 pushback at the bottom of the pit. The latter will supply most of the ore until the end of 2026, while mining waste in Phase 4 to expose more ore from 2027 onwards. To enable this, funds were allocated for the execution of various infrastructure projects in the mining area. The largest of these is the construction of a high-energy rock-fall catch fence on Trolley 11 that will protect mining activities in the bottom of the pit from rockfalls arising from Phase 4 mining above. This project is still under construction and will be completed in 2024. Smaller infrastructure projects included the removal of power lines from the Phase 4 mining area, as well as the allocation of facilities to Beifang. While mining continues in both areas until the end of 2026, Rössing will continue to operate its remaining HME, after which Beifang will take over all mining from 2027 onwards.

Public access to the open pit from the northern directions is only possible through the main entrance of the mine. Otherwise the surrounding waste rock dumps and rugged terrains on the southern, eastern and south-eastern sides limit wildlife, and human, access to the open pit. From the west human access is not permitted.

The open pit cross-cuts the hydrogeological connection between the existing processing plant situated above the Boulder Gorge fracture system and the Khan River receiving environment. In this way the pit acts as a cut-off trench, and enables the interception and subsequent evaporation of water moving downstream from the plant area. The elevation of the bottom of the pit, furthermore, is substantially below the level of the Khan River – 3 km to the south – and the regional water table is about 20 m below ground. The direction of groundwater flow is towards the water table depression around the pit, and not away from the pit into the surroundings. The Khan River, in turn, is separated from the pit by a low-permeability rock mass, significantly reducing the possibility of water from the Khan entering the pit void.

3.2.3 THE WASTE ROCK DUMPS[35]

The total footprint of the waste rock dumps is about 760 ha, with 6,78 million tonnes mined and disposed in 2023, which results in 1,018.42 million tonnes of cumulative waste rock on the mine. The stockpiles have a combined footprint of more than 120 ha. In general, rock disposal sites are established as close to the major mining areas as possible (Figure 3.11). The current waste rock dumps and low-grade stockpiles consist of a mix of the abundant rock types in varying and random proportions. No deliberate efforts are made to segregate specific rocks when dumping, but minimising haul

[35] Additional information relevant to this section is contained in the Rössing Closure Management Plan, (2011)

distances from the respective mining phases dictate that waste rock from the different formations are segregated. Typically, as mining deepens the pit, the dumps grow in height rather than width in terms of footprint area.

Waste and low-grade stockpile areas are mostly located around the western, southern and eastern margins of the pit void, in the former valleys of dry drainage lines that drain towards the Khan River. Dumps extend up to 2 km away from the pit.

The waste rock dumps and low-grade stockpiles consist of mineral waste and low- or high-grade, high calcium-carbonate-content (high-calc) material that is generally resistant to weathering. The waste material varies in size from large boulders more than 1 m in diameter, to gravel-sized particles and fine sand. The following cut-off grades are used to classify the material transferred to the rock dumps:

- Waste rock: <0.118 kg/t U_3O_8
- Low-calc material: >0.118 < 0.169 kg/t U_3O_8, at low-calc index values, and
- High-calc material: >0.194 kg/t U_3O_8, at high-calc index values.

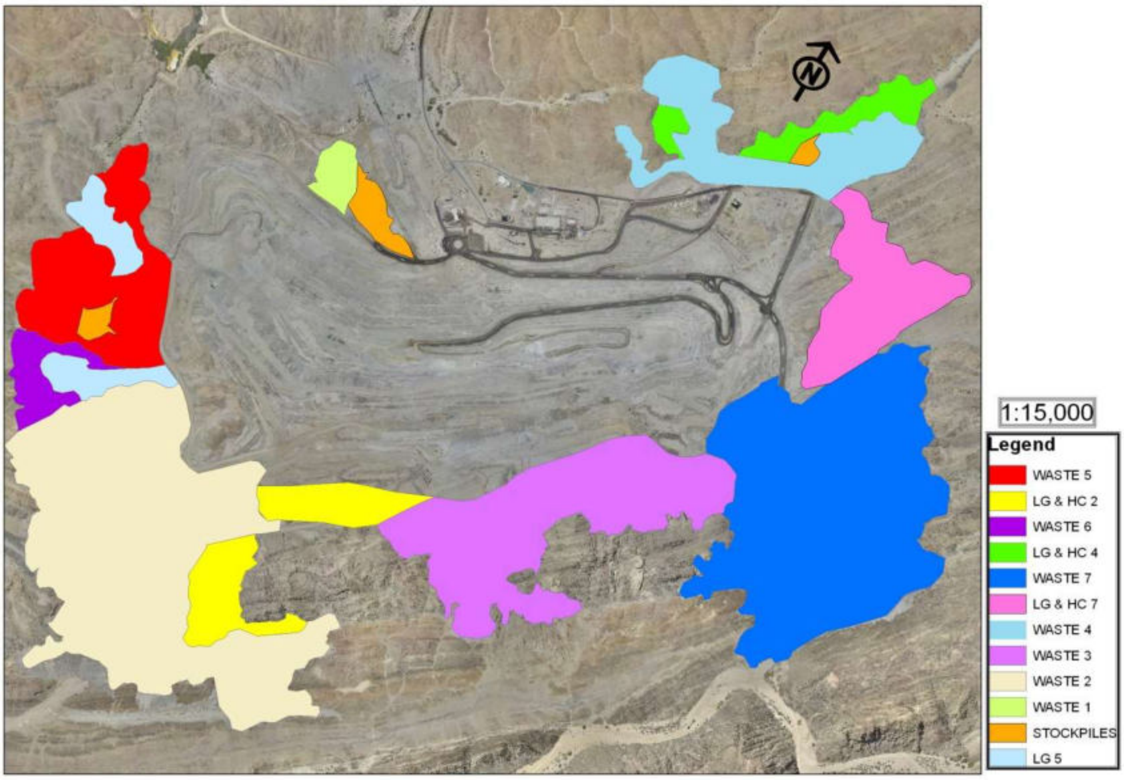

Figure 3.11: The location of waste rock dumps at Rössing

Dump heights have reached levels between 520 and 575 mamsl. This is at about the same elevation as the surrounding topography and, at this stage visual impacts of these man-made landforms are restricted to a small number of viewing points outside the Mining Licence and accessory works areas. Due to the sheer magnitude of the waste material to be dumped and stockpiled, it is inevitable that new land would be disturbed. About 70 ha would be eventually disturbed in addition to the current dumps, meaning that the total footprint of the waste rock dumps and stockpiles would be more than 830 ha.

Secondary aquifers underlying the rock dumps consist of rock of different geological formations weathered on structural features like fractures and joints. Water moves slowly through these secondary features, following the down-gradient direction, with velocities and volumes of flow being much smaller than in the sand of the dry drainage lines, but showing a wide range of variability depending on rock type.

Positioning of the waste rock dumps has already permanently altered some of the surface drainage patterns that join the Khan River. The flow of surface water is directed either through or beneath the waste rock dumps, with the potential to increase the levels of heavy metals, salts and radio-nuclides in groundwater. Primary and secondary aquifers play an important role in transmitting groundwater to the Khan River. Groundwater flow is for this reason adequately monitored and controlled.

Since waste rock contains low or sub-economic concentrations of radioactive minerals, radioactive emanations have been determined. Radon exhalation rates average around 0.74 Bq/cm^2s, ranging between 0.01 Bq/cm^2s and 3.97 Bq/cm^2s.

On occasion, foreign materials have been placed within the waste rock dumps. For example, high-grade ore from underground workings, which are contaminated by metal pieces, was stockpiled on the Waste Rock Dump 4 footprint. Over time, non-mineral waste was also placed on the waste rock dumps. The latter type of waste included contaminated waste from the FPR facility and the burnt-down SX facility, scrap metal, grease, vanadium pentoxide drums, tyres, and bags of jarosite. The placement of this form of waste on the waste rock dumps has been terminated as a practice, and over the years, the non-mineral waste has been covered with thick layers of waste rock.

3.2.4 THE TAILINGS FACILITY[36]

The tailings facility is the largest component of the combined Rössing footprint, covering a footprint of about 746 ha and containing about 500 million tonnes of tailings. It rises to an elevation of about 670 mamsl, more or less 100 m above the surrounding surface. The location and layout is shown in Figure 3.12.

All tailings from the uranium extraction process are conveyed and pumped to the facility situated to the north-west of the plant and separated from it by a north-east trending ridge and hills. Due to the low uranium content of the ore, the tailings consist of virtually the entire mass of input ore plus waste process liquids. The tailings material is coarse, by industry standards.

Originally designed as an upstream ring deposition facility, it was operated as an open surface tailings dam until the early 1980s. In this design, deposition was confined to a catchment, protected by a surface seepage collection dam situated in the main channel about 1,000 m downstream of the depositions. From 1976 to 1984, the process plant was operated on freshwater. Water pumped to the tailings dam as part of the tailings

[36] Additional information relevant to this section is contained in the Rössing Closure Management Plan, (2011)

slurry, as well as all process plant run-off from the plant drainage sump known as the *snake pit*, was left on the dam to evaporate. By 1984 pumps were used to distribute the tailings around the crest of the tailings dam. It became clear that water savings measures became necessary and it was decided to change the circuit within the processing plant, to recover water stored on the tailings facility and to reduce the wetted surface of the facility. As part of these measures a paddock operation over the entire tailings facility was introduced in 1984. It proved so successful in saving water that the decision was taken to implement the paddock operation throughout the tailings facility.

Figure 3.12: Location and lay-out of the tailings facility at Rössing

In 2000, a number of pump stations were decommissioned, a conveyor installed to transport sands to the top of the tailings facility and two new pump stations had been commissioned. During 2008 and 2010, a number of studies were carried out to investigate the feasibility of alternative tailings deposition methodologies, including dry-stacking and high-density tailings deposition, using various footprint extension options. The preferred option was to continue with conventional slurry deposits in paddocks on the entire footprint of the existing facility.

A biodiversity study to assess the footprint impact of proposed extensions in 2005 indicated that, in the west, the tailings facility borders an important zone of *lithops* – not only a Red Listed plant species but also an endemic to Namibia. Since the study area is covered by about a quarter of the entire population, a decision was taken not to expand the tailings facility horizontally, but vertically.

To accommodate the maximum volume of tailings vertically, it is assumed that all existing but currently dormant paddocks, as well as paddocks to be re-established on existing tailings materials, will be brought back into service as part of routine operations, using the normal equipment. For this phase a new starter embankment, a seepage recovery sump and a seepage collection trench were introduced.

The 300 million tons of coarse and fine tailings material contain radioactive minerals and have a specific activity of roughly 50 Bq/g. Radon emanations between 0.11 and 2.21 $Bq/m^2/s$ with a mean of 1.6 $Bq/m^2/s$ are characteristic. Four radioactive release pathways are discernible: from radon, airborne radio-nuclides in dust, water-borne radio-nuclides, and direct radiation.

Tailings material is also susceptible to wind erosion. Windblown tailings have been accumulated to the southwest of the facility over the years and heavy wind storms in the past have dispersed tailings to a distance of up to 8 km west of the facility.

Surface seepage from the tailings impoundment occurs through the filter drain in the embankment and the foundation materials. An extensive seepage control programme and monitoring system has been established to contain sub-surface seepage in Pinnacle and Panner Gorges.

A designated part of the tailings facility is used for disposal of contaminated waste, but it is covered by layers of tailings material.

3.2.5 THE PLANT, OFFICES AND ADMINISTRATIVE BUILDINGS[37]

The processing plant at Rössing covers a surface area of 195 ha and encompasses the primary crusher, the coarse ore stockpile and conveyer system; the secondary crushing plant; the fine crushing plant; the uranium extraction section, which includes the rod mills, the leaching section, sands washing, ten counter-current decantation thickeners; the tailings handling systems; CIX plant; the SX plant; the FPR plant; and the engineering workshops and offices.

The plant also includes the former pyrite stockpile area, the former acid plant area, the acid unloading facilities, the acid pipeline, and the acid storage tanks. Buildings are mostly of concrete and concrete block construction. The tanks for storing petrol are stored underground, while diesel is stored in a designated bunded area. Solvent, acid and ammonia storage are above ground.

The area comprising the processing plant is delineated in Figure 3.13. Elongated in shape, the south-eastern boundary of this area is the corridor formed by the main mine road and railway line, and in the north-west by the elevated slopes of a north-east-trending ridge, the Berning Range, which forms a natural buffer zone against the tailings facility. The total processing plant area is approximately 195 ha in size. The layout of the plant has remained virtually unchanged since the beginning of production in 1976 although some changes to facilities and infrastructure were made over the years.

With the height of the tailings facility rising continuously at the time, it became impractical to pump the tailings slurry from the level of the plant to the high level of the tailings facility. For this reason, an overland conveyor was commissioned in 2000 to transport tailings sand to a new mixing station on the dam and the pump system in the processing plant area altered accordingly.

[37] Additional information relevant to this section is contained in the Rössing Closure Management Plan, (2011)

A pre-screening plant was added prior to 2000 as a way to save on ore-crushing costs. A pilot ore-sorting plant was constructed during 2000, and was operated from 2001 to 2007. It was then closed down because the operations were no longer considered feasible due to continuously high maintenance requirements. Slimes, mixed with the sands, were pumped to the dam.

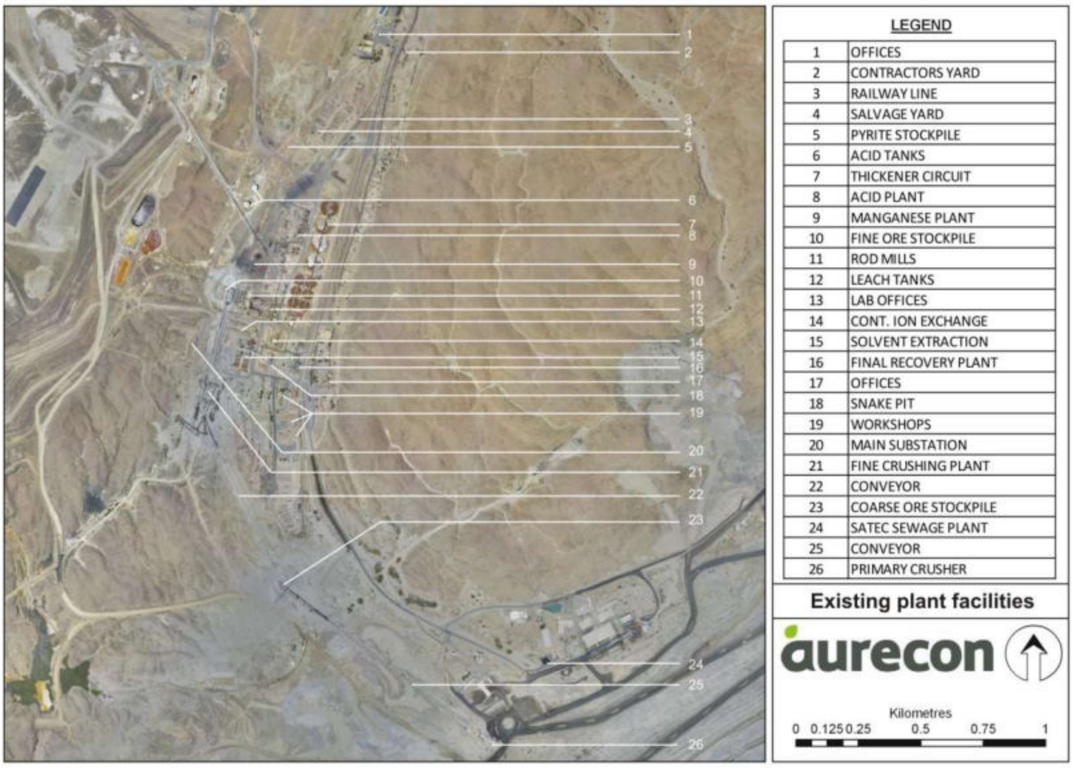

Figure 3.13: Lay-out of the processing plant at Rössing

In 2010 the former acid plant was demolished as part of the mine-wide progressive rehabilitation programme. The area was cleared of rubble but not decontaminated, because of the potential future use of the land as part of the processing plant. In order to provide more acid storage on-site, a third acid storage tank was built in 2010 and taken into service in 2011. A new set of emergency generators was built in 2010.

In the original area that became the processing plant, the top soil was originally thin, sandy and unconsolidated. Although the area had a low elevation, bedrock was exposed at a number of places. Fill materials from various sources have been used to make up the ground levels over most of the processing plant area. Tailings have been used as fill in some instances. Parts of the plant area were initially uncovered, but were later paved with concrete. Most of the roads in the area are tar-sealed.

The entire area where the processing plant is located dips gently towards the east, and surface drainage aims towards Boulder Gorge situated on the eastern side of the administrative buildings and offices, along the main road that runs from the main gate towards the pit. In turn, this drainage line aims towards the Khan River, but is intersected by the open pit. In the southern part of the processing plant area, run-off is divided between the Boulder and Pinnacle Gorges.

Underneath the surface of the processing plant bedrock fractures provide the pathway for water-borne contamination from some parts of the plant. A number of potentially hazardous chemicals and materials are present on the surface and in the subsurface at the site. These residues have accumulated over many years, and may be concentrated or diffused where they occur. Most of these contaminated sites have been verified to identify management requirements. The list of potential residues is summarised in Table 3.1.

A removal programme for asbestos has been in place for some years. The last significant quantity of asbestos was removed from the demolished acid plant area in 2011. It is company policy not to use chemicals containing polychlorinated biphenyl (PCB). None have been identified in inspections since an exchange campaign was put in place in the late 1980s.

Table 3.1: Potential hazardous chemicals and materials present in the processing plant area

Chemical/material	Location
Uranium concentrate	FPR/Laboratories
Uranium-containing aqueous solutions	Laboratories/Plant (rod mills to FPR)/Tailings facility
Resin	CIX/Fibreglass workshop
Uranium-bearing organic solutions	SX
Sulphuric acid	Acid tanks/Leaching plant/CIX/SX
Pyrite	Former acid plant
Manganese	Leaching/Manganese plants
Caustic soda	CIX
Sodium hydroxide	SX
Isodecanol	SX/Tailings facility
Alamine	SX/Tailings facility
Shellsol	SX/Tailings facility
Flocculants	Thickener area
Ammonia	Ammonia tanks/SX/FPR
Explosive chemicals, e.g. ammonium nitrate	HEF plant/Ammonium nitrate store
Laboratory chemicals	Laboratories/Leaching plant/CIX
Compressed gases, e.g. oxygen and acetylene	Workshops/Compressor room and plant
Degreasers, descalers, etc.	Workshops and plant
Cleaning chemicals	Plant, offices, workshops
Other chemicals such as paints and adhesives	Paint shop, plant, rubber lining workshop
Soil stabilisers	Open pit and tailings facility
Water treatment chemicals	Acid plant, CIX, SX and Satec plants
Petrol and diesel	Workshops and service stations

The mine's progressive rehabilitation programme was implemented in 1995. Within the ambit of this programme, a number of smaller buildings, redundant plant sections and waste sites were rehabilitated over a three-year period. The programme was resuscitated in 2010 upon the demolition of the acid plant and, in 2011, saw the removal of redundant infrastructure and a number of salvaging and waste site clean-up projects. Since 2011 all historical waste disposal sites are identified and assessed in terms of remediation requirements.

3.2.6 EXPLORATION ACTIVITIES

Exploration activities at Rössing re-commenced during the mid-2000s in response to improvements in uranium prices and demand. Prior to this, there were numerous exploration campaigns between 1955 and 1978, following discovery of uranium mineralisation in the Rössing area in 1928. During the mid-2000s exploration program, a number of areas on the mining lease were targeted for drilling to verify and potentially upscale the extent of uranium mineralisation identified from previous exploration programs, and for assessing potentially new deposits from a 2005 airborne radiometric survey. Work involved geological mapping and exploration drilling by percussion and diamond core drilling to establish three-dimensional pictures of the occurring ore bodies. Land disturbance during exploration is inevitable, because the drill platforms and access tracks can only be shifted in a limited way.

Specific archaeological and vegetation surveys have been carried out to identify areas of sensitivity and vulnerability. The findings of these surveys were incorporated into a social and environmental management plan that were part of the exploration programs, signed off by the national authority and internally within Rössing Uranium. Transport of samples for assay and final storage at Rössing's sample storage facilities and transport of mineral waste generated during the drilling process to be disposed at the contaminated waste storage facility on the tailings facility was officially permitted.

Exploration area rehabilitation at Rössing generally includes the removal of drilling samples and all waste material types from the drilling sites, clearing of spillages, raking of vehicle or rig tracks, and covering of open drill holes with concrete cones or wooden blocks. For example, drilling in the SH area was completed in 2007 and the area was rehabilitated, inclusive of sample and waste removal, some restoration of the chert quarry and road areas. The exploration work in the Z19/Z20 anomalies were conducted between 2010 and 2012. Since these anomalies are located inside the Namib-Naukluft Park (NNP), an environmental management plan (EMP) for exploration was developed. Approval was obtained from the Department of Parks and Wildlife Management of the Ministry of Environment, Forestry and Tourism (MEFT) and had a special emphasis on the rehabilitation part of the plan. Following completion of the Z19/Z20 exploration activities, a rehabilitation contractor experienced in working in the NNNP was contracted to implement the rehabilitation commitments which were signed off by the MEFT in mid-2012 after completion.

In 2024, Rössing consulted MEFT (Department of Parks and Wildlife and Environmental Commissioner) with plans to commence with exploration activities in the Z20 area. A consultation meeting was held, with the Executive Director, Environmental Commissioner and Director of National Parks and Wildlife, in which RUL informed the regulator of plans to reinitiate exploration activities in Z20. Subsequently, preparations for exploration activities commence for exploration drilling to commence within the year.

3.3 COMPONENTS OF THE SOCIO-ECONOMIC FOOTPRINT

Rössing is Namibia's first uranium mine, and the only one for about three decades. As an employer and contributor to various levels of the economy, the mine played a significant social and economic role in the Erongo Region since the 1970s, and has since become well integrated into the socio-economic fabric of the region and of Namibia. When operations commenced at Rössing, it triggered multiple developments in the Erongo Region and among the communities in the immediate vicinity of the mine. A great number of people were drawn from inside and outside Namibia into the Erongo Region and significantly enriched its social fabric. An increasing need for housing employees saw the establishment of the town of Arandis, while an obvious socio-economic influence on Swakopmund arose with the need to accommodate the majority of Rössing employees, besides seeing the development of a range of related supporting services, facilities and infrastructure.

Rössing always aims to ensure that its contribution to social, economic and environmental improvements in the Erongo Region in particular and to Namibia in general will be sustainable over time, an aspiration that is based on a firm stakeholder engagement approach. Given the socio-economic context of Namibia as a developing country, stakeholders recognized Rössing as a major employer and an indirect contributor to various levels of the economy. Rössing contributes significantly to Namibia's revenue from taxes on income and profits. In 2023, 74% of Rössing's total procurement expenditure was allocated to Namibian registered suppliers. Rössing's exports also contribute a significant amount to foreign exchange for the country.

To comprehend Rössing's socio-economic footprint, it is important to understand the characteristics of its workforce. Rössing's influence on the socio-economic fabric of Namibia and the Erongo Region is manifested in many ways, but mostly in the hosting communities and through the Rössing Foundation.

3.3.1 THE WORKFORCE[38]

At the end of 2023, Rössing Uranium had a workforce totalling 871 employees. This comprised 775 permanent employees and 96 employees with fixed-term contracts. Rössing's recruitment strategy is primarily aligned to its overall business strategy while providing equal employment opportunities for the job applicants. A key measure in the process is its compliance with the Namibia Affirmative Action Act (Act 29 of 1998) in ensuring equal employment opportunities for applicants and that they are equitably represented in the workforce. The company has made significant progress in achieving the country's Affirmative Action objectives. The reduction in workforce of the historically disadvantaged Namibian men is attributed to the voluntary separation packages offered to the employees as part of the LoME strategy.

The ratio of men and women employed in the company was 80:20. Measures have been put in place through talent management to increase the employment of women through focus groups, succession planning, targeted recruitment strategies, job attachments and graduate development programmes. A key enabler is the designated platforms and workplace committees in place that, from time to time, engage in addressing key

[38] Information relevant to this section was obtained from the Rössing Closure Management Plan, (2011)

environmental, social, and governance ("ESG") HR issues with a strong focus on a culture incorporating inclusion and diversity, pay and equality.

The 2023 statistical information on our workforce profile, indicates 98.74% (860) Namibians with permanent employment and fixed-term employment contracts and 1.26% (11) Non-Namibians, including fixed term contract. Female representation among employees is about 19.74% (172).

Primary benefits of Rössing employees include a salary, medical aid contribution, retirement provision, cash in lieu, housing, and risk cover (death, accidental and disability). Medical coverage is likely to be beyond the reach of most employees when they are not employed by Rössing, meaning that employees may depend on the State's provision of health care when not working for Rössing. For those employees with chronic medical conditions other than HIV/AIDS, the termination of medical aid may result in having to rely on State facilities for chronic care. State facilities began providing anti-retroviral treatment (ART) in 2004.

Rössing has been participating in the Vocational Education and Training Levy submission since inception and has contributed N$8,483,662.37 to the 2023 Training Levy cycle. Nineteen job attachments from Namibia Institute of Mining and Technology ("NIMT") vocational training centre were provided an opportunity to work alongside skilled artisans to gain valuable practical technical skills and knowledge. The cost of external training interventions for 2023 amounted to N$6 million, with overal training and development cost amounting to N$28 million.

3.3.2 THE HOSTING COMMUNITIES[39]

Information gathered in 2011 concerned with the multiplier impacts of the uranium sector estimated that about three jobs are created downstream for every two direct jobs[41]. At end 2023, Rössing employed 871 employees and an equal amount of contractors.

As a major employer and purchaser of goods and services, Rössing made a significant annual contribution to economic development in the Erongo Region and to Namibia at large. Rössing's total spend for goods and services for our operations was N$3.88 billion during 2023 (2022: N$3.42 billion). As during the previous reporting years, most of the procurement expenditure was on Namibian-registered suppliers. Rössing's spend with local suppliers amounted to N$2.86 billion during 2023 (2022: N$2.54 billion), accounting for 74% of our total procurement expenditure. The continued high percentage of local spend reflects the company's confidence in procuring locally. N$487 million was spent with South African suppliers, representing 12% of our procurement expenditure, while we spent N$531 million with international suppliers, representing 14% of our total expenditure. Rössing remains committed to supporting local suppliers, including spend on developing small and medium-sized enterprises ("SMEs"). The bulk of the Namibian spend remains in the Erongo (41%) and Khomas (50%) Regions. Spend in other regions of Namibia amounted to 9%, with the highest spend in the northern region due to the current Supply of Sulphuric Acid agreement with Dundee Precious Metals in Tsumeb.

Arandis was established in the late 1970s as a resettlement town for Rössing's largely semi-skilled employees. Later, in 1994, Arandis was handed over to the State and

[39] Information relevant to this section was obtained from the Rössing Closure Management Plan, (2011)

proclaimed as an independent town. The Updated Baseline study that was conducted in 2017/18 showed that Arandis is 43% dependent on the mine for its income.

3.3.3 THE RÖSSING FOUNDATION

The company has established the Rössing Foundation, a special purpose vehicle which is managed independently from Rössing by its own set of trustees on which Rössing's Board members are represented. The Rössing Foundation was established in 1978 by Rössing Uranium Limited through a Deed of Trust to implement and facilitate its corporate social responsibility activities within the communities of Namibia.

Honouring our corporate social responsibilities, Rössing Uranium supported the Rössing Foundation and other community initiatives with an investment of over N$41 million in 2023 compared to N$29.4 million during 2022. Of this amount, N$38 million went to the Rössing Foundation, and about N$3 million was in-kind and cash contributions to worthy community initiatives.

4 DESCRIPTION OF ENVIRONMENTAL IMPACT ASSESSMENTS AT RÖSSING

Rössing has a long history in proactive management and over its 48 years of existence various environmental strategies were applied. Wherever possible Rössing prevented, or otherwise minimise, mitigate and remediate, adverse impacts of operations on the environment. Compliance with all environmental laws, regulations and standards is the foundation on which environmental performance is build.

4.1 FROM PRE-MINING AND CONSTRUCTION TO NAMIBIA'S INDEPENDENCE

During the late 1960s, the Rio Tinto Zinc Corporation (RTZ) acquired the exploration rights to the Rössing deposit and reinvestigated the resource intensively. This included airborne and ground radiometric surveys, detailed topographical and geological mapping, drilling, bulk sampling and metallurgical testing in a 100 t per day pilot plant to determine the feasibility of establishing a mine. A period of exploration, which included the construction of exploration camps and development of basic infrastructure, followed.

Actual development of the mine commenced in 1974 when the open pit was started. The plant was commissioned thereafter. By 1976 the first uranium from the new mine was produced with the intention to reach full capacity by 1977. However, certain design weaknesses in the plant emerged, and the ore proved to be highly abrasive. The SX-part of the plant was also destroyed by fire in 1978. As a result a great deal of the plant was extensively modified and one of the two solvent extraction sections totally reconstructed. Full production was reached in 1979 and in 1980 most of the construction work was completed.

Although no environmental assessment was required at the time of construction, the early mine operations commenced with due cognisance of the sensitive environment in which Rössing is situated. Since 1974 several investigations into specific aspects were conducted and documented. The initial investigations focused on changes of dust levels, water use, seepage and groundwater flows. An air quality monitoring program was established to address the early air quality concerns, and although no pre-operational radiation safety assessment was carried out, due care and attention was given to possible influences of radioactivity on both the human and the environment as from the late 1970s. At the end of the 1970's, the Environmental Department at Rössing was set up – something that was not mandated by law and considered as a unnecessary expense by many other mines.

Initial work on the environmental transfer of radio-nuclide discharges through the air and groundwater pathways started in 1979. In September 1982, Rössing contracted consultants to conduct the initial radon exhalation measurements on the tailings impoundment and other areas of the mine. A further study on the reclamation of the Rössing Tailings Impoundment was completed in 1984. One of the conclusions was that radon exhalation from this source could be reduced by applying a specified thickness of alluvium or waste rock[40].

[40] The bulk of the consultancy work at Rössing between 1979 and 1984 was done by Dames and Moore. See Ashton, *et al.*, (1991).

Focus on water and seepage remained strong during the 1980s, but the focus increasingly included air quality and employee health. Investigations with a biodiversity focus were conducted since the second half of the 1980s, but investigations and reports with an integrative approach were still rare.

Early commitment with regard to responsible environmental management was shown with the transplanting of *Aloe dichotoma* (quiver trees) from the area that was to become the open pit to the national botanical gardens in Windhoek. In the 1980s this commitment was strengthened when Rössing supported the former State Museum in an ambitious program to catalogue key elements of biodiversity on site. Monitoring of vegetation in the Khan River to examine the impacts of water extraction by the mine started in the early 1980s and became routine monitoring in 1988. It has been carried out ever since and contributed to the Tree Atlas of Namibia published in 2005[41].

Three important studies on radioactivity at Rössing were conducted by the Atomic Energy Corporation of South Africa between 1988 and 1990: Doses in the open pit was assessed and adaptation of the monitoring programme was suggested[42]; environmental radon concentrations were measured and a dispersion modelling was carried out[43]; and radon exhalation rates from identified sources were identified[44]. These studies assisted to model environmental radon concentrations associated with mining activities at Rössing[45] and to estimate the average radiation dose to the people of Arandis from radioactivity originating from natural and mining-related sources[46].

4.2 OPERATING IN INDEPENDENT NAMIBIA – THE FIRST 20 YEARS

Since Namibia gained independence from South Africa in 1990, a new legislative environment began to evolve. Shortly after independence, Namibia's Green Plan was drafted. Rooted in Article 91 (c) and Article 95 (l) of the Namibian constitution, the Green Plan was developed on a framework to promote sustainable development and described and identified actions to address the main environmental challenges facing Namibia. Following the Green Plan a lengthy, but pioneering stakeholder engagement process began to establish Namibia's 12-point Plan for Integrated and Sustainable Environmental Management and the Environmental Assessment Policy of Namibia. The latter was approved by the cabinet of the Namibian government in 1994.

Soon after independence, and before the Environmental Assessment Policy was approved, Rössing reiterated that one of its up-front, recorded goals (embedded in the business plan) is environmental improvement. The proactive pursuit of this philosophy moved Rössing management beyond the compliance focus to a focus of continual improvement in environmental performance.

In this spirit Rössing committed itself to responsible environmental management in an independent Namibia by conducting an Environmental Impact Statement, completed in

41 Curtis and Mannheimer, (2005)
42 De Beer and Leuschner, (1988)
43 Grundling and Leuschner, (1988)
44 Strydom *et al.*, (1989)
45 Grundling and Leuschner, (1990)
46 De Beer, (1990)

1991[47]. A first of its kind, the purpose of the project was to provide a scientific base of the possible pre-mining environmental conditions describing location, topography, geological and mineral reserves, radioactivity, soils, hydrology and surface water quality, geo-hydrology and groundwater quality, ecological and biodiversity features, demographics, socio-economy, patterns of land use and communications and infrastructure.

The study comprehensively describes the mining operations of then, including waste disposal, dust and radiation control measures, workforce and environmental health and safety and interpolate from adjacent and similar, but undisturbed areas to set a reference document against which the impacts of both current and future developments, as well as the effectiveness of environmental protection and reclamation measures, could be assessed. Possible impacts as a result of projected future mining operations are assessed, and decommissioning plans are also proposed, but an Environmental Management Plan was not included.

Closure Planning at Rössing began in 1991 to accommodate anticipated operational changes for the remaining life of the mine, as well as the vision for closure. In support of the continuous planning process, several social and technical closure studies were done and have been updated. Since 1991 various studies were conducted to increase the knowledge base regarding mine closure.

In search for a long term solution for water supply to Rössing, an impoundment of the Khan River was suggested and investigated during the second half of the 1990s. The idea was to create an aquifer recharge scheme whereby a portion of the occasional floodwaters in the river would be captured, silt to settle out and then channel clear water into the downstream alluvial aquifer. Several technical and design investigations were made and assessment of the potential environmental impacts of the proposed aquifer recharge scheme was conducted during 1997[48].

The final document contains comprehensive information about water supply along the coast of Namibia; extensive baseline information about the Khan and Swakop Rivers; describes the methodology to evaluate the magnitude and importance of impacts associated with the proposed project; describes the main findings and lists the key issues and concerns; assesses the identified and possible impacts of the proposed project and summarizes recommendations and monitoring requirements. The report also contains consideration of mitigatory actions and finally concludes that there are no “fatal flaws” which would prevent the proposed project from proceeding. Despite this conclusion, the report recognizes the importance of negative public discernment about perceived undesirable detrimental effects of the project. Finally the report made firm recommendations about the removal of invasive plant species along the two rivers; monitoring of water tables and sharing of this information with the public; improved recharge and irrigation methods and the long term need for routine monitoring of sand, sand mining and the dynamics of sandy beaches north of the Swakop River mouth.

Although the project did not go ahead, the assessment of potential impacts was one of the most comprehensive conducted in Namibia at the time. The final documented report contains extensive baseline and technical information about water management as well

[47] Ashton, *et al.*, (1991)
[48] CSIR, (1997)

as a number of specialist reports organized as appendices. Even though the assessment did not include an Environmental Management Plan, the final report contains a summary of impacts, mitigatory actions and further recommendations. As such the final report is still regarded as an important reference document to many of the more recent studies, assessments and investigations conducted at Rössing.

In 1997 an assessment of the radiological impacts associated with the use of Rössing tailings for maintenance of haulage roads in and around the open pit was conducted by the Atomic Energy Corporation of South Africa[49]. Before, Rössing was using alluvial sand from nearby drainage lines for cover of the roads inside and around the open pit. Due to a possible long term adverse impacts on the drainage lines and groundwater, the replacement of the alluvium with Rössing tailings material was contemplated. It was concluded that the average airborne activity concentration from and gamma dose rate on haulage roads should decrease or stay similar to the levels determined.

A similar study was conducted to assess the impacts of using seepage water for dust suppression in the open pit[50]. Rössing was using water from the open pit sump, from seepage collection trenches in the Pinnacle and Panner Gorges and from an aquifer in the Khan River for dust suppression in the open pit. Due to a reduction in the water available from the Khan River aquifer, the need arose to find an alternative – seepage water from the tailings facility. Possible radiological impacts from this source were assessed and the conclusion was that it is unlikely to cause any significant increase in radiation doses because of limited increase in radioactivity concentrations and a small fraction of seepage water involved[51].

A wildlife survey was carried out in 1998 to determine wildlife migration routes and the influence of fences (specifically around the tailings facility) on wildlife. Two reports and a map of migration corridors of wildlife as well as watering points were produced[52]. BirdLife International was instrumental in carrying out a number of bird surveys at Rössing to update the inventory produced during the 1980s[53].

Since its inception the Environment Department at Rössing was responsible to ensure that environmental impacts of operations are controlled and managed. In 1996 the International Organization for Standardization (ISO) published standard 14001 Environmental Management Systems (EMS) – Requirements with Guidance for Use and Rössing immediately started to develop its EMS in line with this international standard. Rössing was awarded certification the first time in February 2001 and became the second Namibian land-based mining operation to achieve certification. When ISO14001:2004 was published, Rössing incorporated the change into the existing EMS and received certification to ISO14001:2004 in early 2006.

Until the late 1990s Rössing produced acid for the extraction process in the metallurgic plant. Initially the acid plant used pyrite ore that was obtained from the Otjihase Mine near Windhoek, but after the closure of Otjihase in 1997, the pyrite ore was substituted with sulphur to produce sulphuric acid. From time to time acid stocks were supplemented by importing sulphuric acid from overseas, via the port of Walvis Bay. The imported acid

[49] De Beer, (1997a)
[50] De Beer, 1997(b)
[51] Rössing's Radiation Management Plan, (2012)
[52] Campbell, (1998)
[53] Stacey, (2006)

was pumped to storage tanks on shore and then railed to the mine where it was stored for further use. In 2000 the acid plant was mothballed because it became more economical to import acid than to produce it on-site. The decision was taken to import the entire acid requirements via Walvis Bay and to expand the storage facilities thus. The new arrangement also implied more frequent and larger quantities of acid to be railed to Rössing.

Due to the nature and scale of the proposed expansions and the potential hazards sulphuric acid pose to human health and the environment in the event of a spillage, a team of specialists was commissioned to conduct an environmental impact assessment of the envisaged expansion to the importation, storage and transfer of acid to Rössing and evaluation of alternative processes, recommendation of best options, mitigation measures and management plans for the preferred options. It was made clear that the assessment should exclude responsibilities of non-Rössing organizations (such as aspects related to transport). The terms of reference included also formal communication with regulatory authorities and interested and affected parties[54].

The final report has been preceded by a comprehensive scoping report. The scoping report was used to answer the majority of concerns and issues raised by stakeholders and highlighted those concerns that were addressed through the actual impact assessment. The information compiled for assessing potential impacts is documented in the final report, issues of concern were listed and grouped into a logical sequence to provide the scope and scale of concerns as well as appropriate mitigatory measures that could enhance positive benefits and minimize potential adverse effects. Criteria to evaluate the impacts include anticipated scale, duration, severity, certainty and significance. Moreover, the assessment process brought issues to the fore in an open debate, improved public awareness about Rössing's operational practices, enabled wide and constructive stakeholder engagement and underlined the importance of maintaining a high "state of readiness" to deal with possible disaster events such as sulphuric acid spills. Organized as appendices the report contains also a specialist study on acid handling; design specifications on storage facilities; transport logistics and scheduling; handling, training and emergency responses; medical preparedness; and public awareness about sulphuric acid.

Radiation remains a challenging priority at Rössing and in 2001 the company invited Rio Tinto Technical Services to conduct a study on post-closure radiological exposures and mitigation options, in particular to evaluate the tailings facility cover options, by calculating doses for the various options of the 1997 Closure Plan. In the study, post closure doses were estimated to be well below the dose limit for members of the public, both during and after decommissioning. All doses in the Rössing environment for the offsite maximally exposed persons were found to be less than 0.25 mSv/a. It was concluded that radiation from Rössing, and the tailings facility in particular, would not have a significant radiological impact at Arandis[55].

A number of radiation-related studies followed during the 2000s: On radon exhalation values, radon sources and dose attributable to radon at receptor locations surrounding Rössing[56]; assessment of airborne and deposited dust levels[57]; and background radon

[54] Ashton, *et al.*, (2000)
[55] Isaack, (2001)
[56] Everett, (2001)
[57] PARC Scientific and EnviroSolutions, (2001)

concentrations for determining pre-mining conditions[58]; a screening assessment of the post-closure radiological impacts of Rössing[59]; post-closure public dose assessment for proposed expansions at Rössing[60]; an investigation into the possible increase in external radiation doses at the FPR[61]; atmospheric dispersion calculations to assess radiological impacts of radon and long-lived radioactive dust at selected locations to assess current, extension and post-closure scenarios[62]; and a dose assessment to compare current radiological impacts of the mine on members of the public compared to the life-of-mine-extensions and after mine closure[63].

The sustainability assessment for Rössing in 2003 included an environmental impact assessment conducted, which considers social, environmental and biophysical impacts of proposed mine extensions. The assessment aims to ensure appropriate remedial action where needed, and to identify actions that will create positive socio-economic outcomes for stakeholders beyond the physical and time dimensions of the present mine[64]. The proposed changes to the mine are described, which included a pushback of the then existing open pit to the west (referred to as Phase II) and a subsequent pushback of the pit to the south (referred to as Phase III).

The study includes a public stakeholder participation programme, and assesses socio-economic impacts on the towns of Arandis, Swakopmund and the Erongo Region elsewhere, and on- and off-site biophysical impacts. The environmental assessment showed that there are no environmental impacts that cannot be addressed or minimised and the highest environmental risk is associated with the expansion of the tailings facility. Assessment of the radiation levels indicated to remain well below occupational and public dose limits. Some of the proposed operational changes indicated possible improved environmental performance, such as reduced water usage, reduced dust emissions and reduced groundwater pollution.

The first complete closure management plan for Rössing, according to the Rio Tinto Closure Standard, was conducted in 2005. The plan covered two closure alternatives: closure in 2009 or 2016. The plan was the first to document detailed discussions of

- Impact and risk identification;
- Stakeholder consultation;
- The development of a vision for closure;
- The development of closure objectives and targets;
- A description of preferred mitigation alternatives;
- An identification of knowledge gaps and further work required;
- An estimation of closure cost and accounting provision.

The expansion activities proposed in the mid 2000s required authorisation and clearance and consequently a multiphase Social and Environmental Impact Assessment (SEIA) has been commissioned by Rössing for the proposed expansion project in

[58] EnviroSolutions, (2002)
[59] De Beer, Ramlakan and Schneeweiss, (2002)
[60] De Beer and Ramlakan, (2003)
[61] Abrahams and Anderson, (2004)
[62] Strydom, (2006)
[63] De Beer and Liebenberg, (2008)
[64] Rössing Closure Management Plan, (2005)

accordance with these requirements, as well as the internal standards and guidelines prescribed by Rio Tinto[65].

The entire extent of the envisaged expansion of the Rössing comprised a number of components, dealt with in two phases. Phase 1 of the SEIA process entails a sulphuric acid manufacturing plant; associated sulphur storage on the mine; transport of sulphur from the port of Walvis Bay; a radiometric ore sorter plant and the mining of an ore body known as SK4. Phase 2a entails the sulphur handling facility in the port of Walvis Bay whereas Phase 2b entails the extension of the current mining activities in the existing SJ open pit; increased waste rock disposal capacity; establishment of a new crushing plant; increased tailings disposal capacity; establishing of an acid heap leaching facility; establishing of a ripios disposal area and additional plant associated with the above.

The assessment of the proposed expansions entails an outline of legal and policy frameworks regarding the environment within which Rössing operates; a description of the proposed expansion project components, their alternatives and potential impacts; a description of the public participation process; a description of the methodology; and, most importantly, an assessment of the significance and possible mitigation of the potential impacts that were identified, and management recommendations.

The proposed expansions were announced in the media in 2007, followed by public and key stakeholder meetings with a wide array of interest groups and organisations. Public meetings were again held in early 2008 in Arandis, Swakopmund and Walvis Bay. The purpose of this series of meetings was the release of the Phase 1 Draft SEIA Report, as well as the introduction of the Phase 2 Scoping Report of the SEIA process.

An SEIA for the construction of a sulphur handling facility in the port of Walvis Bay was completed in 2009. In the interest of time and to allow for an earlier clearance, it was decided to separate the sulphur handling component in the port from the remainder of Phase 2 of the SEIA process, meaning that this component was subjected to an individual SEIA process (referred to as the Phase 2a process).

Phase 1 of the SEIA process has been approved by the Directorate of Environmental Affairs at the Ministry of Environment and Tourism by 2008 and Phase 2a in 2009.

A number of specialist studies have been undertaken to properly understand the most significant impacts of the further proposed developments and to ensure an acceptable level of confidence in the assessment of such impacts. Impacts were evaluated according to a tabulated rating system, where each impact is described according to its extent (spatial scale), magnitude (size or degree scale) and duration (time scale), with and without mitigation. After mitigation, no risks remain that are high or critical.

Engagement with the public and stakeholders interested in, or affected by, the proposed development formed an integral component of the assessment process. Public and stakeholders have had several opportunities at various stages throughout the SEIA process to gain more knowledge about the proposed components, to provide input and to voice any issues of concern. The general low attendance of public meetings and the lack of comments on the draft Phase 2 Scoping Report caused concern that the public was not accessing information about the expansion project, and that the concerns and

[65] Ninham Shand, (2008) and Aurecon, (2011a)

recommendations were not being articulated and recorded. It was hoped that a new approach would reach a broader audience than before and result in a better and more detailed understanding. This would, in turn, lead to more comprehensive input. Difficulties in engaging with marginalised groups were also identified as a need to be addressed. A decision was therefore taken to change the format of the public participation process for Phase 2b of the SEIA process, by moving away from large open house public meetings to specific focus groups based on stakeholder categories.

During August 2010 focus group meetings were held with the interest groups, preceded by a tour of the mine and a visit to the site of the proposed expansion project components. This contextualised the discussions at the meetings, and facilitated more informed and in-depth questions and comments. Meetings focused on issues which had been identified as of interest to each particular group and presentations and specialist attendance were arranged to match.

The new format proved to be extremely productive. All focus groups were involved in the consultation process, and the inclusion of marginalised groups was particularly successful. Participants freely voiced their concerns, questions and recommendations, captured and included in the final assessment. Participants also showed great interest in the technical details of the proposed new acid heap leaching process.

A key component of any thorough SEIA is the consideration of alternatives (strategic or project level; site, arrangement of facilities and layout; technology or process) during assessment. A two year process of refining the decision criteria and technical information was used to inform the decision on the preferred layout with the following main objectives:

- Minimise the physical footprint of the proposed expansion
- Optimise the use of areas where the sustainable development impacts are minimised
- Find the best practical site for each of the facilities
- Make the best use of newly impacted sites, and
- Ensure that the expansion follows a strategic Life of Mine approach.

Key decisions had to be taken about facility locations and overall site layout during the 'order of magnitude' stage. Two workshops were held to identify the most appropriate areas for new processing and waste disposal facilities by using multi-criteria decision making methodologies. The land use database (developed in 2008) was an essential tool in the subsequent process used to identify the most appropriate layout. Rössing determined a list of criteria comprising four main categories for land use optimisation during the assessment. The objective was to ensure that proposed extensions are in line with a sustainable development approach, which emphasises economic viability, environmental sustainability, and social acceptability. Criteria were sorted as technical, environmental, socio-economic and strategic categories.

The series of documents that support Phase 2b of the SEIA process, and culminate in the final SEIA Report, comprise:

- A Public Information Document (PID) released in August 2007
- A Scoping Report released in April 2008
- A Background Information Document (BID) released in October 2008
- A summary of specialist study findings released in August 2010 and

- The eventual SEIA Phase 2 Report (3 volumes)

The final SEIA Report provide a wide range of sufficient and reliable information to make an informed decision on whether or not the proposed components of Rössing's expansions were acceptable from a social and environmental perspective. Outcomes include confirmation of the social and environmental acceptability of preferred or indicated sites; identification or confirmation of the environmentally preferred process and technology alternatives; identification of possible mitigation measures to reduce the significance of potential impacts; and documentation of the identified mitigation measures in a Social and Environmental Management Plan (SEMP). The SEMP has been developed to guide the design, construction, operational and closure phases of the proposed expansions. The final SEIA report was submitted to the Directorate of Environmental Affairs by the end of 2011 and approved in 2012.

Exploration activities at Rössing commenced during the mid-2000s, causing a number of areas on the mining lease to be drilled in search of new uranium ore bodies. Rössing has decided to proactively follow best practice to manage these activities. Specific archaeological and vegetation surveys have been carried out to identify areas of sensitivity and vulnerability. The findings of these surveys were incorporated into a social and environmental management plan that became part of the exploration program rolled out in the Z-area since 2010, signed off by the national authority and internally within Rio Tinto.[66] Part of this management plan is to rehabilitate the areas disturbed by exploration activities.

4.3 STRATEGIC ASSESSMENTS

Ideally, cumulative environmental impacts should be taken into account in all environmental assessment processes. Environmental impact assessments have traditionally, however, failed to come to terms with cumulative impacts, largely as a result of the following reasons:

- Cumulative effects may be local, regional or global in scale and dealing with such impacts requires co-ordinated institutional arrangements; and
- Environmental assessments are typically carried out on specific developments, whereas cumulative impacts result from broader biophysical, social and economic considerations, which typically cannot be addressed at the project level.

In 2009, an initiative was launched to provide a guiding framework for sustainable uranium mining development specific to the Erongo Region, including aspects of mine closures and early planning for desired post-closure conditions. Consequently, the Southern African Institute for Environmental Assessment (SAIEA) was contracted by the Ministry of Mines and Energy to undertake a strategic environmental assessment (SEA) of the so-called uranium rush in the central Namib[67].

The SEA was expected to provide direction to the uranium industry, government and other stakeholders in the central Namib. Exploration for and mining of uranium is a collection of projects, each being conducted by individual companies that are not related to each other and, in many cases, undertaken in isolation of each other. However, they collectively combine to produce potentially cumulative impacts including the loss of a

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[66] Aurecon, (2011b).

[67] Rössing Closure Management Plan, (2011)

sense of place; the over-abstraction and pollution of groundwater; short- and long-term exposure to radiation by workers and the public; stress on physical and social infrastructure; and opportunity costs on other, more sustainable industries. But the uranium rush could also offer substantial opportunities for synergies, and the industry could stimulate critically needed development.

One of the objectives of the SEA was to outline a Strategic Environmental Management Plan. The latter offers a set of environmental quality objectives, expressed as a set of desired future environmental conditions elicited through a stakeholder consultation process. The Plan sets targets as regards how best to achieve the desired objectives, suggests indicators that could be used to map progress towards those targets, and lists the parties responsible for the Plan's implementation.

Implementation of the Plan is the most critical part of the SEA and the extent to which it is implemented will determine its ultimate success in guiding the uranium rush towards a sustainable future. The planning for closure is addressed in a number of environmental quality objectives contained in the Plan, and provides specific guidance for the Erongo Region in this respect. Recognising the opportunities and constraints presented by the uranium rush, the Chamber of Mines of Namibia established the Uranium Stewardship Council as a 'spokesperson' for the Namibian uranium industry, both nationally and internationally[68].

In 2008, a significant milestone was achieved when the Namibian Stock Exchange (NSX) agreed that uranium exploration and mining companies could not be listed on the NSX unless they were members of good standing with the Uranium Stewardship Council. All Council members are bound by the Chamber's Constitution that commits them to upholding the Namibian uranium 'brand', and ensuring the highest standards in environmental and radiation safety management.

[68] Chamber of Mines of Namibia, (2009)

5 IMPACT MANAGEMENT AT RÖSSING

5.1 THE IMPACT MANAGEMENT SYSTEM IN EFFECT AT RÖSSING

All operational activities at Rössing are managed to ensure that the impact on both the biophysical and socio-economic environment are reduced to acceptable limits. This management is implemented in a number of ways, at all stages of mine operations, namely planning, construction, operation and decommissioning of facilities. For this purpose Rössing implemented an integrated Health, Safety and Environment Management System (HSE MS) in 2008.

The management system is a tool designed to assist in achieving Rössing's goals, including its legal obligations. This systematic approach to management performance promotes the efficient use of resources and offers the prospect of financial gains to the company – generating a win-win outcome in terms of environmental and business performance.

Health	Safety	Environment
H1 – General principles **H2** - Fitness for duty **H3** - Noise, vibration and manual handling **H4** - Hazardous substances management **H5** - Airborne contaminants **H6** – Radiation **H7** - Carcinogenic substances **H8** - Travel and remote health	**C1** – Isolation **C2** – Electrical safety **C3** – Vehicles and driving **C4** – Working at heights **C5** – Confined spaces **C6** – Cranes and lifting equipment	**E1** - Air quality, noise control and Greenhouse gases (GHG) **E2** - Hazardous materials and non-mineral waste control and minimisation **E3** - Biodiversity, rehabilitation and Land use management **E4** - Mineral waste, acidic and other impacted drainage control **E5** - Water usage and quality management
Major Hazards **D1** – Rail Safety **D2** – Fire Safety Management **D3** – Management of Pit Slopes, Stockpile spoil & Waste Dump spoil. **D4** – Explosives Management **D5** – Management of Tailing and Water Storage Facilities. **D6** – Process Safety **D7** – Communities and Social Performance		

Figure 5.1: The RUL HSE Performance Standards

In addition to the HSE MS Rössing developed internal Health, Safety and Environmental Performance Standards. The intent of the standards is to gain commitment of employees on an annual basis to improvement in impact management performance. Figure 5.1 displays the new set of standards that was introduced in 2019 and being successfully audited for compliance on annual basis.
The International Standard for environmental management systems, ISO 14001, through its design encourages continual improvement. ISO 14001 is embedded in the HSE MS at Rössing. The system not only helps to ensure that major health, safety and environmental risks and liabilities are identified and managed, it also establishes a framework for tracking, evaluating and communicating the performance in these aspects. Adoption of ISO 14001 therefore implies a constant commitment to improving Rössing's environmental monitoring and environmental performance efficiency.

Figure 5.2 provides an overview of the integrated HSE MS in effect at Rössing. The structure of the management system follows the layout of common international standards such as ISO 14001:2015, (Environment); ISO 45001:2018 (Health and Safety); ISO 9001:2015 (Quality). The system is based on the principles of continuous improvement and adopts the methodology of Plan, Do, Check and Review.

Figure 5.2: Overview of the HSE management system in effect at Rössing

The use of a formalised, integrative HSE MS is essential in allowing Rössing to optimise, coordinate and manage the various operations, personnel, plant and equipment and their interactions in a manner that demonstrates consistent application of best practice in environmental management. Matters of planning, implementation and operation, checking and corrective action, and management review, are embodied in the system. This approach assists in identification of key environmental aspects and serves to guide Rössing in continued formulation of suitable Standard Operating Procedures (SOPs) and in attaining continual improvement objectives. Through the system Rössing can efficiently detect and minimise the potential adverse impacts of its activities on the receiving environment.

Codes of Practice have been developed as part of the HSE MS design to ensure a process of continual improvement in the HSE management and performance. The HSE MS Code of Practice (JA05/COP/003) provides a set of management steps, focussing on the organisation's achievement of its HSE goals that form part of the wider management of the organisation's operations. The Code of Practice considers all aspects of Rössing's operations in order to manage any potential HSE impacts and it contains references to the HSE MS procedures.

The HSE MS is furthermore divided into seventeen elements. Each element sets out to achieve a specific objective that enables the business to best identify and manage its various HSE threats and opportunities. Many of the elements are inter-related. The four core elements of the HSE MS are:

- The Environmental Policy
- The Legal and other requirements register
- The HSE risk register
- HSE improvement plan/s

5.1.1 PLANNING

HSE Policy

The HSE Policy is the overarching and guiding document that informs the manner in which Rössing conducts its business activities and manages impacts on the environment and the health and safety of its employees and on the public at large.

Rössing's Managing Director (MD) is accountable to the Rössing Board for all HSE matters and the MD is the custodian of the HSE Policy.

Legal and other requirements

The management of all identified HSE hazards / aspects must comply with the relevant Namibian legal requirements and relevant standards and guidelines to ensure that good international practices are applied to the HSE MS. The term "other requirements" refers to non-regulatory requirements to which Rössing has voluntarily subscribed, and / or CNNC has formally committed Rössing to meet. A Legal Register that contains all applicable legal and other legislative requirements is maintained and annually updated.

Appendix 1 summarizes some of the legal requirements relevant to Rössing's operations.

Hazard identification and risk management

The policy and goals of the HSE MS are based on an understanding of all the HSE hazards / aspects of operations, products or services related to Rössing. This means that every hazard / aspect in which operational activities may affect health, safety and the environment must be investigated so that the most important HSE impacts (HSE hazards / aspects with significant impact) are identified.

A description of the potential or known HSE impact as a result of each identified HSE hazard / aspect is listed on the HSE risk register. Where mitigating measures are already in place to reduce the severity of any potential impact to the health, safety and environment, these measures are also described. The HSE hazards / aspects that potentially result from any particular input or output are classified according to their impact category, for example: Employee health; employee safety; pollution to air, water or soils; fauna and flora; hazardous and non-hazardous wastes; radioactive material, etc.

Appendix 2 summarizes environmental impacts according to their spheric dimension, hazard, outcome, operational phase, risk management control mechanisms and way that the impact is managed.

Risk assessment framework

In accordance with the HSE MS, the Rössing risk management framework is based on a three-tiered model (Figure 5.3) that allows the appropriate level of risk assessment to be selected to match the nature, context and scale of the hazard being considered.

Figure 5.3: The three-tier risk assessment model

Qualitative risk matrix

The HSE Risk Matrix (Table 5.1) and associated Consequence (Table 5.2) and Likelihood (Table 5.3) descriptors are used to assess risk levels.

Table 5.1: Qualitative risk matrix

	Most serious consequence				
	Very Low	Low	Moderate	High	Very High
Almost Certain	Class II	Class III	Class IV	Class IV	Class IV
Likely	Class II	Class III	Class III	Class IV	Class IV
Possible	Class I	Class II	Class III	Class IV	Class IV
Unlikely	Class I	Class I	Class II	Class III	Class IV
Rare	Class I	Class I	Class II	Class III	Class III

Table 5.2: Descriptors for the consequence of an impact occurring

Consequence Type	Consequences				
	Very Low	Low	Moderate	High	Very High
Health & Safety	Negligible health impact	Low level short term inconvenience or symptoms. Typically a first aid case with no medical treatment.	Injury or illness requiring medical treatment, that does not lead to restricted duties or lost time. Typically a medical treatment case injury or illness. Also includes diagnosed occupational illnesses that do not require medical treatment E.g., Dermatitis, laceration requiring suturing, NIHL, pneumoconiosis or other diagnosis without significant impairment or disability.	Injury / illness with moderate damage or impairment (<30% on impairment scale) to one or more persons. Typically a restricted duties or lost time injury/illness. E.g., Loss of finger, broken leg, injury requiring in-patient care, severe asthma attack, mental illness (with lost time), NIHL, pneumoconiosis or other diagnosis with significant impairment or disability.	Single fatality or severe permanent impairment to a person (>30%) e.g. loss of hand or lower limb (at knee), paraplegia
Environment	Transient, minor impact to environment.	An unplanned or unpermitted or unintended event; or a series of chronic or cumulative events results in: Harm to the environment that is localized, of short-duration, effects no sensitive receptors and is quickly and easily rectified (eg, within a shift). (For impacts to groundwater – a few days to weeks of natural recovery.)	An unplanned or unpermitted or unintended event; or a series of chronic or cumulative events results in: Harm on the environment that is localized, effects no sensitive receptors and is rectified or reversed within a few days to weeks of work effort, or a few days to weeks of natural recovery. (For impacts to groundwater – weeks to months of natural recovery.)	An unplanned or unpermitted or unintended event; or a series of chronic or cumulative events results in: Harm on the environment that is largely localized but starts to be unconfined, effects sensitive receptors and is rectified or reversed within weeks to months of work effort, or weeks to months of natural recovery. (For impacts to groundwater – months to years of natural recovery.)	An unplanned or unpermitted or unintended event; or a series of chronic or cumulative events results in: Harm on the environment that is unconfined, effects sensitive receptors and is rectified or reversed within months to years of work effort, or months to years of natural recovery. (For impacts to groundwater – years to decades of natural recovery.)

Table 5.3: Descriptors for the likelihood of an impact occurring

Likelihood	Likelihood description	Frequency	Substance Exposure
ALMOST CERTAIN	Recurring event during the life-time of an operation/project.	Occurs more than twice per year.	Frequent (daily) exposure at > 10 x OEL.
LIKELY	Event that may occur frequently during the life-time of an operation/ project.	Typically occurs once or twice per year.	Frequent (daily) exposure at > OEL.
POSSIBLE	Event that may occur during the life-time of an operation/project.	Typically occurs in 1-10 years.	Frequent (daily) exposure at > 50% of OEL. Infrequent exposure at > OEL.
UNLIKELY	Event that is unlikely to occur during the life-time of an operation/project.	Typically occurs in 10-100 years.	Frequent (daily) exposure at > 10% of OEL. Infrequent exposure at > 50% of OEL.
RARE	Event that is very unlikely to occur very during the life-time of an operation/project.	Greater than 100 year event.	Frequent (daily) exposure at < 10% of OEL. Infrequent exposure at > 10% of OEL.

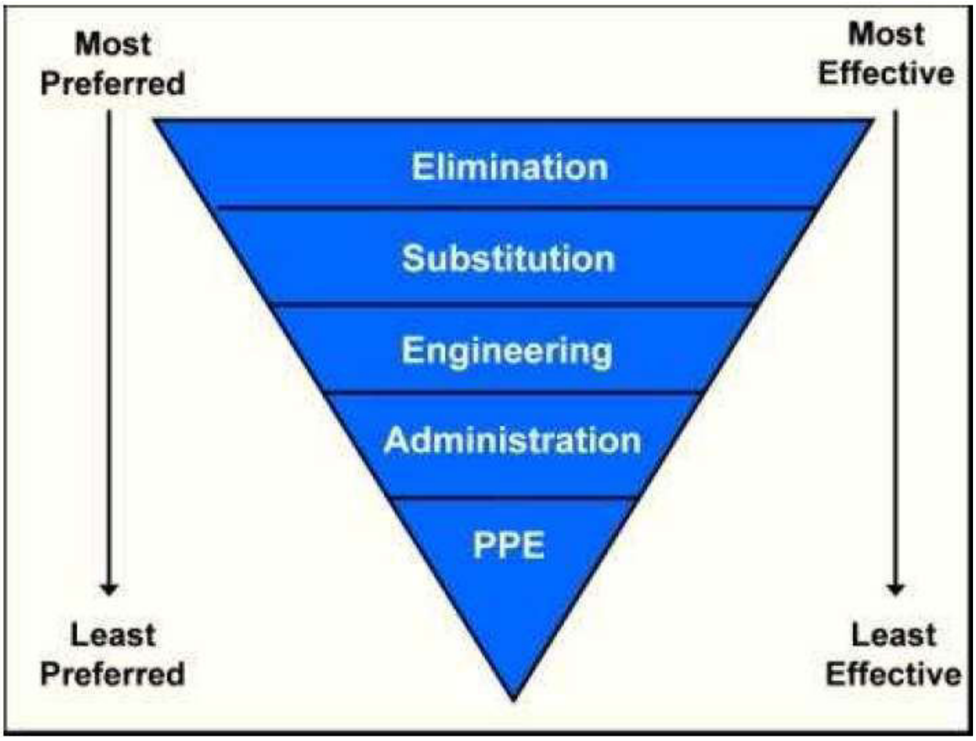

Figure 5.4: Hierarchy of controls

The potential impact resulting from each identified HSE hazard / aspect is prioritised into a HSE impact, as follows:

- Critical priority impact, and particularly all risks identified with a 'major' or 'catastrophic' consequence significantly exceed the risk acceptance threshold and require urgent and immediate action.
- A high priority impact is a risk that exceeds the risk acceptance threshold and requires proactive managements. This includes risks for which proactive actions have been taken, but further risk reduction is impracticable. Active monitoring is required.

- A moderate priority impact is a risk that lies on the risk acceptance threshold and require active monitoring. The implementation of additional measures could be used to reduce the risk further.
- A low priority impact is a risk that is below the risk acceptance threshold and do not require active management and requires only periodic review to test its status.

This HSE risk register is updated by Rössing employees and HSE advisors annually.

Hierarchy of controls

Operational controls are measures undertaken to mitigate risk and these are classified in accordance with HSE MS hierarchy, and preference given as follows (ordered from most to least effective): Elimination, Substitution, Engineering Controls, Administrative Controls and Personal Protective Equipment (PPE) (Figure 5.4).

HSE management improvement planning

HSE improvement plans are the cornerstone of the Rössing's HSE MS. An improvement plan describes the activities or tasks to achieve the set HSE objectives and targets in terms of timetables, resources, responsibilities and reporting frequencies for the various tasks and actions required.

Information for the HSE annual policy and policy strategies review, which is used to revise objectives and targets, is based on the following:

- Results of HSE MS audits
- Feedback from annual reviews
- Relevant incidents or emergencies
- HSE performance – monthly monitoring reports from the Health, Safety and Environmental Sections
- Legal compliance and new requirements
- Results of benchmarking to ensure that Rössing operates its HSE programmes in line with international trends, as defined by RUL
- Decommissioning requirements

HSE management improvement plans are set for each high and critical priority hazard / aspect, while monitoring programmes are set for medium and serious priority hazards / aspects to ensure that these remain well managed. There is ongoing monitoring of moderate and low priority hazards / aspects to ensure they remain well managed and do not become high priority hazards / aspects.

The results of the improvement plans are reviewed annually. During the operational review process, new activities, processes and HSE hazards / aspects are identified and incorporated into the database. New hazards / aspects are prioritised and programmed where required.

The following methodology is used to set up the improvement plans:

- The mine is subdivided into work areas with responsibilities
- Activities pertinent to each work area are identified and HSE hazards / aspects arising from each activity are identified
- A description of the impact resulting from each hazard / aspect is noted for each hazard / aspect, together with a priority ranking (Low, Moderate, High and Critical)

- Actions are identified for each high and critical priority HSE hazard / aspect to minimise the impact of that hazard / aspect on health, safety and / or the environment.
- A programme of implementation for each action is developed for incorporation into the HSE risk database, to include the following data:
    - Objective to achieve
    - The target for improvement (measurable outcomes)
    - A list of actions, to indicate the person responsible, the completion date and / or the frequency of monitoring and
    - Monitoring of progress, in accordance with the required reporting frequency

5.1.2 IMPLEMENTATION AND OPERATION

Organizational resources, accountabilities and responsibilities

The objective of this element is to ensure HSE responsibilities are allocated and accountability for the maintenance and continual improvement of HSE management is established at every level of the business.

The various appointments and their associated roles and responsibilities are central to the adoption and implementation of an efficient HSE MS.
General Managers are responsible for ensuring that the HSE Policy is implemented, that annual targets are met and that the necessary reporting procedures and structures are in place.

The HSE Manager is custodian of the HSE MS and is responsible for the implementation of health, safety and environmental strategies. The implementation of the operational HSE MS in each work area is the responsibility of the individual departmental managers. They work according to the guidelines maintained by the HSE Manager.

The HSE superintendents are the appointed management representatives of the HSE MS. As such they are responsible for the overall implementation of Rössing's HSE MS and so must co-ordinate implementation efforts throughout all departments. They liaise closely with the departmental managers, superintendents and the HSE specialists to ensure the programme is correctly managed and maintained, and facilitate and co-ordinate specialist HSE projects, should it be required. They are also responsible for reporting on the performance of the HSE MS to senior management for review.

The sectional superintendents are responsible for all HSE hazards / aspects in his / her work area and for ensuring that the objectives and targets as stipulated for each HSE hazard / aspect in his / her area are met within target dates stipulated in the relevant HSE improvement plans.

The HSE advisors are responsible for monitoring the hazards / aspects and impacts of Rössing's operations to the HSE Department. They assist departmental managers and superintendents with the implementation of the HSE MS in their respective work areas. The HSE advisors facilitate the internal communication on HSE issues within Rössing, collate and interpret monitoring results, set up and update the HSE improvement plans, based on annual HSE MS reviews as aligned with the operational HSE MS, and identify training requirements.

The HSE officers are responsible for the monitoring of those aspects within the department that are stipulated in the monitoring programme.

Training, competency and awareness
All Rössing employees and contractors have a responsibility to work in accordance with the foundations of the HSE MS. They should also possess the necessary knowledge and competence to carry out delegated tasks in compliance with the HSE MS, especially those activities that have the potential to have significant impacts. Accordingly training requirements for the various departments and work areas are undertaken.

A generic HSE induction training course is delivered to all new employees or contract workers, which deals with overarching health, safety, and environmental issues at Rössing. Task-specific training can take place in the various departments and sections on an ad hoc basis. Records of all training courses are kept on the HSE MS register.

HSE advisors raise awareness and train employees about HSE hazards / aspects, as relevant to the employee's particular work area. Follow-up awareness training is scheduled where internal audits show HSE awareness is lacking. Records of HSE training and awareness programmes are maintained in the dedicated HSE folder on the Rössing Intranet.

Supplier and contractor management

Suppliers
The Rössing HSE MS includes procedures to ensure that the procurement of equipment, materials, chemicals and services (including labour) fall within the acceptable HSE risk to the operation, as follows:

- Potential suppliers of products or services are assessed on their ability to meet HSE requirements, appropriate to the assessed risk to the operation
- Suppliers must provide Material Safety Data Sheets (MSDS) to Rössing as far as possible, prior to the delivery of such products
- Equipment, materials and chemicals are received, stored and dispatched to and within the operation in accordance with HSE requirements and
- A Procurement Standard is in place to control any liability regarding the disposal of surplus, used materials, chemicals, equipment, and hazardous waste.

Contractors
Contractors are categorised and managed according to identified HSE risks, as assessed for each contract. Where risks are identified as unacceptable, agreements are made for the contractor to manage these risks, according to the Rössing HSE standards and procedures. Each contractor must designate an on-site works manager and contract owner responsible implementing the HSE MS in relation to that contract. All contractor personnel are given appropriate orientation and induction training, including emergency response procedures, by the Rössing HSE trainers, prior to commencing work.

Documentation and document control
A procedure for document control is in place for the HSE MS to ensure that appropriate procedures are available as required, implemented and maintained. The HSE Compliance Section is responsible for the distribution, control, storage and collection of all such documents and records, which includes process information, organograms of

responsible personnel, internal standards and operational procedures. All HSE controlled documents are managed and disseminated via the HSE portal of the Rössing intranet. Systems and compliance audits are undertaken to verify the document control procedure.

Communication and consultation
Successful management of HSE hazards / aspects of concern are largely based on the effective communication of HSE monitoring results. The HSE MS ensures sound and effective communication and reporting structures so that hazards / aspects of concern are reported correctly, accurately and to the correct personnel. This allows for an appropriate response and the continual improvement of each of these aspects. The communication process in place also allows for changing requirements to be internalised and acted on, by way of the annual review process and by changes to the HSE policy and the HSE MS, as relevant.

Operational control
Operational controls are essential for the management of HSE risks associated with Rössing's work activities. This is achieved through the RUL Performance Standards (Figure 5.1), as well as other mandated or necessary risk treatment processes to control the risk to *as low as reasonably achievable* (ALARA). Procedural documents for specific operations and activities are developed on which management and mitigation measures are based. Performance against the operational procedures is monitored and non-conformances are reported so that area owners can rectify non-conformances by means of corrective actions.

Appendix 3 tabularises all procedures in operation at August 2024.

Management of change
Change is regarded as any alteration to the facilities, equipment, procedures or operating conditions outside the intent of current established parameters. The HSE MS includes a Management of Change procedure. The goal is to ensure that proposed temporary or permanent changes will not result in increased risk to health, safety, environment, financial systems and operations processes.

The Management of Change procedure requires that:

- all affected personnel are notified of any intended or actual change that poses a potential risk
- all affected personnel are fully aware of any possible dangers associated with the proposed and actual changes
- all affected personnel are informed of how to handle any adverse situations that may arise and
- required paper work is completed to record any temporary or permanent change.

The change owner, as the individual assigned to implement the change, is responsible for ensuring that a change is co-ordinated and all affected personnel are fully informed. Change is then implemented throughout the relevant area and line managers as appropriate, with required documentation to record measures for auditing purposes.

Business resilience and recovery
Through the Business Resilience and Recovery Programme (BRRP) Rössing ensures that the appropriate level of resources (plans, procedures, facilities, equipment and

trained personnel) are available for an effective response to control and recover from disaster and emergency situations.

Rössing has procedures in place for responding to emergencies and unexpected and uncontrollable situations. Business resilience and recovery procedures are developed on an ongoing basis, based on a comprehensive risk assessment of the operations. Emergency procedures are practised regularly across the mine, as initiated by the Fire and Emergency Response Section.

5.1.3 CHECKING AND CORRECTIVE ACTION

Measuring and monitoring

HSE monitoring programmes are implemented to track workplace occupational hygiene and environmental performance. Monitoring of HSE hazards / aspects is undertaken by the HSE advisors, who have the following responsibilities:

- Collect and maintain all HSE records
- Develop techniques and procedures for monitoring
- Define standards
- Determine monitoring equipment, instrument control and calibration and
- Communicate results of all monitoring to HSE Superintendents, who reports performance on a monthly basis
- Compile monthly, quarterly and annual Health, Safety, Environment and Communities reports.

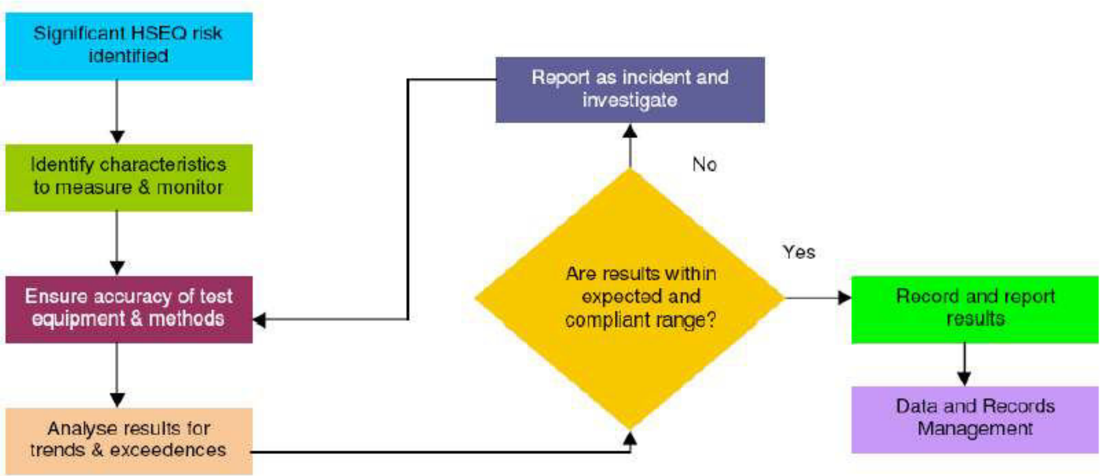

Figure 5.5: HSE monitoring work flow

Results from monitoring (Figure 5.5) are analysed on a regular basis to:

- Outline trends and potential exceedances of operating criteria (e.g. legal exposure, emission standards)
- Assess control designs and their success
- Identify the needs for corrective actions and improvement opportunities
- Reflect the level of achievement of objectives and targets, and
- Record, report and investigate exceedances.

Non-conformances, incidents and action management

The departmental managers are responsible for non-compliance reporting and investigation, allocation of resources for corrective action, and for ensuring the success of the corrective actions. Action is required when one of the following occurs:

- An HSE incident is reported;
- Monitoring (or auditing) has identified negative impacts;
- Non-compliance with Rössing standards and / or legal requirements occurs;
- Deviations from objectives and targets occur, and
- A complaint is received from a member of the public concerning any HSE hazard / aspect.

While HSE advisors can assist and facilitate implementation of corrective and/or preventive actions to minimise or prevent any HSE impact, the responsibility for the investigation and remedial actions rest with line management.

Reporting on HSE issues is integrated with existing reporting on operational issues, at monthly intervals. The HSE advisors attend departmental meetings to report on any non-conformance and corrective actions that were carried out or which are still outstanding.

Data and records management

Data relating to HSE management monitoring surveys conducted around the mine by the HSE advisors are stored in the HSE system. HSE records include:

- Collected HSE monitoring data
- Instrument calibration certificates
- Audit findings reports, and
- Corrective actions stemming from HSE incidents and non-conformances

Audit findings, HSE incidents, HSE non-conformance reports, as well as any other relevant correspondence (e-mails, photographs etc.) are stored either electronically or as hardcopies in the HSE filing system. The HSE improvement plans are documented in the electronic support system Business Solution and actions stipulated under an HSE improvement plan in the Business Solution as a result of an HSE incident are cross-referenced to the incident number or audit report number.

Performance assessment and auditing

The Rössing Audit Programme which allows for periodic evaluation has the following objectives:

- Determine / verify compliance with Namibian and other relevant international legislative frameworks
- Determine / verify compliance with HSE policies and standards
- Identify HSE hazards / risks
- Minimise potential liabilities by identifying areas where corrective action is required
- Assess the HSE MS, and
- Assess HSE performance against predetermined goals and targets.

HSE audits, as well as internal system compliance and technical audits are conducted according to prescribed procedures. The audit finding reports are stored in the relevant HSE sections. The HSE Manager ensures that audits occur within a year cycle and that all audit findings detailed in the audit reports are addressed. The HSE advisors sign off audit findings once audit deviations noted in the relevant audit report are satisfactorily addressed.

Rossing appointed global certification provider audits against ISO14001, ISO 45001 and the HSE MS standard and issues certificates relevant to the defined scope of Rössing's business or management system.

Rössing has received ISO14001 certification the first time in February 2001. Appendix 4 provides a summary of the various assurance approaches followed at Rössing.

5.1.4 REVIEW

Management review

The objective of the management review is to ensure the effectiveness of the HSE MS through evaluating the need for changes and establish actions to improve the system, audits and resources.

The management review is undertaken annually to ensure the effectiveness of the system and evaluates the need for changes and establishes actions to improve the system.

5.2 HSE MANAGEMENT PROGRAMMES

Because of their complexity, the management of some HSE aspects requires a multi-dimensional, multi-year approach. The risks and liabilities of these aspects cross-cut over many terrains, involving many departments and operational activities, and require strategic and specialized management programmes. Examples include radioactivity, air quality, water, biodiversity, rehabilitation, mineral waste and non-mineral waste management. These management programmes are discussed below.

5.2.1 MANAGEMENT OF RADIATION[69]

Sources of radiation in uranium mining

The mining and processing of ores containing uranium and thorium can give rise to exposure to ionising radiation in various forms to both employees and to members of the general public living in the vicinity of the mine. In order to control the exposure to ionising radiation, all aspects of radiation protection and monitoring need to be addressed.

Radiation levels at Rössing are low compared with some other uranium mining operations in the world. This is due to the low-grade ore, and to a lesser extent due to the favourable uranium: thorium ratio of the ore; the ratio of uranium to thorium in the ore is about 6 to 1. Rössing ore contains an average of 360 g/t of uranium and environmental radioactivity is therefore low. The total radioactivity per gram of ore is typically 60 Bq, originating from uranium and thorium and their radioactive decay

[69] Information relevant to this section was obtained from the Rössing Closure Management Plan (2011) and Rössing Radiation Management Plan (2012)

products. Uranium is extracted from the ore using an open-pit mining, crushing, milling and metallurgical extraction process.

After milling, the radioactivity is concentrated by the metallurgical extraction process. Radioactivity levels along the production process range from 60 Bq/g in the ore to 380 Bq/g in OK liquor. The majority of the radioactivity entering the processing plant ultimately ends up in Rössing's commercial product – U_3O_8 – at levels of about 21,000 Bq/g. The remaining radioactivity from the ore, which is associated with the rest of the daughter radio-nuclides in the uranium decay chain and those in the thorium series, is deposited to the tailings impoundment, along with other mineral waste. The radioactivity level in the tailings is typically 50 Bq/g.

The processing of bulk uranium containing materials also leads to the formation of radioactive scale on equipment within vessels and pipes. The radioactivity level of this scale can reach up to 40,000 Bq/g. Radioactivity from the above materials and process chemicals can lead to exposure to workers, and/or the contamination of the soil, air or water in the vicinity, and will require remedial measures during operation and at closure. Radioactivity also occurs in dust generated by the mining and milling process which is dispersed by wind. Finally, the extraction and size reduction of ore results in an increase of radon concentrations in the environment, both within the borders of the mine site and beyond.

Most of the radiation occurring at the Rössing mine originates from the uranium, actinium and thorium decay chains. Because of the low ore grades, radiation levels in most areas of the mine are low, except for the areas in the plant where concentration of uranium takes place. Figure 5.6 shows mining related sources of radioactivity in purple colour.

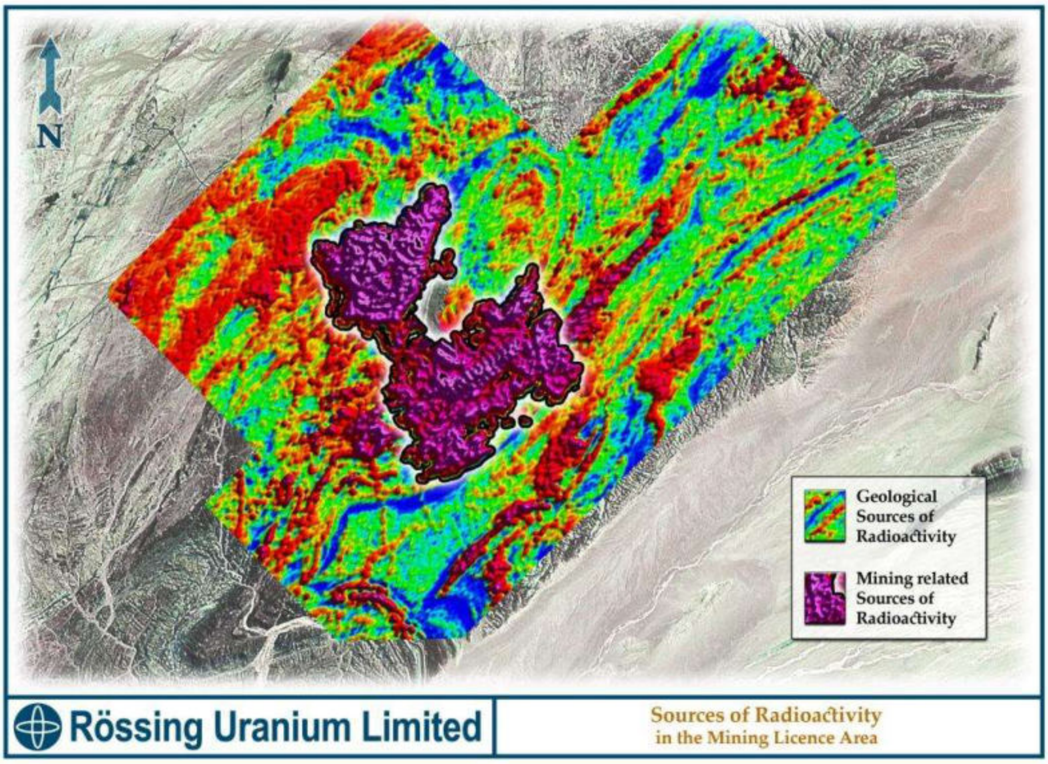

Figure 5.6: Sources of radioactivity at Rössing

Radioactivity in excess of the natural background radiation specific to the area enters the environment through the redistribution of rock materials by mining out the open pit, placing material on rock dumps and placing tailings into the tailings repository.

Long-lived radioactive dust comprises the inhalable portion of dust containing the long-lived radio-nuclides of the uranium, thorium and actinium decay chains. Sources at Rössing include

- The open pit and mining and blasting activities therein (ore dust)
- Dust roads, especially when covered with tailings sand (ore or tailings dust)
- The rock dumps, coarse ore and fine ore crusher dust plumes (ore dust)
- Areas of coarse and medium grained tailings on the tailings facility, the tailings dust plume, areas of silt and precipitated salts on the tailings facility and areas of seepage precipitate between the toe of the tailings facility and the seepage dam (tailings dust)
- Stack emissions from the FPR, if not adequately controlled, and the FPR area itself (uranium dust)

Radon-222 is a radioactive gas which is a member of the uranium decay chain. Sources of radon at Rössing include

- Ore body (open pit)
- Ore stockpiles (coarse ore stockpile, fine ore stockpile)
- Waste dumps and low grade ore stockpiles
- Tailings area
- Empty tanks and pipes with radon scales (jarosite)
- Crushing circuit

Since 1989, Rössing has measured radon exhalation rates from various radon sources. A comprehensive data set of radon flux measurements has been developed. The radon sources measured include:

- The open pit shell;
- The waste rock and low grade ore stockpiles;
- The crushing circuit, including the coarse and fine ore stockpiles;
- The tailings impoundment;
- Contaminated areas around the plant; and
- Background locations in the surrounding environment, including localized areas containing enhanced natural radioactivity levels.

Measured radon concentrations across the mine site range from background (50 Bq/m^3) to 350 Bq/m^3 in some areas of the pit and tailings.

Radiation exposure pathways

The path followed by radio-nuclides from their source via air, soil, water, and food, to humans, animals, or the environment is called the exposure pathway. The exposure of humans to radiation can occur directly from the outside (external), or internally through ingestion or inhalation. The most relevant pathways for the exposure to ionising radiation as a result of mining activities are as follows:

- Direct exposure to external gamma radiation
- Atmospheric pathway: The inhalation of dust containing radio-nuclides
- Atmospheric pathway: The inhalation of radon and radon progeny

- Aquatic pathway: Radioactivity can enter the environment via the aquatic pathway, in the form of seepage water that contains dissolved radio-nuclide salts. Seepage emanates from the tailings facility as surface water flow and groundwater flow in fractured rock aquifers and alluvial aquifers. If uncontrolled, the seepage could enter the Khan River and reach downstream users in the lower Swakop River. Active seepage control measures are in place to prevent this from happening.
- Ingestion: Radio-nuclides can be ingested directly, or swallowed after inhalation of dust.

Legal requirements
In terms of the Atomic Energy and Radiation Act, 2005 (No. 5 of 2005) in Namibia, regulation of radiation exposure falls under the jurisdiction of the National Radiation Protection Authority (NRPA). The NRPA is currently situated within the Ministry of Health and Social Services, but it may eventually be an independent body. In addition, the Atomic Energy Board advises the Minister and the NRPA on radiation protection matters. The Act is implemented in the form of the *Regulations for Protection against Ionising Radiation and for the Safety of Radiation Sources*, which were gazetted in November 2011. The NRPA was established in 2009. Since then, mines have been required to compile and implement a Radiation Management Plan according to guidelines supplied by the NRPA. The Radiation Management Plan is approved by the NRPA and compliance with the Regulations is audited annually. In addition, each operation is mandated to report its uranium exports, transport of radioactive materials, disposal of radioactive waste and worker exposures to the NRPA on a six-monthly basis. Furthermore, the transport, storage and/or possession of radioactive materials, as defined in the Regulations, are subject to regulatory control from the NRPA.

The national radiation protection legislation is based on the internationally accepted principles recommended by the International Commission on Radiological Protection (ICRP), which are implemented in the form of Regulations by the International Atomic Energy Agency (IAEA). The ICRP guidelines include the principles of optimisation[70], limitation[71] and justification[72], which form the basis for the discipline of radiation protection. The Rio Tinto Health Standard B5, which deals with radiation protection, sets additional goals for optimising radiation protection in the workplace and for the public.

In addition to national legislation, Rössing follows the IAEA approach to radiation protection, which aims to reduce exposure to maximally exposed members of the public (‘critical groups’) to below the recommended and internationally accepted International Commission on Radiological Protection (ICRP) public dose limit and constraint. The public dose limit is set at 1 mSv per annum, with all exposures kept ALARA. In addition, the public dose constraint is used to ensure that exposure from all operations in the area combined, and to any specific critical group, is limited to a total of 1 mSv per annum. A reasonable starting point, therefore, is a public dose constraint of 0.3 mSv per annum, which would assume the unlikely situation of three operations contributing radiation exposures to a common critical group. A public dose assessment performed in 2020 has demonstrated that public exposure from the mine’s radioactive emissions is well below

[70] Radiation doses and risks should be kept as low as reasonably achievable (ALARA), economic and social factors being taken into account.
[71] The exposure of individuals should be subject to dose or risk limits, above which the radiation risk would be deemed unacceptable.
[72] No practice involving exposure to radiation should be adopted unless it produces a net benefit to those exposed or to society generally.

applicable limits, i.e. below both the public dose limit (1 mSv per annum) and also below the public dose constraint (set at 0.3 mSv per annum).[73]

Radiation Management Plan

The objective of Rössing's Radiation Management Plan (JK20/MMP/001) is to ensure that exposures to ionising radiation will not give rise to unacceptable levels of risk, and that the sources of such exposures are identified, quantified, controlled and minimised.

The plan describes the occupational radiation protection programme, details the public exposure monitoring programme, the waste management programme and emergency preparedness and response programme, and provides a product transport plan. It also gives a comprehensive summary of the risk-assessments done, including all impact assessments, public dose assessments and closure management plans.

Occupational Radiation Protection

Measures for limiting and mitigating occupational radiation exposures include

- Radioprotection zoning (areas with a potential exposure exceeding 5 mSv are zoned controlled radiation areas, are fenced and access restricted, and workers in this area are monitored continuously)
- Occupancy limitation (in areas with a dose rate potentially exceeding 10 µSv per hour, occupancy limitation is applied to limit the maximum daily dose to below 80 µSv).
- Ventilation (ventilation is an effective measure to reduce the concentration of radon decay products in air, hence reducing the potential internal exposure from radon decay products)
- Dust or fume control measures (dust control measures include wetting or stabilisation of roads, covering of dust generating processes such as crushing and ore storage areas)
- Personal hygiene facilities (clean change rooms and lunch areas are provided, care is taken to avoid contamination of areas outside the mine by laundering contaminated clothing on site)
- Contamination control (items leaving site undergo a comprehensive contamination inspection routine before they are cleared to leave site. This prevents contaminated materials, such as scrap and tools, from leaving site and contributing to the spread of contamination)
- Administrative controls (safe work procedures)
- Training (awareness raising and skills improvement initiatives are offered to employees and to identified public stakeholders such as police officers, teachers, municipal workers, journalists, emergency responders and many more)
- Personal protection (PPE, in particular respiratory protection where needed) together with clean shaven policy.
- Emergency plan and drills

The effectiveness of employee radiation protection controls are monitored by way of personal and area radiation monitoring programmes:

- Continuous personal sampling of external radiation for all radiation workers. Thermo luminescent dosimeters (TLD) are used for this purpose. The wearing period is 12 weeks and TLD's are analysed and serviced by the South African Bureau of Standards (SABS).

[73] Aurecon, (2011)

- Random personal sampling of external radiation for all exposure groups. Electronic personal dosimeters are used for this purpose. Two models are presently in use, the Thermo Scientific EPD-G and the Tracerco PED.
- Random personal sampling of internal exposure from radon progeny. The SARAD DosemanPro is used for this purpose, a highly effective and user friendly direct-reading progeny measuring device.
- Random personal sampling of internal exposure from the inhalation of radioactive dust. The SARAD MyRIAM is used for this purpose, a direct reading instrument which uses in internal pump to collect dust on a filter, which is subsequently analysed for its radioactive content. A dose can be read directly from the instrument.
- Monthly urine bioassays are taken for all designated radiation workers to exclude any potential internal contamination or workers with uranium.
- Monthly pregnancy testing in female plant workers ensures timely removal of pregnant employees from areas with annual radiation exposures exceeding 1 mSv per annum.
- Air quality on site is monitored by using high-volume samplers and PM10 air samplers. Dust samples are regularly submitted for radionuclide analysis.
- Air quality in the FPR area is monitored continuously by using an Trolex Air XD Real-time Dust Monitor with real time reporting to the Central Processing Control (CPC) room.
- Comprehensive radiation clearance procedures for tools and equipment ensure any cross-contamination between contaminated and uncontaminated areas occurs on site.

Public Radiation Protection

The public dose limit is 1 mSv per annum. However, the maximum public dose assessed is significantly below this, at a maximum of less than 0.3 mSv per annum and down to very low exposures. It is therefore not possible to directly measure public exposure by issuing dosimeters to members of a critical group, as the measurement signal (the dose due to mining activities) will be swamped by the much larger measurement noise (natural background radiation, at approximately 2 mSv per annum).

The public dose assessment therefore builds on the principle of (see Figure 5.7)

1. Identification of radiation source
2. Identification of exposure pathway
3. Identification of critical group for this exposure pathway
4. Assessment of maximum exposure from identified source to identified critical group along pathway
5. Combination of all relevant pathways for each critical group

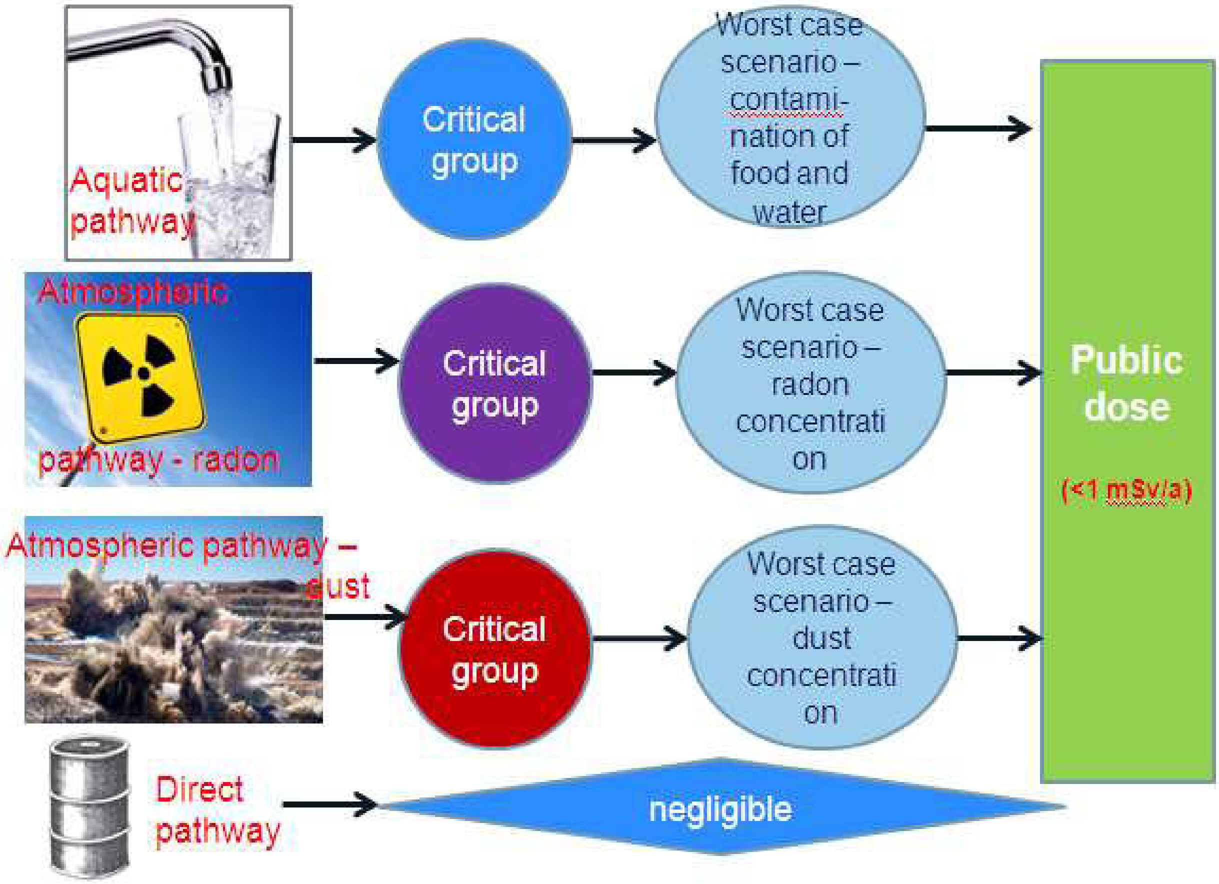

Figure 5.7: Exposure pathways and critical groups for public dose assessments

Aquatic pathway

Pollution of groundwater can occur through

- Dissolution and leaching into groundwater of radionuclides in tailings, ore and waste dumps
- Underground migration of seepage from tailings
- Deposit of radioactive materials on soil surfaces and subsequent dissolution in groundwater.

Radionuclides in groundwater can lead to the uptake of radioactive material through direct water consumption, or through the consumption of crops which have been irrigated with the groundwater, or by the ingestion of animal products from animals using the groundwater as drinking water. Assuming a groundwater concentration of radionuclides, the following processes are relevant:

- Irrigation of crops, subsequent crop ingestion by humans
- Irrigation of crops, ingestion of crops by animals, subsequent ingestion of animal products by humans
- Water ingestion by humans
- Irrigation of soil, soil uptake by humans and animals
- Irrigation of soil, direct irradiation of humans from soil.

A part of the tailings solution discharged to the tailings dam infiltrates into the tailings pile and either remains entrained around the particles or percolates through and emerges at the toe of the dam. The toe seepage is mostly collected in trenches, pumped to Lake Geoff. Overflow from the trenches is channelled on surface to the seepage dam from where it is recycled. Water that seeps into the bedrock under the dam is recovered by a collection of seepage control systems. Seepage recovered is re-entered into the plant process as a water saving measure. Monitoring of seepage control installations on the tailings facility is carried out daily.

Water quality is monitored by using a collection of monitoring boreholes located around the site and in the Khan aquifer, the aspect is discussed in section 5.2.3.

Atmospheric pathway – radon
For an assessment of public dose as a result of radon emissions from mine sites, the following information is required:

- Radon exhalation rates at various sources
- Meteorological data (wind speeds and directions)
- Local topology in the area surrounding the radon exhalation

Detailed atmospheric dispersion modelling is required to fully evaluate the distribution of radon from its sources to areas of concern, such as towns and villages, and also for impacts of dust containing long-lived radioactive nuclides.

The modelling exercise is supplemented with an extensive radon measuring programme, covering a 16 by 16 km grid across the mine site. This grid covers both areas affected by mining and background and hence serves as a confirmation and check of the radon dispersion models.

Atmospheric pathway – dust
For an assessment of the dose to humans resulting from fugitive dust, the following factors have to be considered:

- Sources of dust
- Chemical composition and particle size distribution of dust
- Radionuclide content of dust
- Meteorological conditions
- Age distribution of critical groups
- Rate of uptake of radionuclides by different crops from deposited dust
- Percentage of use of own grown crops versus crops imported from elsewhere
- Percentage of animals and animal products consumed versus animal products imported
- Percentage of milk and milk products produced by own cattle, versus imported products

Dust collected at the locations for critical groups is analysed for radionuclide concentration, in Bq/g. Dust samples are sent regularly to an accredited laboratory for an analysis of the radionuclide content in the inhalable portion of the dust.

Records
All records relevant to the employee and public exposure monitoring programme are kept indefinitely, in a format that allows the presentation of yearly statistical information about the monitoring processes.

Industrial radiation sources
All sealed radioactive sources (industrial gauges) previously stored in secure bunkers were removed for offsite disposal in RSA by NECSA with approval from the NRPA. Safety and security of sealed sources is detailed in the Radiation Management Plan.

Emergency preparedness and response
Actions taken in an event of a uranium oxide spill are detailed as part of Rössing's BRRP procedure. Valid emergency information sheets accompany the consignment throughout the duration of the voyage which provides correct emergency actions to the relevant parties. Formal and legal regulations are in place in the countries through which Rössing's product containers are transported and clearly address responsibilities and accountabilities regarding emergency response and clean-up. A drill on the action to be taken during an emergency is practiced at least once a year.

Transport
Rössing's final product, U_3O_8 is listed as a Class 7 hazardous material, with a United Nations hazardous material number of 2912 (radioactive material, low specific activity LSA-1 non-fissile or fissile excepted). The hazardous properties of U_3O_8 are relatively low compared to other radioactive materials and most hazardous materials in general. Transportation of U_3O_8 is governed by the IAEA Regulations for the Safe Transport of Radioactive Material[74] as well as national and international standards and regulations. These standards and regulations stipulate the responsibilities of shippers and carriers. In many jurisdictions, carriers must be licensed to carry nuclear material.

U_3O_8 is packed in drums steel drums and sealed. All cleaning, marking, labelling and monitoring of product drums and containers are done following the IAEA Regulations for the Safe Transport of Radioactive Material[75]. Employees working with the drums and close to the drums during packing, cleaning and monitoring, are monitored for external radiation dose.

Uranium ore samples are sometimes transported to laboratories off site, either within Namibia or across its borders.

Ore samples containing uranium, with an activity of 1 Bq/g (from uranium alone when ore grade is > 40 ppm), or with a total activity of 1,000 Bq or more, may only be transported if permitted by the National Nuclear Regulatory Authority. Packaging and disposal of ore is furthermore accompanied by required documents and subjected to internal control measures.

5.2.1. MANAGEMENT OF AIR QUALITY
Air quality management at Rössing is guided by an Air Quality Management Plan (JE20/MMP/004). All air emissions are listed in an inventory (JE65/STD/002) and all air quality standards applied at Rössing are documented (JE65/STD/001).

The current air quality monitoring program is based on the original one established during the pioneering years at Rössing. In the meantime the **E1 (**Air quality, noise control

[74] IAEA, (2005)
[75] Ibid

and Greenhouse gases (GHG)) guides the current operations. Concerns about air quality – then and now – are based on two uncertainties: The relationship between air quality and employees' health; and concerns about impacts on the ambient environment[76].

Measurements are taken in order to ensure that exposure levels of employees do not exceed prescribed occupational limits and to ensure that existing and newly introduced controls efficiently detect differentiations as a result of process changes. Informed risk-based decisions, related to the level of control, are introduced for the various exposure levels thus, and the objective is to optimise performance in terms of emission reduction and control measures.

Since its inception meteorological data is collected at Rössing in order to characterise the ambient environment and to determine the dilution and dispersion of atmospheric contaminants. There are four weather stations that are in operation, located at Point Bill, Hill Jim (open pit) and the tailings facility on site, and in Arandis at the valve house.
The Rössing air quality hazard assessment was initially conducted during a series of workshops in March 1993. During the workshops the nature of the airborne emissions, the mechanisms that result in the release of the airborne contaminants and the control systems to limit these releases were identified.

An air quality risk assessment for Rössing was conducted in 1998. It was identified that SO_2 (from the former acid plant), total dust and lodged silica from tailing dust were the air-borne contaminants with the most significant impacts. A study, which assessed hazards, exposure, pathway, intake and toxicity, was completed in 1998[77]. The study also applied the background and philosophy of risk in setting environmental control thresholds for use at Rössing. More recently an air emission risk screening was conducted and the risks at Rössing were classified as low. Although air quality risks are thus characterized, there is a need to update the risks to reflect current operations.

Rössing's documented dust inventory is based on the air quality risk assessment of 1998. Models such as the US-EPA recommended Fugitive Dust Model, AirDos EPA, Industrial Source Complex Long Term Model and Industrial Source Complex Short Term Model were used in the past to determine fugitive dust inventory sources at Rössing according to area, type and dust generating activity. The inventory was amended with calculated PM10 and Total Particulate Matter (TPM) emissions from the Air Quality Impact Assessment conducted in 2007 as part of the proposed Rössing expansions. Fugitive dust emissions were quantified during this assessment using the most recently United States Environmental Protection Agency's approved regulatory model, the AERMET/AERMOD suite of models.

[76] The ambient environment, which may be adversely affected by radiation, dust and gases emanating from Rössing and its related activities, is defined as general public, visitors to Rössing, the residents of Arandis and the fauna and flora surrounding the mine. It is not only human health that can be adversely affected by impurities in the air: the fall-out of heavy metals onto soil and foliage of plants also results in adverse impacts. The metals are either taken up directly from the deposits on the foliage, or it is taken up by plants and concentrated in the leaves of the plants. This can result in the bio-accumulation of heavy metals and radio-nuclides in the food chain, with severe adverse impacts in some cases. On the other hand, greenhouse gases have a knock-on effect on (global) atmospheric processes.
[77] Metago Environmental Engineers, (1998)

It is acknowledged that the operations at Rössing can result in the generation of dust, and in combination with natural occurring background dust levels, dust can have adverse impacts on the surroundings. The Rössing Dust Management Plan intends to provide a consistent approach for dust management at the mine, with the aim to continuously reduce levels of fugitive dust. Specifically, the plan contains information about dust inventories, risk assessment measures and practices to minimize the generation of dust, monitoring, plumes, performance criteria, communication and reporting.

Detailed sources of dust and particulate emissions at Rössing are identified and documented. The main sources and activities that contribute to dust emissions are drilling and blasting; loading and hauling; transfer, crushing, conveying and storage of ore; operations (including vehicle movement) and exposure to wind[78]. Currently comprehensive air quality monitoring activities take place at various locations on the mine site. Monitoring includes measuring PM10 dust, for example (Dust fallout sampling procedures JE50/PIN/003; PM10 monitoring JE50/PIN/007; Multi-vertical dust sampling JE50/PIN/006).

The impact of the fugitive dust emissions on the quality of the air is determined from dust fall out depositions measurements (including multi-vertical samplers) and monthly estimates. Multi-vertical dust samplers at the edge of the tailings facility collect dust and sand particles that are blown westwards off the tailings facility. Readings from the multi-vertical sampler around the tailings facility during Bergwind conditions is estimated annually. The PM10 dust sampler is situated at four (4) places around the mine, at the Arandis residential area, mine Boundary on the South westerly side of the mine, Tailings west and at the Contractor Management Centre (CMC). PM10 dust samplers are used to determine the level of dust in the air. The primary concern is to test to see how much dust under 10 microns in size is airborne, as dust particles this size or smaller can cause damage to human health.

Rössing is using the ambient air quality standards based on Schedule 2 of the South African National Environmental Management Act: Air Quality Act (Act No.39 of 2004), as a reference to set criteria. In keeping with the current best practise, Rössing will also adopt the new South African ambient air quality standards as provided by the South African Government Notice (No.32816 Vol. 534). Details are set (see Table 5.4 and 5.5).

Table 5.4: Particulate matter (PM10)

Type	24 hours average	Annual average	Comment
Ambient air concentration	75 $\mu g/m^3$	40 $\mu g/m^3$	Frequency of exceedance for a 24-hrs average not more than 4 times

For fall-out dust depositions, Rössing adopted the South African method of evaluation as given in Table 5.6. The1,200 $mg/m^2/day$ threshold level is used as an action level and in the event that on-site dust fall-out exceeds this threshold, the specific causes of high dust fall-out should be investigated and remedial steps taken. In Arandis a 600 $mg/m^2/day$ will trigger an investigation and remedial steps.

78 Aurecon, (2011)

Dust at Rössing is managed in various ways. Water is used to suppress dust on gravel roads. In addition, ligno-sulphonate, a chemical binder, is sprayed onto some road surfaces. A mobile road sweeper is used on tarred surfaces to remove dust and air-borne debris. At the crushers dust control entails preventative maintenance and frequent wash downs. Engineering controls such as dust extractors (at the crushers), scrubbers and baghouses (at FPR) are also in place.

Table 5.5: Dust fall-out range

Restriction Area	**Dust Fall Rate (D) ($mg/m^2/day$, 30-day average**	**Permitted frequency of exceeding Dust Fall Rate**
RESIDENTIAL	D<600	Two within a year, not sequential months
INDUSTRIAL	600<D<1200	Two within a year, not sequential months

Dust fall-out is monitored and recorded internally - monthly on site and annually to CNNC - to reduce dust through innovative controls. The impacts of blast dust are reduced by considering wind direction, prior to blast events, in order to limit dispersal and deposition. In addition, the blast areas are soaked with water before blasting. At the tailings facility, windrows are created to break prevalent air flow over the paddies. Table 5.6 shows some of the dust control measures that are applied at Rössing.

Dried-out tailings and seepage deposits may represent a major source of wind-blown dust. As a remediation option for fugitive dust from the tailings facility after mine closure, covering the entire tailings facility by a layer of rock is presented. Seepage areas, which also present a dust hazard after drying up, can be covered with rocks after mine closure too.

It was observed that biological soil crusts at Rössing are present in a somewhat reduced form compared to their occurrence in nearby habitats[79]. The suggestion is that the reduced form of biological soil crusts found at Rössing may be the result of fine layers of dust coating rocks and stones reducing the natural flow of condensed moisture to the hypolithic environment, resulting in a drier microclimate non-conducive to biological soil crust formation. A reduction in biological soil crusts could reduce the productivity of the desert habitats - biological soil crusts are known to be very active in fixing and remobilising carbon and nitrogen in desert soils[80]. Further research and monitoring is required to fully understand the likelihood and consequence of the impact of dust on the formation of biological soil crusts.

[79] EEAN, (2008)
[80] Belnap, (2001); Evans and Lange,(2001)

Table 5.6: Dust control measures at Rössing

Source	Dust control measures
	Open pit
Haul and other roads	Spray with seepage water Spray with ligno-sulphonate Dust-A-Side Restricted speed limit (40 km/h)
Muck piles	Spray with water
	Waste rock dumps
Tops	Spray with water
	Blasting
Large blast	Wet drilling Consider wind direction
Small blast	Wet drilling
	Plant
Primary crusher	Spray at tipping point and dust collectors
Coarse ore stockpile	Spray at tipping point
Conveyors	Partially covered
Fine crushing	Regular wash-downs Dust collectors
	Tailings facility
Paddocks	Wind-breaks, e.g. wind rows
Roads	Spray with seepage water Spray with lingo-sulphonate Regular maintenance (road grading) Restricted speed limit (40km/h)
	Mine-wide
Roads	Road sweeper, Restricted speed limit (60 km/h)

It was also observed that the abundance and diversity of solifuges is exceptionally low at Rössing and the abundance and diversity of spiders is relatively lower than expected[81]. The Central Namib is a global hotspot of solifuge diversity so this paucity of solifuges and arachnids is likely to have a causal link. Dust attributable to operations at Rössing may reduce the availability of shelter and refuge for invertebrates. Coupled with dust related reduction in plant productivity, the reduced form of biological soil crusts and a reduction in moisture in the hypolithic environment, dust generation attributable to Rössing may have an impact on solifuge and arachnid mortality outside of the area of direct disturbance.

Invertebrate data collected from Rössing is restricted in terms of comparisons and identifying landscape-based patterns and some taxa are known only from one specimen trapped during survey work by the State Museum in the 1980s. To fully understand the likelihood and consequence of the impact of dust on solifuges and arachnids, quantified research and monitoring is required to a) establish a baseline of invertebrate abundance and diversity and b) fully understand the impact that dust has on invertebrate mortality.

[81] EEAN, (2008)

Efforts to stabilise global atmospheric concentrations of greenhouse gas (GHG) at lower levels is a priority, as a result, Rössing measures GHG emissions too which requires Rössing to:

- Develop and maintain detailed knowledge of energy use, GHG emissions and saving / abatement opportunities at its operations;
- Identify and assess GHG related risks and opportunities for the business;
- Develop a plan and targets that drive improvements in energy efficiency and GHG emissions.
- Implement programmes that maintain energy efficiency and GHG emission reductions

Current measuring of impacts that can contribute to climate change includes the monitoring of GHG emissions and the monitoring of energy use at Rössing.

The intensity of emissions is reported per unit of product target, according to an operation procedure (JE65/PRC/001). Sources of GHG emissions include electricity and fuel consumption transport of reagents and uranium, blasting (explosives), waste (sewage, rubbish disposal and landfill) extraction and processing.

GHG emissions intensity per unit of product target, the so called Tier 1 target, is reported monthly and annually. The Tier 2 target is an internal target that calculates energy use per unit of "*work done*". To calculate the GHG equivalent of the amount of energy used, the total energy consumed is converted to CO_2 per tonne of U_3O_8 produced. The figures are used to drive energy efficiency and emission reductions on site, and are reported monthly and annually.

Electricity at Rössing is supplied by NamPower. It is a mix of 58% hydro (from the Ruacana plant in Namibia) and 42% Eskom (mainly from coal power stations in South Africa) power. Taking into consideration the electricity makeup, factors were developed for conversion of electricity to energy and GHG and these are 3.6 (GJ/MWH) and 0.529 (t CO_2-e/MWH) respectively. These factors need to be verified from time to time. Sub-metering of electricity is done on all working areas at Rössing in order to calculate the contribution of each component to the total energy consumption. The electrical feed to the various working areas are monitored by an online monitoring system which is used as inputs to an energy efficiency analysis and to track improvements.

Fuel, mainly diesel, is consumed by drilling, hauling, blasting and support equipment and vehicles. Diesel is also used for roasting purposes in the FPR. Default factors used in conversion of diesel to energy and greenhouse gas and these are 0.0382 (GJ/L) and 0.00269 (t CO_2-e/L). For petrol these figures are 0.0345 (GJ/L) and 0.00227 (t CO_2-e/L).

For the conversion of explosives, the default factor is 0.1778 (t CO_2-e/t explosives). For sodium carbonate it is 0.434 (t CO_2-e/t), but at Rössing the factor becomes 0.434 * 0.05 = 0.0217 tonne of CO_2 for every tonne of Na_2CO_3 (as only 5% of the carbonate is used up). The factor used for conversion of ore processed to GHG is 0.0022 (t CO_2-e/t ore milled). GHG emissions (CO_2-e) from domestic waste dumped at the landfill are determined using the methodology provided by Rio Tinto specifically for Rössing's landfill site.

The transport of uranium to converters and the transport of major reagents from suppliers to the mine are also reported annually only.

Constant improvement in GHG management is guided by the documented plan (JE20/MMP/003). Accordingly targets to reduce energy consumption and emissions are set and reporting of performance against these targets are done monthly and annually (Monitoring and reporting procedures JE65/PRC/001).

Annual stack emissions monitoring are done at FPR to assess the efficiency of the stack filters. Chlorine detectors with an alarm system, for safety purposes, are in place at the sewage plant. Outcomes on several specialist studies (e.g. Volatile Organic Compounds) were done at various areas and indicated that the risk at Rössing is low.

Noise and vibration is monitored at Rössing through a network of various points and studies. Information is used to assess compliance and to address concerns, as well as to provide feedback to the Geotechnical Section, which utilized the information in investigating the impact of blast vibrations on the stability of the pit. The management of noise and vibration is guided by the Standard E1(Air quality, noise control and Greenhouse gases (GHG)) on which the Noise and Vibration Management Plan (JE20/MMP/008) is based. Environmental noise is monitored according to a procedure (JE65/STD/003). Noise is monitored and monthly reported to minimize noise to threshold levels and to identify exceedances. Engineering solutions and continuous business improvements attempt to mitigate the impacts of noise. Regular inspections and audits are conducted. Best practices are shared.

In conclusion, improvements of the air quality management practice at Rössing aim at

- a refined understanding of Rössing's dust pollution footprint, as expressed by the current dust plume in correlation to the wind regime
- a better understanding of the correlation between blasting and its impacts – dust, noise and vibration
- a review of the existing sources of emissions from mining operations
- characterising ambient air quality
- a better comprehension of the impacts of air quality on biodiversity
- review of control measures to recommend additional measures if needed, and mitigation to manage air quality better.

5.2.2. MANAGEMENT OF WATER

Water management at Rössing is guided by a formal water strategy, Water Management Plan and a Rössing specific-specific environmental standard on water usage and quality management. The Standard covers all activities connected to water abstraction, dewatering, transport, storage, usage (potable and process), and direct / indirect discharge, involving surface water (including run-off), impounded water and groundwater. The intent of the Standard is to ensure efficient, safe and sustainable use and protection of water resources and ecosystems. An understanding of water resources, their spatial and temporal interrelationships, ownership and the needs of key catchment stakeholders is thus required to provide the basis for the development of an integrated and strategic approach to water management that promotes the maintenance or improvement of water quality, upstream and downstream, minimisation of fresh water use and the maximisation of reuse and recycling.

Water supply at Rössing dates back to the late 1960s when two wells in the Khan River were permitted to provide water to exploration activities. In 1971 a third borehole was drilled to serve the pilot plant. More boreholes were drilled between 1973 and 1976, some of which were washed away in the 1985-flood and had to be re-drilled in 1986. In

1993 two more boreholes were drilled. Power lines and pipelines connect the abstraction system to the mine's water distribution network.

In December 2004, The Water Resource Management Act, 2004 (Act No. 24 of 2004) was gazetted and enforced. Subsequently in 2013, the Water Resources Management Act 11 of 2013 was gazetted and it came into operation on the 29 August 2023.

The government agency controlling Rössing's water management programmes is the Department of Water Affairs (DWA) in the Ministry of Agriculture, Water and Land Reform.

From the early years of Rössing's existence the DWA permitted Rössing to extract 870,000 m^3 per annum (2,384 m^3 a day) of brackish water from the Khan River aquifer for industrial use, mainly to suppress dust in the open pit. Power lines and pipelines of Rössing connect the abstraction system to the mine's water distribution network. As a proactive measure to concerns about a dropping water table, the DWA granted Rössing permission to extract water on the condition that vegetation along the river is monitored. Since 1988, the monitoring results have been submitted to the DWA to provide basis for revising water abstraction rates, should abstraction be identified to have an impact on vegetation. As of 1995, the sustainable yield of the Khan River aquifer has been determined every year after the rainy season and the extraction target set accordingly. Volumes and water levels are monitored monthly and used to update the water reserve estimation according to a documented operational procedure, JE65/OWM/001.

Hydrogeological studies indicated that, as a result of abstraction, the water table would be lowered to 10 metres below the surface but groundwater reserves at a depth of 10-20 metres below surface would still be available to sustain vegetation and dependent biodiversity. Monitoring results have shown that water levels measured upstream of the aquifer have a natural range of variation extending from approximately 1-10 m below the surface.

Extraction of brackish water from the Khan aquifer was voluntarily suspended between 31 December 2009 and 3 August 2011 in line with a drive to promote water savings. The monitoring and measuring of the vegetation and water levels in the river continued during the same time[82]. Abstraction of water resumed because of an increase in the need to suppress dust in the open pit as a result of the present extensions. The current rate of 600 m^3 a day is a target that Rössing set internally and is below the safe allowable abstraction. Rössing continues to adhere to another permit condition which is the monitoring of the ground water and the biannual vegetation in the Khan aquifer as described in procedures JE65/OWM/002.

About 40 million cubic meters of effluent is contained in the tailings facility at Rössing. This is a potential source of contamination that needs to be controlled. By law Rössing is obliged to ensure that no seepage from the tailings facility flows into the Khan River and other downstream receiving environments and to prevent residual contamination by metals, salts or radio-nuclides. Thus, impacts on water quality will fall within the range of natural variability for the receiving environment. Subsequently, water management at Rössing puts a strong emphasis on the tailings facility, and is regulated by various operational manuals and standard operational procedures that form part of the overall Water Management Plan (JA10/MMP/001).

[82] Rössing Closure Management Plan, (2011)

Most of the surface seepage from the tailings facility flows down Pinnacle Gorge and is contained in the seepage dam below the facility. Two cut-off trenches further downstream were constructed during in the early 1980s by digging ditches across the riverbed into the weathered bedrock and removing any loose material. One or two concrete wells were placed in the deepest parts of the trenches before the latter were backfilled with permeable sand and gravel. The wells are installed with electrical submersible pumps which are operated by a fully automated system & monitored live on the Central Processing Control (CPC).

The purpose of the trenches is to remove groundwater flowing in the alluvium and thus cut-off the major flow paths of potentially contaminated water towards the Khan River (see Figure 5.8). A groundwater flow model of the tailings facility exists[83], which assists in the assessment of ongoing operations at the tailings facility and the consequent predictions of impacts of various long-term options. There is no diversion of storm water around the tailings facility in place. Due to the low rainfall in the area, there is minimal possibility of storm water damming up.

The buffering capacity of the rock types that surround the tailings facility, as well as the tailings sand itself, significantly inhibits the leaching of contaminants from the facility. However, small volumes of water from the tailings facility infiltrate into underlying bedrock where fractures allow some movement of groundwater from the western side of the dam towards Panner Gorge. Seepage of these contaminants into the alluvial aquifers of the Pinnacle, Panner and Dome Gorges is curbed by cut-off trenches and dewatering boreholes which are arranged in a double line on and along the western side of the tailings facility, in addition to the surface seepage collection dam in Pinnacle Gorge (Figure 5.8). Geophysical surveys were carried out to ensure that boreholes were placed on all major fractures. A cut-off trench is placed across the lower Panner Gorge to prevent inflow to the Khan River.

[83] Aquaterra, (2005)

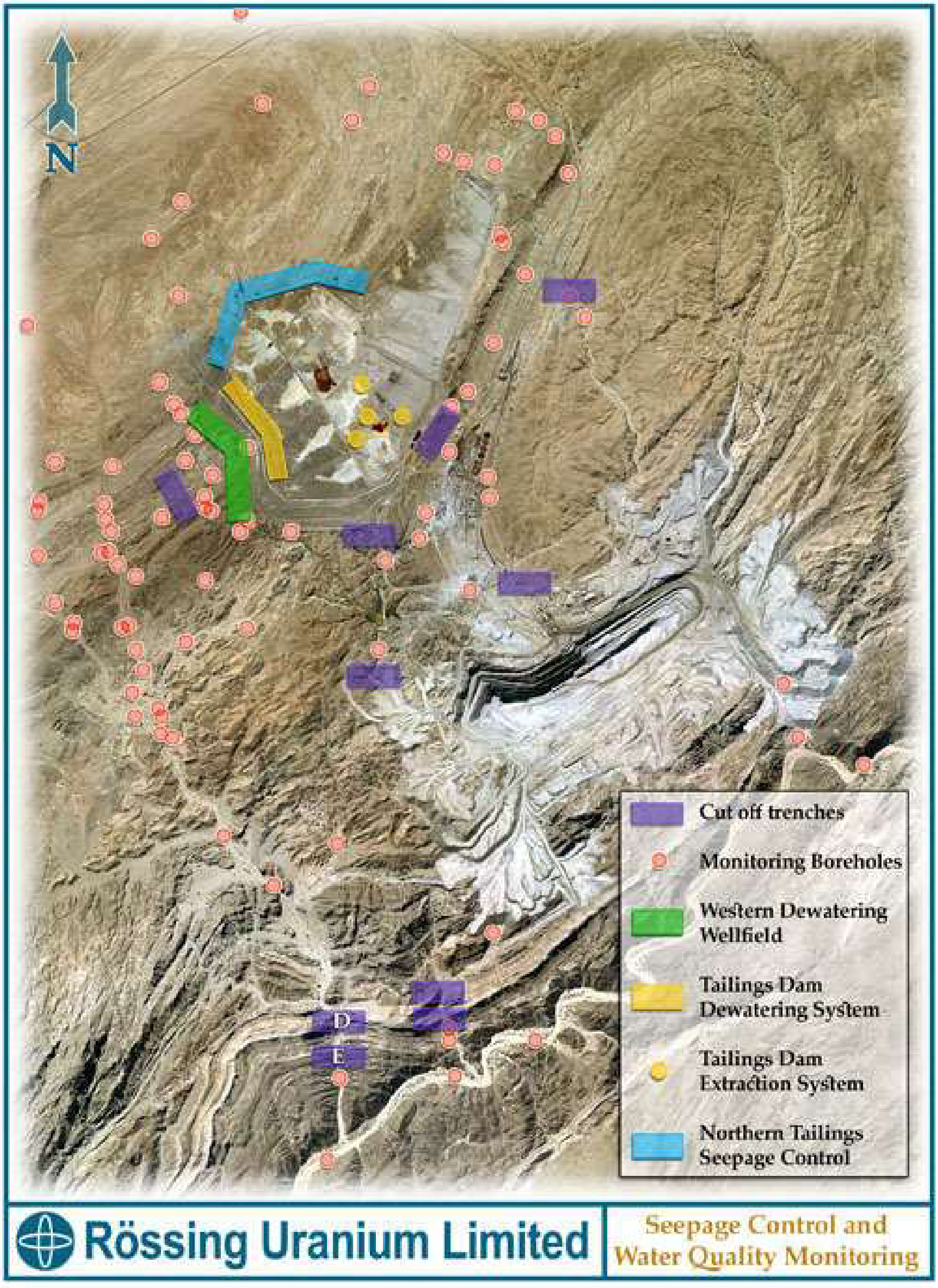

Figure 5.8: Water monitoring and seepage control at Rössing

Many former dewatering wells are currently not in operation because their yield has declined to less than 1 m^3/day, additional 20 boreholes were drilled in the in the area. This project was realised in 2023 and contribute increased dewatering in the area.

The efficiency of the measures to control contamination of the Khan River is confirmed with regular borehole water monitoring in Pinnacle and Panner Gorges. The tailings facility is continuously monitored over 24 hours, generally completing a circuit every 2 hours. Groundwater flows and water quality are monitored at various other points and the seepage control installations are monitored daily. Monitoring includes checks on the available capacity at each operational open end as well as the water levels and shift log sheets are completed for evaluation. Flow meter readings are taken once per week and entered in a dedicated database to compile water balances and other reports. Water samples from the boreholes is analysed for radio-nuclide concentration, in Bq/L. Of the roughly 150 monitoring boreholes, monitoring is done against a schedule agreed upon between the mine & MAWLR under the Waste Water and Effluent Disposal Exemption Permit 674. Water samples are sent to accredited laboratories for analysis as per the agreed upon schedule.

Water storage in the tailings facility is minimised through a system of abstraction boreholes on and around the tailings facility. Away from the tailings facility the de-watering system exists of trenches and boreholes located in Pinnacle, Dome and Panner Gorges. The trenches and boreholes are pumped continuously to lower the water table and to reduce the advancement of groundwater contamination into the Khan aquifer. Detailed operational procedures include the Operation and monitoring of the seepage control systems (JE50/OWM/002); Water quality monitoring (JE65/OWM/004); Water quality management (JE50/MSP/001); Water recycling and re-use (JE50/OWM/003); Seepage recycling on the tailings dam (JE50/OWM/009) and Treatment of TDX boreholes (JE50/OWM/007). AutoCAD drawings of the seepage control systems and monitoring sites are annually updated (Water Control Plan 1002A) and filed at the Survey section. The location of the trenches and well fields can be seen in Figure 5.8.

Rössing uses steel pipelines of various diameters for the freshwater reticulation system. There are four main separate pipeline systems: 1) domestic water supply, 2) process water feed to the plant, 3) supply to the crushers and open pit and 4) supply to the fire tank and lakes. The purpose of having separate pipelines for domestic and process fresh water is to reduce the risk of potable water contamination. Drawings of the reticulation systems for fresh and recycled water are filed at the Engineering Drawing Offices. Pipes are colour-coded to indicate the type of solution.

The current water management system ensures that practically all process effluent is recycled, either directly from the paddy pond or from the seepage dam and seepage control systems. Only a small volume of seepage reaches the underlying bedrock and dissipates into fractured bedrock whose permeability is too low for effective dewatering. Hydrogeological modelling has shown this volume to be in the order of 100 m^3 per day. It is included in the site water balance as “seepage loss”.

The environmental impact of seepage is reduced by chemical reactions inside the tailings facility, which remove most of the acid and chemicals contained in the tailings solution. Tailings contain an average of 0.5% carbonate, which neutralizes sulfuric acid to gypsum and carbon dioxide. Other chemical reactions lead to the precipitation of iron hydroxides and co-precipitation of heavy metals and radionuclides. For instance, the TDS concentration of tailings solution is above 30 000 mg/L, but the seepage emanating from the facility is below 20 000 mg/L TDS.

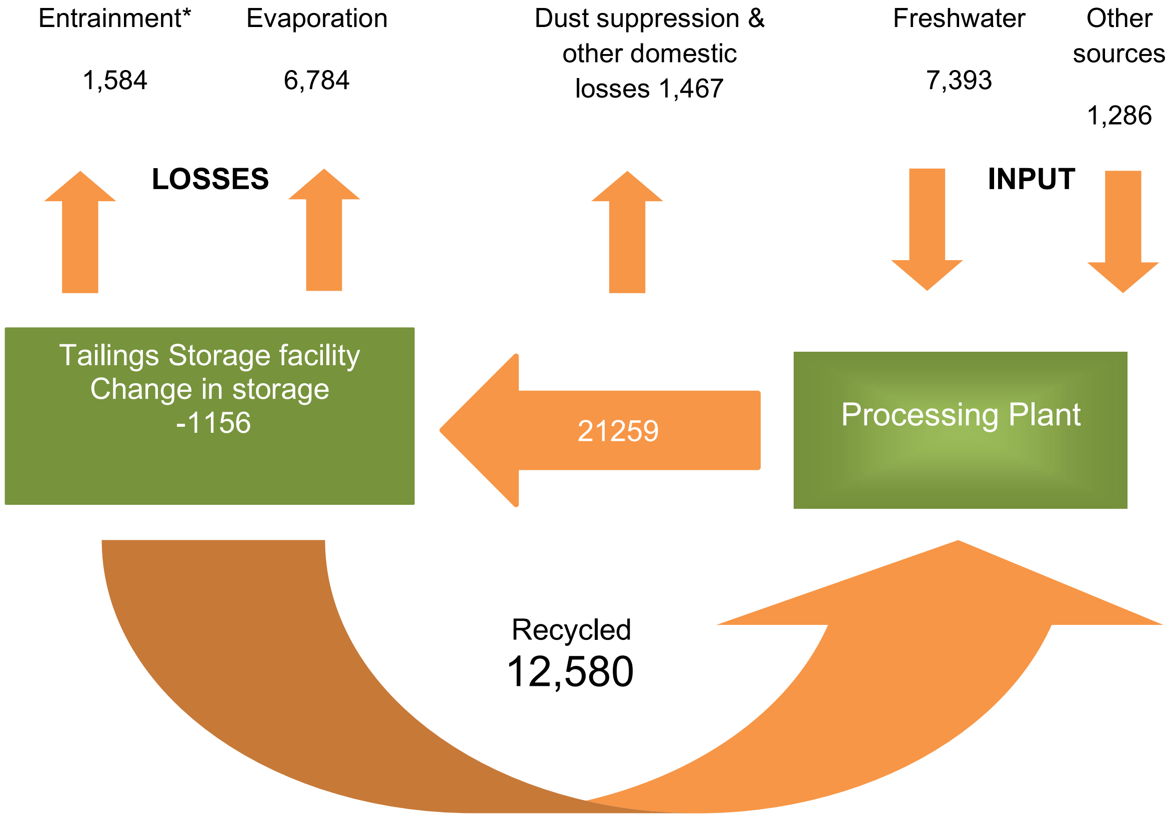

Figure 5.9: Schematic water balance for Rössing in cubic meters per day, 2023

Seepage is mainly characterized by increased sulfate, nitrate and magnesium concentrations, while chloride and sodium predominate in natural groundwater. The "seepage plume" around the tailings facility is defined at Rössing by the 3000 mg/L sulfate contour, while natural groundwater usually contains less than 2900 mg/L sulfate. The objective of water quality management in the mining area is to prevent as far as possible any expansion of the seepage plume beyond the area it occupied in 1999. Monitoring results since 2000 confirm that the plume did not spread outwards, but rather retreated in some places.

The Rössing water circuit is closed under normal operating conditions and no effluent is discharged. The water input balances the losses, so that the required volume of re-circulating process solution can be maintained. Water input to the mine (Figure 5.9) includes fresh water supplied by NamWater, brackish Khan River groundwater and recycled water from the seepage control systems, as well as moisture in ore and water in sulfuric acid.

Water losses occur due to evaporation from open water, e.g. tailings pools, lakes, tanks, wash-down and from entrainment of solution that will remain adsorbed to the tailings material. Other losses include water sprayed for dust suppression in the open pit, garden irrigation and seepage that bypasses the seepage control system. Evaporation loss is estimated at 6,784 m^3 per day.

In 2023, Rössing used a total of 2 698 292 m³ of fresh water. The ratio of fresh water versus total water use was 0.290; meaning that 59% of the total water usage was obtained from reclamation. In essence fresh water is needed to counter evaporative losses and for drinking (household) purposes. Water input balances the losses (mainly through evaporation), so that the required volume of re-circulating process solution can be maintained. The Water Balance Procedure (JE65/OWM/001) and Fresh Water Supply Management (JE50/OWM/005) regulate operational activities.

Table 5.5: Water management procedures relevant to the effluence disposal exemption permit

Paragraph of permit	Subject	Procedure	Responsible section at Rössing
1.2.ii), 1.8.2	Seepage control systems	JE50/SOP/002	Water Management
1.2.i),ii) 1.6.2 1.9.1.6	Water recycling	JE50/OWM/009	Water Management
1.7.6	Fresh water supply management	JE50/OWM/005	Water Management
1.9.1.2	Waste rock dumping	MIN/WRD/001	Mine Planning
1.9.1.5	Disposal of hydrocarbons	JE50/WMP/002 ENV/WMP/003	Environmental Management
1.9.1.5	Disposal of chemicals	JE50/WMP/001	Environmental Management
1.7.3, 1.7.4, 1.7.9, 1.8.2	Water quality monitoring	JE65/OWM/004	Water Management
1.2.i),iii),iv) 1.4, 1.8.2	Monitoring of sewage plants	JE65/OWM/003	Water Management
1.7.1 1.7.2	Supervision of flow meters	JE50/MSP/001 JE50/MSP/002 JE50/SOP/002	Water Management
1.7.9	Monitor acid neutralization	JE65/OWM/004	Water Management

Rössing has standard operating procedures for water quality management and several related procedures to ensure compliance with the permit conditions. These are listed in Table 5.9 with reference to paragraph numbers in effluence disposal exemption permit.

There are currently no state regulations specifying water quality requirements for industrial water in Namibia. For this reason Rössing is using its own water quality criteria, formalised as JE65/OWM/004 (Water quality monitoring) and JE50/MSP/001 (Water quality management) with the Water quality monitoring schedule agreed upon with MAWLR in 2018. To supplement the monitoring of water quality, the monitoring of several other aspects are documented as operational procedures. See Table 5.10.

Table 5.6: Water monitoring procedures at Rössing

Water aspect monitored	Procedure
Water quality (including fresh water, seepage, hydrocarbons)	JE65/OWM/004
Water levels	JE65/OWM/004
Seepage control systems	JE50/SOP/002
Fresh water supply	JE50/MSP/002
Water recycling	JE50/OWM/008
Seepage recycling on the tailings facility	JE50/OWM/009
Sewage water quality	JE50/OWM/003
Septic tanks	JE50/SOP/004
Khan river vegetation	JE65/OWM/002

Water is a scarce resource in the Namib Desert, where Rössing is located and as a management measure, Rössing continuously aims to reduce its water consumption per tonne of U_3O_8.

Two major permits of the DWA have been issued to Rössing – the industrial and domestic effluent disposal exemption permit (current number 674) and the abstraction permit 10200 for the Khan River well field. The objectives of the industrial and domestic effluent disposal exemption permit as stated by the DWA are to regulate the disposal of effluents produced by the mine and to prevent the spread of groundwater pollution from effluent or waste disposal sites into the receiving environment.

5.2.3. MANAGEMENT OF BIODIVERSITY AND REHABILITATION[84]

In 2004 Rossing launched its Biodiversity Strategy at the International Union for the Conservation of Nature (IUCN) World Congress in Bangkok. The strategy outlines the goal to have a ‘Net Positive Impact’ (NPI) on biodiversity on losses (impacts) and gains (offsets and restoration) by minimising the impacts of its businesses and contributing to biodiversity conservation to ensure that a region ultimately benefits as a result of its presence. By 2015, every site listed as High or Very High under the Global Biodiversity Values Assessment will have planned, costed, and commenced implementation of its NPI strategy. Rössing is listed as Very High.

[84] Smit, (2012)

Rössing's Environment Standard E3 (Biodiversity, rehabilitation and Land use management) prescribes the implementation of an overall land management direction for each site. Accordingly, concepts such as avoidance and mitigation are well embedded in decisions with land use implications. In addition to the E3 Standard , the Biodiversity Action Plan (BAP) was developed to manage biodiversity aspects.

Rössing's BAP provides a mechanism to assess, prioritise and develop actions to address biodiversity risks and opportunities. Biodiversity management at Rössing is closely coupled to many other internal assurance processes such as community baseline assessments, Five Year Communities plans and SEIAs.
As custodian over ML 28, Rössing subscribes to minimising impacts of its operations and the maintenance and progression of biodiversity (through concrete as well as inferred conservation measures) on the land belonging to Rössing and in recognition and close cooperation with the neighbouring #Gaingu Conservancy, Namib-Naukluft and Dorob National Parks. Rössing is furthermore committed to enhance biodiversity protection by assessing and considering ecological values and land use aspects in investment, operational and closure initiatives.

Current biodiversity management at Rössing aims at achieving NPI before mine closure. The following outcomes need to be met:

- Continuous improvement of the biodiversity knowledge base
- Adverse impacts are constantly avoided and minimized
- Rehabilitation tasks are part of operational activities
- Additional conservation actions are supported to ensure sustainable landscape- and region-wide biodiversity benefits.
- Residual impacts are accurately calculated and compensatory offsets are implemented and are sustainable.

Biodiversity management activities at Rössing currently focus on the following:

- Monitoring, recording and reporting of biodiversity (including collection and identification) and making biodiversity information of Rössing and the central Namib more accessible
- Stakeholder engagement and awareness building, including the annual Birdwatching Day,
- Continuous updating, refinement and re-alignment of ongoing work identified in the BAP, and
- In cooperation with land use management and closure planning, investigate and plan rehabilitation at Rössing.

In 2011 it was decided to conduct an in-depth floral survey of under-collected biotopes at Rössing and a re-analysis of previously collected data plant data[85]. A total of 133 sample points was used and a total of 21 biotopes were identified at Rössing (Figure 5.10). Four biotopes were identified as Critical: the *Euphorbia virosa* belt (in which the open pit and waste rock dumps are located); the Khan River Mountains; the south-east gneiss hills and the undulating granite hills. Seven biotopes are rated as Rare and all others have a General rating.

[85] Burke, (2011)

Initially only two plant species occurring at Rössing are thought to be of particular concern. The charismatic 'elephant's foot' *Adenia pechuelli*, occurs in relatively high concentrations on rocky hillsides. Formerly classified as near-threatened, it is now realized that the plant has a wide distribution in the Namib Desert and escarpment of Namibia and was down-listed in 2009 as a result. Thus, only *Lithops ruschiorum* remained as a species of concern from the earlier data. This *Lithops* species is believed to have a very restricted range in Namibia and is sought-after by collectors. Rössing possibly has the largest population of this plant in Namibia (around 25%). The species is the focus of continuous attention and research worldwide[86].

Following the 2011-survey, however, the number of recorded plant species in the Mining Licence area increased by over 100 species from 140 in 2005 to 253. A total of 68 plant species of conservation importance are now considered for the rating of biotopes.

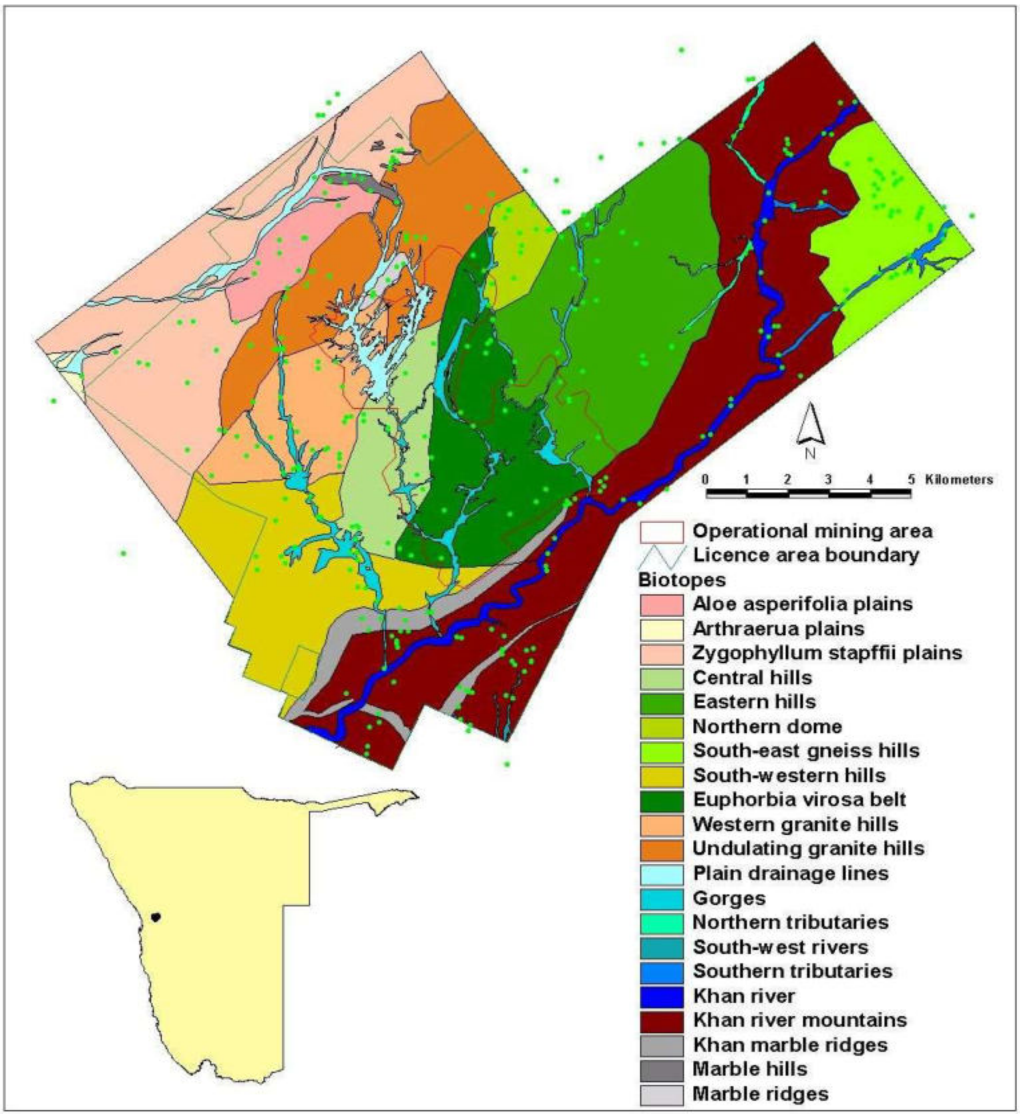

Figure 5.10: Biotopes at Rössing

[86] Loots, (2011)

Invertebrate monitoring is ongoing at Rössing. Specialist identification of some species is challenging due to limited taxonomic capacity globally. As a solution a network of specialists in Namibia, South Africa and elsewhere is requested to do the identification. Since 2010 invertebrate monitoring at Rössing focused specifically on representation within the wider landscape. Reasoning for this is to specifically collect and / or re-discover the eighteen invertebrate species within the Critical, Endangered or Vulnerable categories identified in the earlier surveys since the 1980s. Occurrence of some of the target species is presumably limited to rocky hillside habitats. To determine the habitat compatibility the positioning of the sites identified in the 1980s was correlated and amended accordingly.

Biodiversity at Rössing is well studied over more than three decades – in fact, some regard it as over-studied when compared to the surroundings, including the Namib-Naukluft Park[87]. From the knowledge based built up over the three decades, there emerged also a need for better understanding the bigger picture, the entire landscape, in particular connections, patterns and processes. Categorisation of biodiversity is further hampered by the low level of biodiversity sampling outside the boundaries of Rössing. As a worst-case example, some invertebrates are known only from one specimen trapped during field surveys undertaken in the 1980s[88].

Improved understanding of biodiversity at Rössing provides important insights into rehabilitation requirements. Because about 90% of the disturbed area at Rössing is in operational use, rehabilitation interventions are limited to demolishing redundant infrastructure and facilities, and stabilising and clean-up activities throughout the Life of Mine.

Efforts were made since the 1980s to promote human-induced revegetation of the tailings facility. The learning from this endeavour asks many questions in terms of kind of species, methodology, duration of intervention, etc. Irrigation also proved expensive and impractical under the arid conditions and shows a high failure risk. This experience convincingly indicated that biophysical conditions need to be rehabilitated to allow natural vegetation endemic to the Namib to re-establish itself in disturbed areas.

Demolition, clean up and partial remedial efforts have been in progress since 1995. A number of facilities and waste sites were rehabilitated until 1998. Financed from operational budgets, the total area in question measures about 90 ha. No restoration interventions have been made; instead passive, but supported restoration is preferred. Natural re-growth is evident in most formerly disturbed sites at Rössing, regardless of the age or type of disturbance. Establishment of the perennials *Arthraerua leubnitziae* (pencil bush) and *Zygophyllum stapffii* (dollar bush) on these terrains indicates that, even without intervention, the mine will not leave its entire footprint devoid of life into perpetuity.[89]

Since the mid-2000s a number of areas on the mining lease have been drilled in search for new uranium bodies. A contractor, Namib HydroSearch, was requested to rehabilitate these areas as the exploration program allowed it. Exploration in the Z19 and Z20 areas commenced again in the 2020's with Z20 exploration currently ongoing.

[87] Brett, (2009)
[88] EEAN, (2008)
[89] Burke, (2010)

The progressive rehabilitation programme was resuscitated in 2010 with the demolition of the acid plant and other redundant infrastructure. Currently, rehabilitation at Rössing entails several mechanical activities such as demolishing, remediation, geotechnical stability and protection against erosion.

Demanding climatic conditions, the scarcity of surface water, a high number of species adapted to aridity, and the lack of topsoil are some of the key biophysical determinants and are taken into account in the rehabilitation attempts at Rössing. Rehabilitation aims to initiate and accelerate natural recovery processes, a principle most appropriate to conditions in the Namib Desert where functioning of ecosystems at the landscape level requires special emphasis[90]. In order to facilitate natural recovery, the following base conditions have to be met:

- Suitable substrate needs to be available (stable, correct physical and chemical soil properties)
- Man-made landforms have to be suitable to support plant growth (no erosion and slope shapes and angles favouring seed and water catchment)
- The hydrological conditions need to be right to sustain natural processes
- Re-colonisation sources need to be nearby, and
- No pollution or other disturbances should interfere with the process of natural recovery.

Although rehabilitation is done as far as possible at Rössing, it is unlikely that all disturbed land will be rehabilitated. Backfilling the open pit, for example, is not a viable option. It is thus important to realize at an early stage that the residual impact area has to be calculated accurately and needs to be offset. Guidance from legislative and regulatory frameworks on biodiversity offsets and rehabilitation criteria in Namibia is limited. The sustainability of some offset opportunities is also questionable. The existence of exit plans and clarity with regard to relinquishment of land are some of the important prerequisites for Rössing.

Undoubtedly, the Namib Desert is one of the major attractions for visitors to Namibia. The part where Rössing is located is known for its scenic landscapes, picturesque vistas, solitude and uniquely adapted biotic life. Collectively refer to as *sense of place* these aspects of the Namib Desert are highly appreciated by many. Rössing highly respects *sense of place*. Rössing believes that maintaining this natural *sense of place* throughout the Life of Mine will result in a positive legacy after closure. This will be to the economic benefit of the region and to the enjoyment for the visiting tourist and the community member alike. Rehabilitation is a key initiative to achieve this vision.

5.2.4. MANAGEMENT OF NON-MINERAL WASTE

Namibian legislation is not particularly clear about the various types and definitions of waste, its management requirements and the agencies responsible. Currently at least eight ministerial bodies deal with waste management and pollution control in Namibia. Furthermore, there are no applicable national policies and standards in terms of waste management. The draft Pollution Control and Waste Management Bill is designed to address existing deficiencies and consolidate the legal framework while addressing related institutional fragmentation.

[90] Burke, (2005a)

In the absence of a clear legislative framework, Rössing uses international standards such as ISO 14001:2015 as well as the Rössing Uranium Environmental Performance Standard E4 (Mineral waste, acidic and other impacted drainage control) for conformances and compliance in waste management. Classification and disposal guidelines have been taken from the South African *Minimum requirements for the handling, classification and disposal of waste (2nd Edition)*[91]. Accordingly, Rössing defines non-mineral (solid) waste as a generic term for waste not generated from mineral ore that comprises of redundant conveyor belts, domestic waste, wood pallets, building rubble; commercial and general dry industrial waste. It may also contain small quantities of hazardous substances dispersed within it, for example, batteries, and insecticides on domestic and commercial premises[92].

Waste products are thus divided into two classes. **General waste** is waste that does not pose a significant threat to public health or the environment if properly managed. Examples include domestic, commercial, certain industrial wastes and builder's rubble. Domestic waste is classified as general waste, even though it may contain hazardous components. This is because the quantities and qualities of hazardous substances in domestic waste are sufficiently small to be disregarded as a potential risk. General waste may be disposed of at any licensed landfill site.

Hazardous waste is waste that has the potential, even in low concentrations, to have a significant adverse effect on public health and the environment because of its inherent toxicological, chemical and physical characteristics. Hazardous waste requires stringent control and management, to prevent harm or damage and hence liabilities. It may only be disposed of at a licensed hazardous waste landfill site. Under the precautionary principle, waste is regarded as hazardous where there is any doubt about the potential danger of the waste stream to man or the environment.

Throughout the whole operation various waste products are generated. Effective and responsible waste handling and disposal are key elements of any environmental management system. All waste streams at Rössing are characterized, an inventory was composed and a risk assessment was undertaken to put operational procedures to regulate the management of the various waste items in place. An over-arching non-mineral waste management plan is in place to ensure sound non-mineral waste management through minimization of waste generation and safe handling, treatment and disposal of waste. The plan addresses all non-mineral wastes generated at Rössing during the operational as well as the decommissioning phases. A database for historical waste dumps is also maintained and guidance for the remediation of these sites during operations exists.

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[91] (South African) Department of Water Affairs and Forestry, (1998)

[92] The draft Pollution Control and Waste Management Bill refers to waste as '*an undesirable or superfluous by-product, emission, or residue of any process or activity that has been discarded, accumulated or been stored for the purpose of discarding or processing. Waste products may be gaseous, liquid, solid or any combination thereof. Waste may originate from domestic, commercial or industrial activities, and include sewage sludge, radioactive waste, building rubble, as well as mining, metallurgical and power generation waste*.

The bill defines hazardous waste as '*any pesticide, herbicide or other biocide, radioactive substance, chemical or other substance and any micro-organism or energy form that has properties that, either by themselves, or in combination with any other thing, make it hazardous to human health or safety, or to the environment, and includes any substance, micro-organism or energy form defined as a hazardous substance in (future) regulations'*

Review of the waste management plan is conducted at least every four years. In short the objectives of the plan are:

- Avoid waste generation – the use of substitutes or alternative processes reduces the volume of total wastes and hence management requirements
- Reduce waste generation – waste reduction reduce costs of further treatment and decrease the risk of pollution associated with disposal facilities
- Segregate waste – allows for different waste streams to be recycled, reused or disposed of correctly
- Re-use and recycle waste – reduces the volume of waste disposed of and has the potential to improve economic gain

Specific targets for waste management at Rössing are set annually and progress are monitored and reported monthly, six-monthly and annually. Effectiveness is measured against the following performance indicators:

- Number of non-conformances recorded.
- Increase in number of recycled/re-used waste.
- Reduction in waste generated.
- Incidents of pollution.

All procedures for segregation, temporary storage and eventual transportation of waste are written up and authorised. Area owners are held responsible for the classification of the waste generated in their area and the management of safe and responsible handling and disposal of waste from their areas. Sorting of waste material is carried out at source, prior to removal. Collecting points of waste are demarcated and the disposal bins color-coded. Bins are placed in such a way that it ensures free access, for disposal as well as removal. Used grease and oil are contained and dispatch to storage area as per procedure JE50/WMP/002.

Waste bins on site are regularly removed, emptied and replaced in such a way that they do not become overfilled. The waste is also weighed and a register is kept for reporting against targets. General waste is disposed at a licensed landfill site offsite and managed to comply with all legislative requirements (environmental, safety and health). Access to the landfill and other disposal sites are controlled. The external recycling sites are frequently inspected and audited on a two yearly cycle. Records of waste generated, stored and disposed of are filed and maintained. Groundwater in the vicinity of the landfill site is monitored, according to operational procedure.

In the work areas frequent inspections are done to ensure compliance with procedures and that the management system is working effectively. These inspections cover waste segregation, storage, general housekeeping, and management of hydrocarbon and chemicals. All non-conformances identified during inspections are communicated to area owners and reported in order to investigate the causes of such non-conformances, to take corrective measures and to put measures in place to prevent similar future occurrences.

Disposal of recyclable items at the landfill site is restricted, as far as possible. Adequate resources are provided to ensure that salvageable waste material is collected and removed in such a way that the areas comply with all legislative requirements (environmental, safety and health). Radiation clearance is required before recyclable items and scrap metal are removed from site. Plastic containers (5, 10, 20, 25l) are holed and pressed before taken off site for disposal to prevent unauthorized use by third parties. Empty 210L drums are removed to a temporary storage yard from where they are removed in bulk for recycling. Access to the temporary storage yard is controlled.

Redundant material and equipment that could potentially be contaminated on the mine site are not allowed to be taken offsite. This includes items such as pumps, tanks, pipes, concrete surfaces, soil, resin and infrastructure found in the processing plant of the mine. Contaminated objects are segregated according to the criteria contained in a procedure (JK65/PRD/101-Monitoring and identification of contaminated items). Transport is conducted according to provisions contained in the procedure (JK65/PRD/007-Transport of contaminated items) and disposal is done in accordance with another procedure (JK65/PRD/003-Disposal of contaminated items). Disposal of contaminated material is on the tailings facility where the quantity and disposal location of contaminated waste is recorded. Access to the contaminated waste disposal site is controlled.

Non-mineral waste is waste materials that are not generated from the mineral ore, for example redundant conveyor belts, chemicals, domestic waste, wood pallets, building rubble, scrap materials, used oils, and lubricants from maintenance activities. If waste is not stored and treated properly, it has a negative impact on the environment, health, and safety of the employees.

5.2.5. MANAGEMENT OF MINERAL WASTE

At Rössing mineral wastes are identified as waste rock and overburden, tailings and in the future heap leach waste (ripios). While Rössing managed the disposal of these waste streams throughout the Life of Mine, this was not always done through a formal waste management plan. A formal management plan for mineral waste is required by the Rössing Uranium Environmental Performance Standard E4 (Mineral waste, acidic and other impacted drainage control). The Standard sets the criteria against which Rössing is audited. It stipulates, inter alia, that waste disposal facilities should be located and designed to minimize environmental, health, safety and community impacts and risks. Facility location and design should be consistent with the long-term physical and chemical behaviour of the waste and must result in repositories that are physically and chemically safe and stable during operation and after closure.

Waste storage facilities are placed within permitted areas only. Considerations in the placement are:

- Preferentially placing waste within inactive open pits, underground workings or within existing disturbed areas
- Tying waste repositories into the surrounding topography to maintain regional drainage patterns and reduce visual impacts
- Avoiding placement on land with high biodiversity or ecosystem services values
- Avoiding placement in or near perennial surface water bodies or in large ephemeral drainage lines
- Avoiding placement of chemically reactive waste over important groundwater aquifers or recharge zones
- Avoiding placement in areas with significant archaeological or social value
- Avoiding placement in close proximity to local communities
- Preferentially placing chemically reactive wastes in drainage basins that already contain reactive waste (thereby avoiding placement in pristine drainages)

- Avoiding placement in areas with poor foundation conditions due to topography, underlying geology or hydrology.
- Balancing economic considerations such as haul profiles, potential resource sterilization, and pumping costs with environmental, social and closure considerations.

The Rössing Mineral Waste Management Plan (JE20MMP009) is developed to comply with the standard as well as Namibian regulatory requirements. The intent of the plan is to ensure sound and effective mineral waste management by the minimization of waste generation and ensuring the safe handling, treatment and disposal of these wastes. The 3-yearly review of the Mineral Waste Management Plan for Rössing was done in 2022.

The purpose of the plan is to provide a documented record of issues related to mineral waste and to manage all mineral waste produced at Rössing in such a manner that disposal facilities and sites must be physically, biologically and chemically safe. For the purpose of this document mineral waste entails mineralised waste rock and processed waste rock (tailings), and excludes the dormant landfill site (where only non-mineral waste is disposed), commodities imported to site i.e. hydrocarbons, and sewage farms.

Waste rock dumps are typically coarse, angular fragments of very strong rock material that is resistant to mechanical disintegration and chemical decomposition, with the exceptions of amphibole schist and biotite schist. Both these are “minor” rocks in terms of volumes, and are furthermore mostly processed as ore. Typically thus, the Rössing dumps are of pervious, frictional material placed on competent, but steeply sloping foundations.

The mineral composition of waste rock consists mostly of quartz, albite, microcline (both feldspars) and mica. Marbles layers add calcite or dolomite to the list, while weathered samples can contain chloritoid, kaolin or gypsum. Waste rock has higher CaO and MgO contents than ore, which is mainly due to the marble present. Tailings material has a very similar composition with predominant quartz, albite, microcline, mica and small amounts of calcite or gypsum. Precipitates at the tailings facility are composed of chloritoid, potassium and ammonium jarosite, ammonium aluminium sulphate, ammonium manganese sulphate hydrate, quartz, feldspars and some mica. Ore and tailings are quite similar, except for the higher sulphur concentration in tailings, which can be ascribed to sulphate minerals such as jarosite and gypsum in tailings.

An inventory of mineral waste at Rössing is kept. It reflects the tonnage per year, the cumulative tonnage, surface area, volume and the location of waste. Site maps are maintained. The spatial footprint of mineral waste is also maintained and annually reported. Identification of the primary hazards posed by mineral waste is done. Primary hazards associated with mineral waste, reflecting the potential impacts, at Rössing are:

- Radioactivity from waste rock, low grade storage facilities and tailings facility (radon emanation and radionuclides in dust)
- Although there is a possibility that asbestos and asbestiform can be found in dust from the pit and crushing plant because of metamorphosed magnesium carbonate (such as marble) and the presence of serpentine, none has been found when monitoring so far
- Uranium and its decay products can be released into seepage water (from the tailings facility)
- Acidic drainage is possible where mineral wastes are in contact with water

- Residual nitrate, from the use of blasting agents, can be solubilised from waste rock and migrate to underlying groundwater

Reshaping of the huge man-made landforms represented by the waste rock dumps and the tailings facility needs to be minimised at closure and to achieve this aim, dumping progressively meets the final landform requirements. Additional work following closure (monitoring and maintenance) should thus be limited. With this in mind, Rössing follows a Waste Rock Disposal Planning and Design Strategy and in the case of the tailings facility an operating manual sets out the procedures to be followed in accordance with the engineering design. The following management objectives are emphasised:

- Geotechnical stability and access
- Radiation and radon emanation
- Surface drainage and rainwater leaching
- Rehabilitation and restoration requirements
- Visual appearance and aesthetics

Mineral waste facilities need to be geotechnically and erosionally safe and stable, not only during operation but also after closure. The waste rock dumps and tailings facility need to undergo a full geotechnical and geochemical review by an appropriately qualified independent engineering specialist at least once every two year. Information needs to be reviewed regularly and historical trends are examined so that the longer-term chemical behaviour can be assessed. Operation, safety and environmental aspects are periodically reviewed during an inspection by a suitably experienced and qualified engineer.

A good understanding of geotechnical factors governing mineral waste dump stability and the potential modes of failure at Rössing exist and directives for planning, design, construction and operation of these dumps are in place. Operational manuals regulate the management of the waste rock dumps as well as the tailings facility and comply with the RUL Management of Pit Slopes, Stockpiles, Spoils and Waste Dumps (RUL Safety Standard D3). The likelihood of injury to humans and wildlife is minimized through the design, construction and access control and through ensuring (geotechnical) stable conditions. In addition the facilities are made inaccessible for temporary and long-term use or habitation.

Inspections of the tailings facility are carried out quarterly by Water Waste and Land (WWL) Australia. Consultants from WWL and AQ2 undertake biannual reviews and produce a report to document the proceedings, findings and recommendations for improvement.

Radiation management at Rössing is regulated by the Radiation Management Plan (JK20/MMP/001). The radiation potential from mineral waste forms an integral part of the management plan, which aim to ensure that sources of ionising radiation are identified, quantified, controlled and minimised limited, and that exposures to these sources are limited. Dust management is regulated by several operational procedures, coordinated within the Rössing's Air Quality Management Plan (JE20/MMP/004).

The main source of potential groundwater pollution at Rössing is the tailings facility. Due to the acid-leaching process employed at Rössing the tailings solution is acidic and contains residual process chemicals, heavy metals and radio-nuclides. Another source of groundwater contamination is leaching of nitrate, sulphate and uranium from the waste rock deposits overlying the gorges.

To ensure that water quality parameters remain as close as possible to the range of natural variability and to allow optimal water use after closure implies that surface water, groundwater and the biophysical environment is protected against exposure to hazardous waterborne chemicals. The surfaces of mineral waste dump facilities are therefore inward sloped to ensure that surface drainage is not allowed outwards. Downstream cut-off trenches prevent contaminated water to enter the Khan River.

A key mineralogical hazard to be considered is acidic drainage from mineral wastes (RUL Environmental Standard E4). Column rainwater leach tests on samples from the various waste rock disposal areas and low-grade ore stockpiles at Rössing indicated a possibility of acid rock drainage (ARD) from certain minerals, particularly those contained in the pyritic quartzite unit. But this rock type is mostly found within the ore material and it is processed through the plant. Thus, there is very little chance of ARD being formed at the rock waste dumps, but only at the tailings facility.

The low sulphide content of coarser mineral wastes and the neutralisation capacity of the marble lower the potential to generate acid rock drainage in the waste rock dumps further. Finally, the potential of the Rössing waste rock dumps to generate acid rock drainage is minimal due to the arid climate (average annual rainfall around 14 mm and net evaporation potential of 6,784 m^3/day).

Investigations and risk assessments were carried out to understand the stability and seepage of the tailings facility in terms of layout, geometry and raised embankments with and without remedial measures (i.e. buttressing). Input data is obtained from previous studies and reports, seepage modelling, piezometer readings and seismic loading criteria. Outputs from the seepage models are applied as input parameters into slope stability assessments.

The probability of major incidents and excessive rainfall event (for example slope stability failure and overtopping) occurring at the tailings facility will be minimised as long as the procedures of the operating manual are followed. Monitoring systems are in place to give early warning of the preventable hazards. If, however, an emergency situation does arise, the emergency response plan as described in the operating manual is to be followed. In an event which is not covered by the established plans, the situation is to be managed by the BRRP. Although major incidents involving the waste dump storage facilities are not listed in the BRRP, this programme will be used in the event of any major incident to the rock waste dumps.

The waste rock dumps and the tailings facility will remain as man-made landforms at mine closure. Visual impacts of the final landforms are minimized in order to maintain the characteristics and attractiveness of the surrounding landscape. Deposition of mineral waste is thus scheduled in such a way that it complements the contours of the surrounding landscape. A state that allows passive revegetation and integration into functioning ecosystems is the preferred option.

5.3 THE DECOMMISSIONING PHASE

Any kind of development project has a lifetime. A mining project has a lifetime too, and the lifetime is normally limited to a few decades. As soon as mining becomes uneconomical, it is time to close a mine. Closure planning is an essential part of a mine's life cycle: it is a way of ensuring that all impacts are managed until the end of a mine's working life.

Closure planning is a continuous process at Rössing, and changes in operational circumstances, environmental conditions, legislative and regulatory frameworks, and stakeholder expectations were considered every time Closure Management plan is updated.

5.3.1 CLOSURE PLANNING: THE APPROACH

Closure planning at Rössing is driven by the Rössing Closure Standard and accompanying Guidance Notes, whilst also taking account of the guidance from the Chamber of Mines of Namibia and current draft on Mine Closure Framework being developed by Ministry OF Mines and Energy. Planning entails the development, maintenance and management of a process for eventual closure, which addresses all relevant aspects and impacts of closure in an integrated and multi-disciplinary way, and provides a fully scoped and accurate cost of closure to the company that is documented and auditable.

The Rössing Closure Standard and Guidance Notes are based on best industry practice and are compatible with the International Council for Mining and Metals' sustainable development principles. This Standard aligns the design, development, operation and closure of operations to ensure that adverse impacts on the human and natural environment are minimised and that a legacy remains which makes a positive contribution, i.e. that post-closure outcomes are optimised in terms of social, environmental and economic needs and expectations. Specifically, The Standard is intended to guide –

- improving the accuracy of closure cost estimates
- minimising the costs of closure
- the continued integration of closure planning into business plans
- the realisation of positive legacies for communities
- increased host community ownership for post-operational outcomes
- enhancement of Rössing's reputation, and
- Compliance with all applicable legal and other requirements.

The Guidance Note to the Rössing Closure Standard assists operations in meeting the requirements of the Standard with which operations are obliged to comply. There are also several other Rössing standards and guidance documents of relevance to closure planning. In summary, these documents contain guidelines on the following aspects:

- Planning for closure
    - The knowledge base
    - Closure strategy
    - Closure Management Plan and
    - Decommissioning Plan
- Implementation and operation
- Performance measurement
    - Cost estimating

- Review and monitoring

Thorough and comprehensive definition of the scope of measures to be undertaken at closure is necessary in order to reach a realistic estimation of the costs, and to provide assurance to shareholders that adequate financial provision for closure has been made. Reporting of closure provisions to the corporate body is an annual event.

The Minerals Policy for Namibia (2003) requires a Final Mine Closure Plan to be prepared before a Mining Licence is granted and the Chamber of Mines of Namibia has recently published its draft framework for mine closure[93]. The latter is based on the Australian Strategic Framework for Mine Closure with the aim of developing relevant and practical closure plans.

The initial closure plan dated, 2005 foresaw the potential closure of Rössing in 2009 or 2016, based on the prevailing business climate at the time. The closure plan which was updated in 2011, was based on the 2026 mine closure scenario.

The latest full closure plan update was prepared in 2022, this document was presented to MME, MEFT, MAWLR and NRPA and copies thereof were submitted to these regulators.

5.3.2 CLOSURE PLANNING AT RÖSSING[94]

Closure plans, including costing and provision of financial sureties, are based on approved Life of Mine plans only. This means that at the stage when a new expansion plan is approved, provisions are set aside on a continuous basis until the full cost is provided before the end of Life of Mine, or project.

Closure strategies are developed during the financial and technical feasibility studies for projects. Increasing levels of closure detail are developed as the studies progress from an initial concept via the stages of order of magnitude, prefeasibility, feasibility and final design. If a project finally results in an activity that becomes part of Rössing's operations (and thus part of the Life of Mine plan), the scope of the Closure Plan for Rössing is adapted accordingly to include the additional activities.

Rössing's closure plans are guided by an aspirational vision for closure that is translated into objectives and targets. In order to achieve those, a closure strategy is developed by analysing impact mitigation alternatives using sustainable development criteria and choosing a preferred alternative for each aspect or facility. Implementation plans for these preferred alternatives are then developed and the necessary closure costs calculated. Closure cost calculations are updated annually. The present closure obligation for Rössing is calculated at N$1,630m.

A Rössing Rehabilitation Trust Fund was established and makes provision for closure expenditure that will be incurred by the mine, in order to comply with statutory obligations and the requirements of the Ministry of Mines and Energy as well as the Ministry of Environment and Tourism. Clause 15.2 of the Trust Fund Agreement stipulates: *The mining company shall before the end of its financial year concerned, pay to the Fund a contribution towards the estimated cost of implementing the measures so approved.* The agreement also stipulates the formula to be used to calculate the annual contribution.

[93] Chamber of Mines of Namibia, (2009)
[94] Information for this section was obtained from the Rössing Closure Plan, (2011)

As at the end of 2023, the Rössing Rehabilitation Trust Fund had a cash balance of N$1,632m.

The Closure Plan presents a defined closure strategy, an extensive knowledge base, and the costing and scheduling of activities that were developed for the 2026 closure scenario. Rössing Uranium Limited intends to implement mine closure according to the discussions and conclusions detailed in this Closure Plan, and will provide adequate resources to achieve this goal. Should mine closure become inevitable unexpectedly, due to *force majeure*, the Closure Plan might have to be modified according to prevailing circumstances, but it will nonetheless guide the closure process according to the concepts it contains.

Under the current scenario backfilling of the open pit at Rössing is not considered as a viable option at the time when the mine closes. With this presumption in mind, current operations at the open pit are guided by the following management objectives:

- to minimise the likelihood of injury to humans and wildlife by means of appropriate design and constructing, access control and providing safe and stable conditions
- to manage radiological protection so that doses do not exceed allowable limits and prescribed constraints
- to minimise surveillance and maintenance needs at the time of mine closure through appropriate design of the pit void and associated control structures
- to maximise the beneficial use of the pit at the time of mine closure.

In summary closure measures are detailed and include

- No backfilling of the open pit with mineral waste; use of the open pit as evaporation area for reclaimed surface seepage as well as a containment area for contaminated infrastructure and demolition materials; and covering of waste in the pit with a 10 m-layer of waste rock to minimise the likelihood of scavenging for materials.
- Demolition of plant facilities where infrastructure is not suited to further beneficial use; removal of contaminated materials to onsite hazardous waste facility; and remediation of areas no further to be used.
- Covering tailings facility walls and beaches with rock to control erosion; access restriction to tailings facility with fencing and signage; control systems for groundwater management to continue for 30 years after closure; continued operation of seepage control system until seepage has stopped; removal of dust plumes from around tailings dam and disposal in tailings dam; visual blending of tailings into environment with rock coverings; and regular monitoring and maintenance of pumping system.

6 APPENDIX 1: LEGISLATIVE FRAMEWORK

Statutory requirements relevant to environmental management at Rössing, according to Rössing's Environmental and Health and Safety Legal Register, could be divided between International Conventions, Regional Agreements, Domestic Legislations and Domestic Policies. The information contained in the Legal Register cannot be construed as legal advice but provides a summary of relevant international, regional and domestic laws and policies applicable to Rössing's operations in Namibia.

6.1 STATUTORY REQUIREMENTS

6.1.1 INTERNATIONAL CONVENTIONS AND REGIONAL AGREEMENTS

After independence in 1990 South African legislation remained prominent in Namibia but in some sectors it has been replaced by new laws. Presently some sectors are still regulated by outdated acts, or new legislation has only emerged to draft form. In some instances Namibian legislation has been enacted to give effect to obligations contained in international agreements.

In terms of the Namibian Constitution (Article 144), *"... the general rules of public international law and international agreements binding upon Namibia under this Constitution shall form part of the law of Namibia."* In short this means that all international agreements to which Namibia is a party automatically form part of Namibian law.

A summary of the international and regional laws and policies relevant to Rössing's operations in Namibia are listed below:

- United Nations Convention on the Law of the Sea, 1982
- Convention on Biological Diversity, 1992
- Vienna Convention for the Protection of the Ozone Layer, 1985
- Montreal Protocol on Substances that Delete the Ozone Layer, 1987
- United Nations Framework Convention on Climate Change, 1992
- Kyoto Protocol on the Framework Convention on Climate Change, 1998
- International Maritime Dangerous Goods (IMDG) Code

- SADC Environmental Policy and Regulatory Framework for Mining (2001)
- SADC Protocol on Mining (1997)

6.1.2 DOMESTIC LEGISLATION AND POLICIES

The Namibian Constitution contains two clauses, articles 91(c) and 95(I) that are of particular relevance to sound environmental management practice. In summary, these refer to:

- guarding against over-utilisation of biological natural resources;
- limiting over-exploitation of non-renewable resources;
- ensuring ecosystem functionality;
- protecting Namibia's sense of place and character;
- maintaining biological diversity; and
- pursuing sustainable natural resource use.

The State is committed to actively promote and maintaining the environmental welfare of Namibians by formulating and institutionalising policies that can realise sustainable development objectives. General principles for sustainable development and sound environmental management are part of acts such as the Environmental Management Act (No 7 of 2007).

The Environmental Management Act 2007 (Act No. 7 of 2007) was promulgated in December 2007 through Government Notice number 232 (GG 3966). The Act has three main purposes:

1. To make sure that people consider the impact of activities on the environment carefully and in good time.
2. To make sure that all interested or affected people have a chance to participate in environmental assessments.
3. To make sure that the findings of environmental assessments are considered before any decisions are made about activities that may affect the environment.

The Act came into operation in February 2012 through Government Notice No 28 (GG 4878). At the same time, regulations were promulgated that determine:

1. Listed activities that may not be undertaken without an Environmental Clearance Certificate (issued by the Environmental Commissioner).
2. The process to apply for the Environmental Clearance Certificate.
3. Environmental Impact Assessment regulations.

Listed activities that may not be undertaken without an Environmental Clearance Certificate are:

1. Energy generation, transmission and storage activities.
2. Waste management, treatment, handling and disposal activities.
3. Mining and quarrying activities.
4. Forestry activities.
5. Land use and development activities.
6. Tourism.
7. Agriculture and aquaculture activities.
8. Water resource developments.
9. Hazardous substance treatment, handling and storage.
10. Infrastructure.

Furthermore two definitions are of particular relevance:
Activity: “means any physical work that a proponent proposes to construct, operate, modify, decommission or abandon or an activity a proponent proposes to undertake”.

Construction: “means the building, erection or modification of a facility, structure or infrastructure that is necessary for the undertaking of an activity, including the modification, alteration, upgrading or decommissioning of such facility, structure or infrastructure”.

It is important to note that these regulations apply not only to new activities and construction, but also to the modification, alteration, upgrading and decommissioning of any existing facilities, structures or infrastructure.

As implied by the Act, an Environmental Management Plan must be submitted and approved by the relevant authorities. The Environmental Management Plan thus forms the foundation of environmental impact management, also at Rössing.

In terms of environmental management, the Namibian Constitution (Government of Namibia, 1990) and the Environmental Management Act (Act No 7 of 2007), the Environmental Assessment Policy (MET, 1994) and the Minerals Act (Act No 33 of 1992) provide particular guidance. In addition, a number of other pieces of legislation and policies are of relevance:

- Allied Health Professions Act 7 of 2004
- Atomic Energy and Radiation Protection Act 5 of 2005
- Atmospheric Pollution Prevention Ordinance 11 of 1976.
- Constitution of the Republic of Namibia 1 of 1990
- Electricity Act 4 of 2007
- Environmental Management Act 7 of 2007
- Explosives Act 26 of 1956
- Foreign Investment Act 27 of 1990
- Forest Act 12 of 2001
- Hazardous Substances Ordinance 14 of 1974
- Hospitals and Health Facilities Act 36 of 1994
- Labour Act 11 of 2007
- Marine Resources Act 27 of 2000 (and accompanying regulations Government Notice (GN) 241, Government Gazette (GG) 2657, 7/12/2001)
- Medicines and Related Substances Control Act 13 of 2003
- Minerals (Prospecting and Mining) Act 33 of 1992
- Mines, Works and Minerals Ordinance 20 of 1968: Regulations (GN143, GG2927 of 1 October 1968)
- Namibian Ports Authority Act 2 of 1994 and Port Regulations promulgated in terms of this section in GN 117 published in GG2549 of 5 June 2001
- National Heritage Act 27 of 2004
- Petroleum Products and Energy Act 13 of 1990 and regulations relating to the purchase, sale, supply, acquisition, usage, possession, disposal, storage, transportation, recovery and refinement of used mineral oil are published in GN 112 of 1991 (GG 281 of 21 October 1991) ("1991 regulations") and the petroleum product regulations are published in GN 155 of 2000 (GG 2357 of 23 June 2000) ("2000 regulations")
- Public Health Act 36 of 1919
- Road Traffic and Transport Act 22 of 1999
- Soil Conservation Act 76 of 1969 as amended in South Africa to March 1978
- Social Security Act 34 of 1994
- Water Act 54 of 1956
- Water Resources Management Act 11 of 2013

- Environmental Assessment Policy for Sustainable Development and Environmental Conservation, 1994
- National Environmental Health Policy, 2002
- Minerals Policy of Namibia, 2003
- General Environmental Assessment Guidelines for Mining (Onshore and Offshore) Sector of Namibia
- Policy for the Conservation of Biotic Diversity and Habitat Protection, 1994
- National Environmental Health Policy, 2002

7 APPENDIX 2: RÖSSING PROCEDURES

7.1 OPERATIONAL PROCEDURES RELEVANT TO THE HEALTH, SAFETY AND ENVIRONMENT MANAGEMENT SYSTEM

Code of Practice	
HSE Management System Code of Practice	JA05/COP/003
Procedures	
Environmental audit schedule	JA80/SCH/001
Monitoring and Measurement	JA65/MSP/001
Communication and Reporting	JA45/MSP/002
Document Control Procedure	JA40/MSP/003
Record keeping	JA75/MSP/004
Updating and review of Legal and other requirements	JA10/MSP/005
Hazard identification, risk evaluation and risk management	JA15/MSP/006
External Communications/Complaints	JA45/MSP/007
Reporting and investigation of HSE incidents and/or non-conformances	JA70/MSP/010 & MSP/011 merged
Training, competency and awareness	JA30/MSP/013
HSE Auditor Register	JA80/REG/001
HSE Audit Schedule	JA80/SCH/001
HSE Purchasing Criteria	JA35/MSP/013
Management of Change	JA 55/MSP/001
Appendix 1 - Proposal Form guidelines	JA 55/MSP/001.APP01
Appendix 2 - Level 1 Change	JA 55/MSP/001.APP02
Appendix 3 - Request Proposal Form	JA 55/MSP/001.APP03
HSE Committee Meetings for Rossing	JA45/MSP/008
HSE & Product Quality & Quantity Audit and inspection procedure for Rossing	JA80/MSP/001
Vendor pre-Qualification	JA35/PRC/001
Purchasing of chemicals	JA50/PRC/001
Sustainable sand management	JA50/PRC/003
Major Maintenance of Acid tanks	JA50/PRC/002
PPE Procedure	JA50/PRC/004
Customer Audit Procedure	JA80/PRC/002

7.1.1 HEALTH, SAFETY AND ENVIRONMENT MANAGEMENT PLANS

Sustainable sand management	JA20/MMP/003
Product Stewardship Plan	JA20/MMP/004
Biodiversity	JA20/MMP/005
Tailings Dam Dust Management Plan	JA20/MMP/010
Radiation Management Plan	JK20/MMP/001
Non-Mineral Waste Management Plan	JE20/MMP/001
Hazardous Material and Contamination Control Management Plan	JE20/MMP/002
Greenhouse Gas Emissions Management Plan	JE20/MMP/003
Air Quality Management Plan	JE20/MMP/004
Biodiversity Action Plan	JE20/MMP/006
Noise and vibration management plan	JE20/MMP/008
Mineral waste management plan	JE20/MMP/009
Water Management Plan	JA10/MMP/001

7.1.2 HEALTH, SAFETY AND ENVIRONMENT POLICIES

HSE Policy	JA05/POL/001
RUL Smoking Policy	JK05/POL/001
PPE Policy	JA05/POL/002
Fatigue Management Policy	JA05/POL/003
Clean Shaven Policy	JK05/POL/003
RUL Alcohol & Drug Policy	JK05/POL/004
Occupational Exposure Limits applied at Rössing	JK50/STD/001
HSE Policy Strategies	JA10/STR/001
HIV & Aids Policy Agreement	
Golden Rules	JA05/CHK/COP003 App006
Mobile Phone Usage Policy	JH05/POL/001

7.2 OPERATIONAL PROCEDURES RELEVANT TO HEALTH

Codes of Practice	
Peer Educator Programme	JK45/COP/001
Occ. Hygiene Monitoring	JK65/COP/002
Control of Asbestos at work	JK65/COP/003
Respiratory Protection Programme	JK65/COP/004
Thermal Stress	JK65/COP/005
Protection Against Ionising Radiation	JK65/COP/006
Protection Against Ultra Violet Radiation	JK65/COP/007
Control of Substances Hazardous to Health	JK65/COP/008
Hearing Conservation	JK65/COP/009
Human Vibration Protection	JK65/COP/011
Procedures	
Maintenance work carried out on the CIX contactors	JK50/PCL/001
Aerotesting Procedure	JK65/PIN/001
Operating the Thermo Eberline Handecount	JK65/PIN/002
Instrument Procedure for the Automess 6150 AD4 Dose Rate Meter	JK65/PIN/003
Operating Instructions for the Electra and DP2R/4A Probe	JK65/PIN/004
Management of Health Instruments and equipment.doc	JK65/PIN/005
Personal Monitoring of LLRD using the Myriam Instrument	JK65/PIN/006
Personal monitoring of RDP using the DoseManPro instrument	JK65/PIN/007
Thermal Stress	JK65/PRC/001
Maintenance of Water Coolers and Emergency Units	JK50/PRC/002
Area Noise Survey	JK65/PRC/003
Personal Noise Survey	JK65/PRC/004
Alcohol & Drug Testing Procedure for Cottage	JK65/PRC/005
Alcohol & Drug Testing Procedure for Windhoek	JK65/PRC/006
Confined Space Clearances	JK65/PRC/007
Measurement of Whole Body Vibration	JK65/PRC/008
Measurement of Hand-arm Vibration	JK65/PRC/009
Particulate Monitoring Particulates, Mists, Fumes and Vapours	JK65/PRC/010
Diesel Particulate Monitoring	JK65/PRC/011
Alcohol & Drug Procedure	JK65/PRC/012
Wood dust Monitoring	JK65/PRC/013
Confine Space clearances	JK65/PRC/014
HIV & Aids Transfer Procedure	JK65/PRC/015

7.4.1 OPERATIONAL PROCEDURES RELEVANT TO RADIATION

Radiation Protection when working with Sealed Radiation Sources	JK50/PRD/001
Urinalysis Sampling Procedure	JK65/PRD/002
Disposal of Contaminated Items	JK65/PRD/003
Removal of Scrap	JK65/PRD/004
Removal of Equipment and Material from Site	JK65/PRD/005
Decontamination of Contaminated Items	JK65/PRD/006
Transport of Contaminated Items	JK65/PRD/007
Monitoring of Employees Exiting FPR During unavailability of Thermo Electron PCM-2 Portal Monitor	JK65/PRD/008
Uranium Oxide Spillage	JK60/PRD/009
Monitoring & Identification of Contaminated Items	JK65/PRD/010
Product Shipment Inspection & Monitoring	JK65/PRD/011
Baseline Monitoring of Empty Containers	JK65/PRD/012
Analysis of Smear Sample for Alpha Radiation with Handecount	JK65/PRD/013
Procedures for Maintenance Work Carried out on the CIX Contactors	JK50/PRD/014
Area Radiation Survey for Total Alpha and Beta Contamination	JK65/PRD/015
Area Survey for External Gamma Radiation	JK65/PRD/016
Area Radiation Contamination Survey using Smear Samples	JK65/PRD/017
Contact radiation monitoring (Beta/Gamma) in Final Product Recovery	JK65/PRD/018
The monitoring of Personal Radiation Dose	JK65/PRD/019
Personal External Dose Monitoring with a Dosicard	JK65/PRD/020
Monthly pregnancy test	JK65/PRD/021
Container Packing & Strapping Procedure	JK65/PRD/022
Personal monitoring of RDP using the DoseManPro instrument	JK65/PRD/023
Scales Calibration	JK65/PRD/024
Determination of transport requirements for transporting radioactive materials"?	JK65/PRD/025
Microwave testing	JK65/PRD/026
Guidelines on Equipment leaving site	JK65/PRD/027
Alpha Analysis of Smear Samples with the Hand-E-Count (new instrument	JK65/PRD/028
Low Frequency EMF workplace Analysis	JK65/PRD/029
	FPR10
Inspection of Drums	FPR11
Drum Information Stencilling	FPR12
Drum Packing and Handling of Containers	FPR13

7.3 OPERATIONAL PROCEDURES RELEVANT TO SAFETY

Codes of Practice	
Vehicles and Driving	JH50/COP/007
Off-site Vehicles and Driving Standard	Appendix A
Cranes and Lifting	JH50/COP/011
First Responder Training	JH50/COP/012
Storage of flammable and Explosive Material	JH50/COP/013
Aisles, Storage and Demarcating	JH50/COP/014
Stacking and Storage	JH50/COP/015
Colour Coding	JH50/COP/016
Barricading and Demarcation	JH50/COP/017
Machine Guarding	JH50/COP/018
Compressed Gas Cylinders/Pressure Vessels	JH5O/COP/019
Hand Tools	JH50/COP/020
Work, Yard and Back Areas	JH50/COP/021
Appointment of Responsible Persons	JH50/COP/023
Permit to Work Systems	JH50/COP/026
Working at Heights	JH50/COP/030
Personal Protective Equipment	JH50/COP/031
The role of an OHSE Representative	JH50/COP/032
Fire Training	JH50/COP/033
Electrical Safety	JH50/COP/035
Procedure for cutting a lock	JH50/COP/036
Procedures	
Tyre Management	JH50/PRC/001
Confined Space Procedure	JH50/PRC/002

7.4 OPERATIONAL PROCEDURES RELEVANT TO ENVIRONMENT

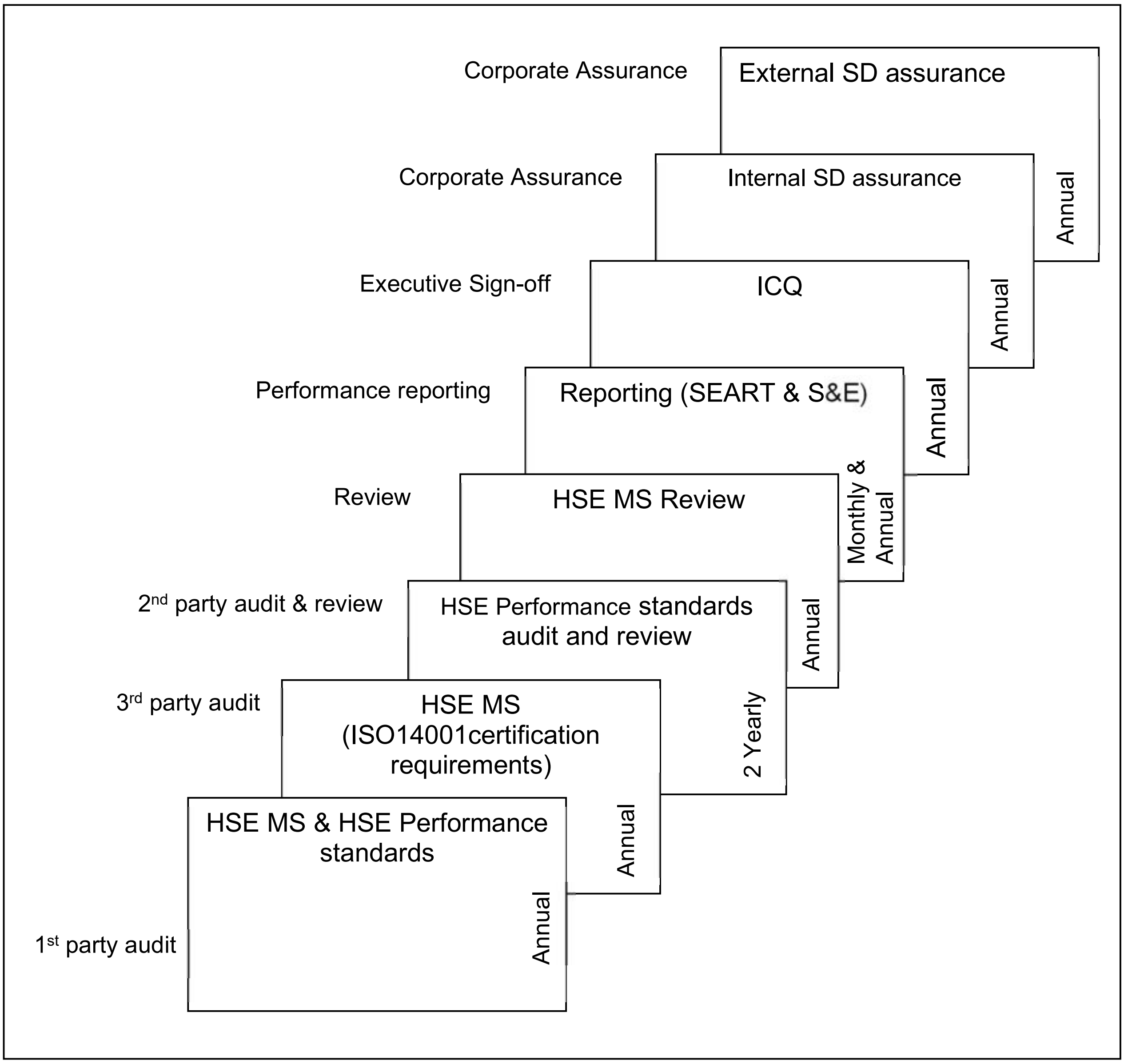
Procedures	
Non-Mineral Waste Management	JE50/WMP/001
Disposal/re-use of Hydrocarbons	JE50/WMP/002
Disposal of capacitors	JE50/WMP/003
Disposal practice for the Rössing Landfill Site	JE50/WMP/006
Procedure for action taken in the event of a diesel/oil spillage	JE50/WMP/010
Disposal of oil and diesel filters	JE50/WMP012
Bio-remediation of hydrocarbon contaminated soil and sludge	JE50/WMP/014
Disposal of Oil Trap Residue to the Oil Separation Plant	JE50/WMP/015
Purchasing of chemicals	JA50/PRC/001
Setting up of the Environmental Aspect Register	EMS/OPS/006
Air blast Ground Vibration Monitoring Programme	JE50/PRC/002
Inventory and Inspection of Chemicals in the lab	JE50/PRC/004
Determining of GHG procedure	JE65/PRC/001
Environmental Noise Monitoring Procedure	JE65/PRC/003
Land disturbance reporting	JE65/PRC/004
Biodiversity Monitoring and Information Management	JE65/PRC/005
Procedure for Storing, Transporting, Usage and Disposal of Hazardous Materials of Puma Energy (Namibia)	JE50/PRC/005
Instructions for Mercury Kit	JE50/PIN/001
Instruction for the ph fix Indicator strips	JE50/PIN/002
Dust Deposition Sampling	JE50/PIN/003
Downloading Data from the OSIRIS Dust Monitor at the Crushing Circuit	JE50/PIN/004
Operating Instructions for the spike pH5/6 meter (Analysing soil contamination)	JE50/PIN/005
Multi-Vertical Sampler	JE50/PIN/006
PM10	JE50/PIN/007
Operating Instructions for Total Petroleum Hydrocarbon (TPH) Test Kit	JE50/PIN/008

7.4.1 OPERATIONAL PROCEDURES RELEVANT TO WATER

Rössing water strategy.	JE05/STR/001
Standard Compliance (Rössing).	JE10/STD/001
Rössing Water Management Plan.	JA10/MMP/001
Khan river Vegetation Monitoring.	JE65/OWM/002
Bioremediation of Hydrocarbon Contaminated Soil and Sludge	JE50/WMP/014
Operation of oil separation plant.	JE50/OWM/001
Operation and monitoring of the Seepage Control systems.	JE50/OWM/002
Monitoring of the sewage plant.	JE65/OWM/003
Operation of the sewage plant.	JE50/SOP/003
Procedure for the operation of septic tanks	JE50/SOP/004
Rössing water balance procedure.	JE65/OWM/001
Water Quality Monitoring.	JE65/OWM/004
Water Quality management.	JE50/MSP/001
Fresh water supply management.	JE50/OWM/005
Water recycling and reuse.	JE50/OWM/008
Weekly Determination of RDS and Seepage Evaporation Rates.	JE65/OWM/005
Seepage Recycling on the Tailings dam.	JE50/OWM/009
Treatment of TDX boreholes with Sodium hydroxide.	JE50/OWM/007
Freshwater Demand planning.	JE20/OWM/001

8 APPENDIX 3: SUMMARY OF AUDITS AND CERTIFICATION

The HSE assurance approach followed at Rössing.



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10 ABBREVIATIONS USED IN THIS DOCUMENT

ALARA	As Low As Reasonably Achievable
ART	Anti-retroviral treatment
ASDP	Arandis Sustainable Development Project
BAP	Biodiversity Action Plan
Bq	Becquerels
CaO	Calcium Oxide
CCD	Counter Current Decantation
CH_4	Methane
CIX	Continuous ion exchange
cm	Centimetre
CO	Carbon monoxide
CO_2-e	Carbon dioxide equivalent
DWA	Department of Water Affairs
EEAN	Environmental Evaluation Association of Namibia
EIA	Environmental Impact Assessment
EMS	Environmental Management System
EPL	Exploration Prospecting Licence
FPR	Final Product Recovery
g	gram
GHG	Greenhouse Gas
GJ	GigaJoule
HEF	High Energy Fuel
HIV/AIDS	Human Immunodeficiency Virus infection / Acquired Immunodeficiency Syndrome
HSE	Health, Safety and Environment
HSE MS	Health, Safety and Environment Management System
IAEA	International Atomic Energy Agency
ICRP	International Commission for Radiological Protection
IPCC	International Panel on Climate Change
ISO	International Organization for Standardization
IT	Information technology
IUCN	International Union for the Conservation of Nature
kg	kilogram
kV	kiloVolt
L	Litre
M	mega, one million
m	meter
m^3	cubic meter
mamsl	metres above mean sea level
mg:	milligram
MgO	Magnesium Oxide
ML	Mining Licence
mSv	milliSieverts, 10^{-3} Sv
µm	micrometre
MVA	MegaVolt Ampere
MWH	MegaWatt Hours
Na_2CO_3	Sodium carbonate
NBRI	National Botanical Research Institute
NECSA	Nuclear Energy Corporation of South Africa
NO_x	Nitrogen Oxide

NPI	Net Positive Impact
NSX	Namibian Stock Exchange
NRPA	National Radiation Protection Authority
OK liquor	The chemical solution containing uranium trioxide
PCB	Polychlorinated biphenyl
PM10	Particulate Matter < 10 µm
PPE	Personal Protective Equipment
ppm	Parts Per Million
RTZ	Rio Tinto Zinc Corporation
RUL	Rössing Uranium Limited
s	second
SAIEA	Southern African Institute for Environmental Assessment
SABS	South African Bureau of Standards
SEA	Strategic Environmental Assessment
SEIA	Social and Environmental Impact Assessment
SEMP	Social and Environmental Management Plan
SX	Solvent Extraction
SO_2	Sulphur Oxide
t	Tonne
TDS	Total Dissolved Solids
TLD	Thermo Luminescent Dosimeter
TPM	Total Particulate Matter
UN	United Nations
UNSCR	United Nations Security Council Resolution
U_3O_8	Uranium oxide
Yellow cake	Ammonium diuranate

11 CHANGES AND REVISION STATUS

Issue and Revision History				
First Issue	**Issue date**	**Prepared by**	**Approved by**	
1.0	30/11/2012	Pierré Smit	Mpho Mothoa	
Version number	**Revision date**	**Revised by**	**Approved by**	**Reason for change**
1.1	29/02/2016	R. Schneeweiss	B. Uris	Periodic review
Version number	**Revision date**	**Revised by**	**Approved by**	**Reason for change**
1.2	01/03/2017	I Shaduka	J. Mwenze	Periodic review
1.3	25/04/2018	I Shaduka	J. Mwenze	Periodic review
1.4	25/06/2021	S Gaeseb	J. Mwenze	3-yearly review ECC application
1.5	05/09/2024	S Gaeseb	J. Mwenze	3-yearly review ECC application

Description / Typification of the environmental impact				Risk rating after mitigation			Compliance requirements and guidelines (legislation and other regulatory frameworks)			How is the impact and aspect managed?			
Aspect (Hazard)	Description of the scenario, i.e. how it can happen	Impact (Threat)	Description of the potential outcome, i.e. what can happen	Conse-quence	Likeli-hood	Classi-fication	International	National	Rossing	Is the impact measured, monitored, reported and disclosed - internal, external? Are the management controls documented, reviewed, audited? Are preventative measures (avoidance, mitigation, rehabilitation) in place?	MONITORING FREQUENCY	PERMIT REQUIREMENT	Responsible Persons
Air emissions	Burning of fossil fuel and the transport, storage, use and disposal of reagents and discarded items emits and releases gaseous substances (e.g. GHG) and vapours (e.g. chlorine)	Air pollution	The quality of ambient air worsens as a result of sudden and continuous releases of gaseous emissions, in the form of particulates, vapours and fumes.	Very Low	Likely	Class II	• United Nations Framework Convention on Climate Change, 1992 • Kyoto Protocol to the UN Framework Convention on Climate Change, 1997 • Vienna Convention for the Protection of the Ozone Layer, 1985 • Montreal Protocol on substances that deplete the Ozone Layer, 1987 • EC Regulation on Certain Fluorinated Greenhouse Gases (F-gases) (No 842/2006) • National Environment Management Act (South Africa): Air Quality Act No. 39 of 2004	• Explosives Act 26 of 1956 and Regulations • Mines, Works and Minerals Ordinance 20 of 1968: Regulations • Atmospheric Pollution Prevention Ordinance 11 of 1976 • Import and Export Control Act 30 of 1994: Regulation No. 80 of 2004, Prohibition of the import into Namibia of ozone depleting substances • Labour Act, 11 of 2007 and its Regulations (promulgated in 1997) relating to the Health and Safety of Employees at Work • Environmental Management Act 7 of 2007 and Regulations (promulgated in 2012)	• E1 Standard - Air quality, Noise control and Greenhouse Gases (GHG) and accompanying Guidance • E3 Standard - Biodiversity, Rehabilitation and Land use management and accompanying Guidance • RUL Closure Management Plan & Draft Mine Closure Framework.	All sources of GHG emissions are listed (JE65/PRC/001). Accordingly projections of energy consumption and GHG emissions are made and reporting against these projections are done monthly and annually.	Projections calculated monthly	No Permit Required	Environmental Advisor
	Mechanical and chemical processes and materials release fumes			Very Low	Likely	Class II				Annual stack emissions monitoring is done at the FPR to assess the efficiency of the stack filters. Chlorine detectors with an alarm system, for safety purposes, are in place at the sewage plant. Outcomes on several specialist studies (e.g. Volatile Organic Compounds) were done at various areas and indicated that the risk is low.	Annually (Stack emission)	No Permit Required	Environmental Advisor
	Sudden releases of non-inhalable particulate matter and nuisance dust from blasts, explosions, demolition activities. etc.	Air pollution and soil contamination	Non-inhalable particulate matter and nuisance dust pollute the air and after deposition (fall-out) can have adverse ecological impacts (e.g. on biological soil crusts, micro-fungi and cyanobacteria.	Very Low	Likely	Class II				Continuous improvement in air quality management is guided by the documented plan JE20/MMP/004; Air quality standards (JE65/STD/001) and the air emission inventory (JE65/PRC/001). Dust suppression on unsurfaced roads in operational areas is done. A road sweeper is used on tarred surfaces. Engineering controls such as dust extractors, scrubbers and baghouses are in place at source of emissions. Best practices are shared. Wind direction, timing, stemming, etc. are considered in the planning of blasts. Continuous improvement in environmental dust management is guided by the documented plan JE20/MMP/010. Dust fall-out is monitored and recorded internally - monthly on site and annually to Rossing - to reduce dust through innovative controls: Dust deposition sampling (JE50/PIN/003), Assessment of airborne particulates with multi-vertical samplers (JE50/PIN/006); Met One PM10-E Sampler (JE50/PIN/007. Exceedances are reported monthly. Regular inspections and audits are conducted. Clean-up of fall-out dust is part of rehabilitation and scheduled closure planning activities.	Monthly (PM10, meterological data, dust fallout)	No Permit Required	Environmental Advisor
	Chronic release of non-inhalable particulate matter and nuisance dust from vehicular movement, earth moving activities and other operational activities (e.g. stack emissions, construction, grit blasting, crushing, stockpiling, etc)												
	Wind erodes, transport and re-deposit tailings dust outside the tailings facility		Airborne tailings dust, in particular during wind events, pollute the air and can result in extensive contamination of the top soil after re-deposition	Very High	Likely	Class IV							
Noise and vibration	Acute vibration is generated from blasts, explosions, demolition activities, etc	Ecological disturbance - nuisance on humans & animals, and infrastructural damage.	Exposure to noise and vibration - chronic or acute - may keep animals away from pasture, water and migratory routes. Infrastructure damage	Very Low	Almost certain	Class II	• The United States Bureau of Mines (USBM) RI 8507 Criteria for safe blasting, 1980	• Explosives Act 26 of 1956 and Regulations • Mines, Works and Minerals Ordinance 20 of 1968: Regulations • Nature Conservation Ordinance 14 of 1975 • Minerals (Prospecting and Mining) Act 33 of 1992 • Minerals Policy of Namibia, 2003 • Environmental Management Act 7 of 2007 and Regulations (promulgated in 2012) • National policy on human-wildlife conflict management (2009)		The management and continuous improvement of environmental noise and vibration is guided by a Noise and Vibration Management Plan (JE20/MMP/008). Environmental vibration is monitored and measured according to a procedure JE50/PRC/002. Environmental noise is monitored and measured according to a procedure (JE65/PRC/003). Both impacts are monthly reported in order to minimize noise to threshold levels and to identify exceedances. Engineering solutions and continuous business improvements attempt to mitigate the environmental impacts of noise and vibration. Regular inspections and audits are conducted. Best practices are shared.	Monthly (Noise & Vibration, Environmental noise)	No Permit Required	Environmental Advisor
	Chronic vibration is generated from operational activities (earthmoving, construction, crushing, stockpiling, etc)												
	Acute noise is generated from blasts and sounds of other operational activities such as instantaneous bangs and bashes, alarms, etc												
	Chronic noise is generated from sounds of operational activities (e.g. earth moving machines and vehicular movements, and processes such as crushing, stockpiling, milling, construction, maintenance, etc.)												
Land clearance	The existing operational areas of the tailings facility, open pit, stockpiles, waste rock dumps, processing plant, solar PV plant, office areas and infrastructure, as well as cleared land (graded and bladed areas), compacted areas, sand and other borrow pits, earth piles and exploration areas comprise a total footprint of about 2640 ha at Rössing currently.	Habitat loss and habitat fragmentation	Operational activities within the existing footprint and continuous extensions (as a result of exploration drilling, patrolling, inspection, maintenance, etc.) and land clearance, grading and blading, compaction, borrow pits, sand piling and human-induced erosion modify the topography, disturb topsoil stability, create habitat fragmentation and degradation, reduce organisms and alter the ecological structure and functioning of the landscape.	High	Unlikely	Class III	• United Nations Convention on Biological Diversity, 1992	• Nature Conservation Ordinance 14 of 1975 • Constitution of the Republic of Namibia 1 of 1990 • Minerals (Prospecting and Mining) Act 33 of 1992 • Environmental Investment Fund of Namibia Act 13 of 2001 • Minerals Policy of Namibia, 2003 • Environmental Management Act 7 of 2007 and Regulations (promulgated in 2012) • National policy on human-wildlife conflict management (2009)	• E3 Standard - Biodiversity, Rehabilitation and Land use management and accompanying Guidance • RUL Closure Management Plan & Draft Mine Closure Framework.	The Mineral Waste Management Plan (JE20/MMP/009) guides the disposal of mineral waste. This is in close association with other over-arching management plans. Overall, land use management is guided by a drafted Land Use Management Plan (LUMP) (JE20/MMP/005). A land use database is kept to report on the geographical extent of the current footprint, per land use category. The georeferenced database, of the various disturbances caused by mining activities, is kept by the Survey Department. Changes in land use disturbance are reported annually to Rossing, according to the Land Disturbance Reporting procedure (JE65/PRC/004). Land use disturbances are managed by applying the mitigation hierarchy, in alignment with the Biodiversity Action Plan (BAP) (JE20/MMP/006) to minimize the footprint through avoidance, mitigation and rehabilitation. Access is patrolled and restricted internally by the Support Services department. Trespassing and illegal activities are reported and handled by the respective authorities. Annexure O: Draft Social and Environmental Management Plan Environmental clearance certificate	AD-HOC	No Permit Required	Protection services Envirnmental Advisor
	Extensions required by operational activities result in continuous encroachment into areas outside the current footprint.			High	Possible	Class IV							
	Linear infrastructure in- and outside the footprint area cause landscape barriers		Linear infrastructure restrict migration routes and disturb the structure and functions (connections) of the landscape ecology.	High	Unlikely	Class III							
	Unpermitted vehicular movement on the land under the auspices of Rössing and into proximate protected areas.		Uncontrolled access to public and employees on informal and unproclaimed roads can favour illegal activities such as poaching and specimen collection and can also have knock-on affects such as biodiversity loss, topsoil compaction and result in landscape scars.	Low	Possible	Class II							
(Flood) lighting	Flood lights are used during the night to increase visibility for workers.	Biodiversity losses	The use of flood lights can change the habitat ranges of nocturnal species.	Low	Possible	Class III					N/A	Environmental clearance certificate	Environmental Advisor
Pesticides	Some pests are controlled through the use of pesticides.		Control of pests (with pesticides) can kill species indiscriminately.	Very Low	Rare	Class I	• United Nations Convention on Biological Diversity, 1992 • Stockholm Convention on Persistent Organic Pollution (POP) 2001	• Nature Conservation Ordinance 14 of 1975 • Environmental Management Act 7 of 2007 and Regulations (promulgated in 2012)	• E3 Standard - Biodiversity, Rehabilitation and Land use management and accompanying Guidance	Planned and controlled fumigation programs, with mitigatory measures, are in place. Invasions and genetic pollution potential is regarded as a low risk at Rössing. Biodiversity monitoring and information management is guided by a procedure (JE65/PRC/005). The drafted BAP (JE20/MMP/006) documents all impacts to biodiversity and is closely coupled to the LUMP (JE20/MMP/005). Through the BAP and LUMP the mitigation hierarchy is applied to to minimize the footprint through avoidance, mitigation and rehabilitation, to determine the residual impact and to calculate the need for having a positive impact - for example by means of additional conservation actions and offsets.	Ad hoc as new chemicals get on site	No permit required	Foreman Maintenance Engineering & Projects Environmental Advisor Health Advisor
Biotic invasions	Conditions for invasive species (ferral animals and alien plants) are favourable on site.	Genetic pollution	Multiplying of alien plants and ferral animals can happen to the cost of natural biodiversity; hybridization can weaken biodiversity integrity	Very Low	Possible	Class I	• United Nations Convention on Biological Diversity, 1992				On-going	No permit required	Environmental Advisor Horticulture contractor
Hazardous materials	Transport, storage, usage and disposal of hazardous materials	Soil contamination	When hazardous materials are not contained during transport, storage, usage and disposal leakages, spillages and disposal of hazardous waste can occur and contaminate soil	Very Low	Likely	Class II	• The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, 1992 • Stockholm Convention on Persistent Organic Pollution (POP) 2001	• Soil Conservation Act 76 of 1969 as amended in 1978 • Hazardous Substances Ordinance 14 of 1974 • Petroleum Products and Energy Act 13 of 1990 and Regulations (of 1991 and 2000) • Environmental Management Act 7 of 2007 and Regulations (promulgated in 2012)	• E2 - Hazardous materials and non-mineral waste control and minimisation	A Hazardous Material and Contamination Control Management Plan (JE20/MMP/002) exists to guide continuous improvement in the environmental management of hazardous substances. Purchasing of chemicals is guided by a procedure (JA50/PRC/001) and the keeping of inventories and inspections of chemicals in laboratories is guided by a procedure (JE50/PRC/004) as well as checksheets, while Material Safety Data Sheets exist for all hazardous substances. Specific procedures guide the storage, transport, use and disposal of major consumables, such as sulphuric acid (JA50/PRC/005); hydrocarbon materials (JE50/PRC/006); sodium carbonate (JE50/PRC/006); sodium hydoxide (JE50/PRC/007); magnafloc (JE50/PRC/008); resin (JE50/PRC/009); iron oxide (JE50PRC/010); manganese dioxide (JE50/PRC/011); solvents (JE50/PRC//012) and anhydrous ammonia (JE50/PRC/013). The handling of hazardous materials and hydrocarbons is confined to designated areas. Decanting happens in dedicated areas with bunding, spillage trays, trenches and collecting sumps and is controlled by standard operational health and safety procedures. Maintenance schedules exist and regular inspections and audits take place to check the various controls (continuous monitoring system, emergency equipment e.g. pumps)	Regular inspections and audits	* Environmental Clearance Certificate * Permit for Used Mineral Oil * Import Permit 009 for Sulphuric Acid * Permit for Explosive Magazine * Explosive Permits (15 tons Ammonium Nitrate Group 7) * Explosive Permit 30 tons matrix Group 5) * Ammonium Nitrate permit * Environmental Clearance Certificate for Service Station	* Environmental Advisor: Hazardous materials and non-mineral waste control * Processing -Senior Chemist * Procurement: Logistics & Supply Chain
Industrial effluent and Return Dam Solution (RDS)	Handling of industrial effluent and Return Dam Solution (RDS)	Soil contamination Groundwater contamination	Leakage, overflow and spillage of industrial effluent (from the plant, for example) and RDS (from Lake Andrew, for example) contaminate soil	Low	Almost certain	Class III	UNECE - The Water Convention and Protocol on Water and Health	• Water Act 54 of 1956 and Regulations • Mines, Works and Minerals Ordinance 20 of 1968: Regulations • Soil Conservation Act 76 of 1969 as amended in 1978 • Hazardous Substances Ordinance 14 of 1974 • Minerals (Prospecting and Mining) Act 33 of 1992 • Minerals Policy of Namibia, 2003 • Environmental Management Act 7 of 2007 and Regulations (promulgated in 2012) • Water Resources Management Act 11 of 2013	• E5 Standard - Water usage and quality management	Emergency pumps, trenches and sumps exist in the processing plant area where spillages can occur. In addition some surfaces are sloped and sealed (in the case of areas were hazardous substances are handled). Regular inspections and audits are conducted and maintenance schedules are followed. Waste water and effluent are reused at Rössing. List of procedures: "Rössing water strategy (JE05/STR/001) Rössing Water Management Plan (JA10/MMP/001). Operation and monitoring of the Seepage Control systems (JA50/OWM/SCP/002). Rössing water balance procedure (JA50/OWM/WBP/001) Water Quality Monitoring (JE65/OWM/004). Water Quality management (JE50/MSP/001) Water recycling and reuse (JE50/OWM/003). Weekly Determination of RDS and Seepage Evaporation Rates (JE65/OWM/005) Seepage Recycling on the Tailings dam (JE65/OWM/006) Treatment of TDX boreholes with Sodium hydroxide (JA50/OWM/WSM/004).	Weekly	Industrial and Domestic Effleunt Disposal Exemption Permit	Processing: Tailings Dam & Water Management Project Hydrogeologist
Seepage	Management of seepage from the tailings facility		Overflow and / or dysfunction of seepage trapping facilities cause soil contamination	Very High	Likely	Class IV					* Continuous on automated systems * weekly on manual systems *Annual Water Quality Monitoring Program	Industrial and Domestic Effleunt Disposal Exemption Permit	Processing: Tailings Dam & Water Management Project Hydrogeologist
Tailings	Management of tailings sludge	Soil contamination Biodiversity losses Groundwater contamination	Incorrect deposition of tailings sludge (outside the tailings facility), erosion and failure of the tailings dam wall can contaminate soil.	Moderate	Rare	Class II	Global Industry Standard on Tailings Management (GISTM)	D5 Standard - Management of Tailing and Water Storage Facilities E5 - Water usage and quality management		Management of the tailings facility is guided by an operational manual for the paddy system and tailings deposition plan. Tailings management is in compliance to the current state license. Cleanup and removal of spillages of ore and tailings are regulated by means of standard operational procedures.	Daily and weekly	Industrial and Domestic Effleunt Disposal Exemption Permit	Processing: Tailings Dam & Water Management
Non-mineral waste	Generation, collecting and disposal of non-recyclable non-mineral waste (including garden refuse,building rubble and sewage sludge)	Habitat loss and habitat fragmentation	Inappropriate reduction and inefficient ways to collect, transport and dispose non-recyclable waste can contaminate soil.	Very Low	Likely	Class II	• The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, 1992	• Soil Conservation Act 76 of 1969 as amended in 1978 • Hazardous Substances Ordinance 14 of 1974 • Petroleum Products and Energy Act 13 of 1990 and Regulations (of 1991 and 2000) • Environmental Management Act 7 of 2007 and Regulations (promulgated in 2012)	E2 - Hazardous materials and non-mineral waste control and minimisation	Management of non-mineral waste is guided by the Non-mineral Waste Management Plan (JE20/MMP/001). The plan contains targets to reduce non-mineral waste and operational activities of non-mineral waste management are guided by a procedure (JE50/WMP/001). Waste seperation for disposal and recycling happens at source. Designated luggerbins are provided for the disposal of non-mineral waste, according to procedure (JE50/WMP/001). Waste management facilities are inspected weekly and audited annually through 1ste, 2nd or 3rd party audits. Waste records are recorded monthly and reported monthly and annually. Monitoring of the sewage plant (JE65/OWM/003). Operation of the sewage plant (JE50/SOP/003).	* Waste management facility is inspected regullarly and audited annually (1st, 2nd or 3rd party audits). * Waste inventory reconcilled weekly, monthly and annually	* Environmental clearance certificate	* Environmental Advisor: Hazardous material and non-mineral waste control and minimisation *Engineering & Projects: Contractor Management
	Generation, collecting and disposal of recyclable non-mineral waste		Disposal at the landfill site modifies the natural topograhy, reduce organisms and alter the ecological structure and functioning of the landscape.	Very Low	Rare	Class I	• United Nations Convention on Biological Diversity, 1992 • Minimum requirements for Waste Disposal by Landfill (South Africa, DWAF 1994)			A procedure guides the operation and disposal practice at the landfill (JE50/WMP/006), which also designates the collecting and sorting, temporary storage and disposal areas at the landfill site.			
Unchannelled surface water	Free-flowing water erodes, transport and re-deposit loose material downstream	Fluvial erosion and soil contamination	Run-off from the mineral depositories (tailings facility and waste rock dumps) can cause downstream soil contamination.	Moderate	Rare	Class II	UNECE - The Water Convention and Protocol on Water and Health	• Water Act 54 of 1956 and Regulations • Soil Conservation Act 76 of 1969 as amended in 1978 • Hazardous Substances Ordinance 14 of 1974 • Environmental Management Act 7 of 2007 and Regulations (promulgated in 2012) • Water Resources Management Act 11 of 2013	• H4 - Hazardous substances management • E5 - Water usage and quality management • E3 - Biodiversity, rehabilitation and Land use management • RUL Closure Management Plan & Draft Mine Closure Framework.	Main releases from mineral waste storage facilities have the potential to contaminate aquatic pathways. A comprehensive control and monitoring system is operational to prevent contamination that derives from effluent from the plant area and tailings seepage. This includes a dewatering system with cut-off trenches and abstraction, borehole monitoring and seepage control, guided by the Water Quality Management procedure (JE50/MSP/001) and aligned to the procedures Operation and Monitoring of the Seepage Control Systems (JE50/OWM/002), Water Quality Monitoring (JE65/OWM/004), Water Recycling and Reuse (JE50/OWM//004), Weekly Determination of RDS and Seepage Evaporation Rates (JE65/OWM/005), Seepage Recycling on the Tailings Dam (JE65/OWM/006), Operation of the Sewage Plant (JE50/OWM/003), Monitoring of the Sewage Plant (JE65/OWM/003) and Operation of Septic Tanks (JA50/OWM/004). Infrastructure includes a borehole monitoring, seepage entrapment and a dewatering system with cut-off trenches and abstraction boreholes. Inside some areas working surfaces are sealed and sloped, accompanied by sumps with emergency pumps. Regular inspections and audits are conducted. Maintenance schedules exist. Soil erosion potential is negligible in the arid environment where the mine is located. The risk of fluvial erosion of the waste rock dumps is thus low. The coarse nature of the tailings material and the inherent drainage characteristics result in an acceptable minimal risk of slope failure. For closure it is planned that the tailings facility will be capped with a waste rock cover to prevent possibilities of wind and water erosion. Mineral waste is characterized according to the Rossing Standard (E13). The potential to generate Acid Rock Drainage (ARD) for mineral wastes is low due to the absence of sulphide minerals and the low annual rainfall. Main ARD releases would contaminate aquatic pathways, but comprehensive control and monitoring systems are in place.	N/A	No Permit Required	Processing: Tailings Dam & Water Management Project Hydrogeologist
	Free-flowing and stationery surface water infiltrates	Groundwater contamination	Infiltration of run-off from the mineral depositories (tailings facility and waste rock dumps) and stationery surface water can cause groundwater contamination.	Low	Possible	Class II							
	Free-flowing water on the waste rock dumps may generate ARD (Acid Rock Drainage) primary products and mobilize and disperse ARD primary and secondary products			Very Low	Rare	Class I							
Spillage of contaminated water	The water management system to cope with leakages and overflows of contaminated water, run-off from contaminated areas and the erosion and failure of the tailings facility after heavy rainfall events as well as constant seepage from the tailings facility can cause unpredictable and unaccounted events of contamination		Dysfunction of run-off, effluent and seepage trapping facilities (for example during heavy rainfall events) result in soil contamination and radioactive contamination of aquatic pathways downstream (off-site).	High	Rare	Class III					AD-HOC	Industrial and Domestic Effleunt Disposal Exemption Permit	Processing: Tailings Dam & Water Management Project Hydrogeologist
Leachates	Rainfall and disposal of water can create leachates from the landfill		Leachates from the landfill can contaminate groundwater	Moderate	Unlikely	Class II	• Minimum requirements for Waste Disposal by Landfill (South Africa, DWAF 1994)			At the landfill, downstream monitoring of groundwater is monitored according to the Water Quality Monitoring procedure (JE65/OWM/004). Emissions of greenhouse gases from the landfill is recorded monthly and reported monthly and annually.	Annual water quality monitoring program	Industrial and Domestic Effleunt Disposal Exemption Permit	Processing: Tailings Dam & Water Management Project Hydrogeologist
Hazardous materials	Transport, storage, usage and disposal of hazardous materials		When hazardous materials are not contained during transport, storage, usage and disposal, spills can lead to groundwater contamination.	Low	Rare	Class I	• The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, 1992			Designated luggerbins are provided for the disposal of hazardous and contaminated waste according to the Non-mineral Waste Management Plan (JE20/MMP/001) and the accompanying procedure (JE50/WMP/001). Hazardous waste is removed from site to certified facilities (at Walvis Bay)	Adhoc inspections and audits	* Environmental clearance certificate	* Environmental Advisor: Hazardous material and non-mineral waste control * Processing Operations: Tailings & Water Management
Hazardous materials	During transport, storage usage and disposal in abnormal (weather,collisions) conditions,	Soil contamination groundwater contamination air pollution biodiversity	Uncontrolled spillages and leakages of Hazardous materials can lead to soil, groundwater and air pollution, biodiversity in the immediate habitat	Moderate	Unlikely	Class II	The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, 1992	• Water Act 54 of 1956 and Regulations • Hazardous Substances Ordinance 14 of 1974 • Environmental Management Act 7 of 2007 and Regulations (promulgated in 2012) • Water Resources Management Act 11 of 2013	• H4 - Hazardous substances management • E5 - Water usage and quality management • E3 - Biodiversity, rehabilitation and Land use management	Transporting, Storing, Using and Disposing of Sulphuric Acid at Rössing JE50/PRC/014 Transporting, storing,using & disposing of anhydrous Ammonia at Rossing JE50/PRC/013 Transporting, storing, using & disposing of Manganese Dioxide at Rossing JE50/PRC/011 Transporting, Storing, using& disposing of solvents at Rossing JE50/PRC/012 Transporting, storing, using& disposing of Resin at Rossing JE50/PRC/009 Transprting, storing, using & disposing of Magnafloc 333 flocculant at Rossing JE50/PRC/008 Transport, storing, using& disposed of Sodium Hydroxide at Rossing JE50/PRC/007 Transport, storing, using& disposed of Sodium Carbonate at Rossing JE50/PRC/006	* Weekly acid line checks and adhoc inspections * Ammonia testing every Tuesday at 15H00	* Authorisation letter from Rossing MD for the underground storage of hydrocarbons * Clearance certificate for Service Station	* Environmental Advisor: Hazardous materials and non-mineral waste control
Hazardous materials	Fire/ explosions during transportation, usage, storage and disposal of Hazardous materials (Ammonium nitrate, Solvent, Resin)	Air pollution soil pollution biodiversity and habitat distruction groundwater contamination	During an explosion or fire of Hazardous material during transport, usage, and disposal, fujmes generated could affect air quality and fire fighting chemicals could contaminate the surrounding areas and ground water.	Moderate	Rare	Class II	The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, 1992	Water Act 54 of 1956 and Regulations • Hazardous Substances Ordinance 14 of 1974 • Environmental Management Act 7 of 2007 and Regulations (promulgated in 2012) • Water Resources Management Act 11 of 2013		Transporting, storing, using& disposing of Resin at Rossing JE50/PRC/009 If an explosion or fire occurs offsite or on site the Emergency Response Team (ERT) will attend to the incident. The ERP is supported by the Business Resilience Management Plan (BRMP): JA20/MMP/007 .containment and clean up of the spilled material followed by soil rehabilititaion Rossing has a procedure in place for fire emergency(JA60/PRC/005) on site. for offsite fire emmergencies, the BRRP procedure Emergency Response Plan (JA20/MMP/008) will be applied..	* Fire Drill is practiced every year * Fire detection system installed	* Sasol Namibia Explosives Continuous Import Permits (<150 tonnes Ammonium Nitrate) *Sasol Namibia Explosives Continuous Import Permits (<30 tonnes Matrix)	* Environmental Advisor: Hazardous material and non-mineral waste control * Protection Services * Business Resilience Management Plan (BRMP)
Hydrocarbons	When hydrocarbons are not contained during transport, storage, usage and disposal spills can lead to contamination		Leakages and spillages (including localized explosions) of hydrocarbons can adversely affect groundwater quality.	Very Low	Unlikely	Class I		• Water Act 54 of 1956 and Regulations • Hazardous Substances Ordinance 14 of 1974 • Petroleum Products and Energy Act 13 of 1990 and Regulations (of 1991 and 2000) • Environmental Management Act 7 of 2007 and Regulations (promulgated in 2012) • Water Resources Management Act 11 of 2013	• H4 - Hazardous substances management • E5 - Water usage and quality management • E3 - Biodiversity, rehabilitation and Land use management	Hydrocarbons are controlled by standard operational procedures - Disposal/re-use of Hydrocarbons (JE50/WMP/002); procedure for Action Taken in the Event of a Diesel /oil Spillage (JE50/WMP/010); Disposal of Oil/diesel filters (JE50/WMP/012); and Disposal of Oil Trap Residue to the Oil Separation Plant (JE50/WMP/015). Removal of hydrocarbons from water is guided by the Operation of the Oil Separartion Plant procedure (JE50/OWM/001).	Adhoc inspections and audits	* Permit For Used Mineral Oil * Environmental clearance certificate	* Environmental Advisor: Hazardous material and non-mineral waste control *Engineering & Projects: Contractor Management * Processing Asset Management: Extraction Maintenance
Hydrocarbons	Major spill of hydrocarbons during transport, storage usage and disposal	Groundwater contamination habitat destruction surface water contamination	The hydrocarbon can infiltrate into theground and contaminate ground water resources; or reach open surface water and affect aquatic microoraginisms and biodiversity in the immidiate habitat	Low	Rare	Class I				Transporting, Storing, Using and Disposing of Hydrocarbon Materials at Rössing JE50/PRC/015 If a major spillage of hydrocarbons occur (for example: the rail tanker derailed while transporting diesel from Walvisbay to site and >1000 L is spilled), the Emergency Response Team (ERT) will attend to the incident. The ERP is supported by the Business Resilience Management Plan (BRMP): JA20/MMP/007 "Procedure for Action Taken in the Event of a Diesel/Oil Spillage": JE50/WMP/010". containment and clean up of the spilled material followed by soil rehabilititaion bund walls to contain the entire content of the storage container	Adhoc inspections and audits	* Permit For Used Mineral Oil * Environmental clearance certificate	* Environmental Advisor: Hazardous material and non-mineral waste control *Engineering & Projects: Contractor Management * Processing Asset Management: Extraction Maintenance
Hydrocarbons	hydrocarbon explosions and fires could be caused by lightning, electrical faults, people not adhering to safe work procedures, vehicle collision and accidents,	air pollution soil pollution biodiversity and habitat distruction ground water contamination	During an explosion or fire of hydrocarbons during transport, usage, and disposal, fujmes generated could affect air quality and fire fighting chemicals could contaminate the surrounding areas and ground water.	Moderate	Unlikely	Class II				Transporting, Storing, Using and Disposing of Hydrocarbon Materials at Rössing JE50/PRC/015 If an explosion or fire occurs offsite or on site the Emergency Response Team (ERT) will attend to the incident. The ERP is supported by the Business Resilience Management Plan (BRMP): JA20/MMP/007 .containment and clean up of the spilled material followed by soil rehabilititaion Rossing has a procedure in place for fire emergency(JA60/PRC/005) on site. for offsite fire emmergencies, the BRRP procedure Emergency Response Plan (JA20/MMP/008) will be applied..	Adhoc inspections and audits	* Permit For Used Mineral Oil * Environmental clearance certificate	* Environmental Advisor: Hazardous material and non-mineral waste control *Engineering & Projects: Contractor Management * Processing Asset Management: Extraction Maintenance
Excessive water use	Water is a scarce resource in Namibia and even more so in the Namib Desert, where Rössing is located.	Waste	Unwise use of water occurs in the form of unsound usage (e.g. washdowns), leaks and bursts and excessive evaporation of open standing water .	Very Low	Likely	Class II	UNECE - The Water Convention and Protocol on Water and Health	• Water Act 54 of 1956 and Regulations • Environmental Management Act 7 of 2007 and Regulations (promulgated in 2012) • Water Resources Management Act 11 of 2013	• E5 - Water usage and quality management • E3 - Biodiversity, rehabilitation and Land use management	Water use at Rössing is guided by controls such as the Freshwater Supply Management procedure (JA50/MSP/001), Freshwater Demand Planning procedure (JE20/OWM/001) and the Rössing Water Strategy (JE05/STR/001). Water consumption is monitored against water targets and the Water Balance procedure (JE65/OWM/001) and is reported monthly and annually. Freshwater constitutes about one-third of the total water consumption at Rössing since about two-thirds are recycled water obtained from the tailings facility.	Monthly	Khan River Abstraction Permit Industrial and Domestic Effleunt Disposal Exemption Permit	Processing: Tailings Dam & Water Management Project Hydrogeologist
Drainage disturbance	Some operational activities (e.g. waste rock dumps, tailings facility, plant area and open pit) caused the permanent blocking and / or re-routing of drainage lines.	Habitat loss and habitat fragmentation	Altering of drainage lines caused species and habitat losses and disrupted the ecological structure and functioning of the landscape.	Very High	Almost certain	Class IV					AD-HOC	Environmental clearance certificate	Processing: Tailings Dam & Water Management Project Hydrogeologist
Abstraction	Water is extracted from the Khan River for the purpose to suppress dust, mainly in the open pit area.	Dewatering	Abstraction of water from the Khan River may result in the lowering of the water table and can have knock-on effects downstream - for users as well as for riparian vegetation.	High	Rare	Class III				Abstraction limits are permitted per agreement with the State, valid until 2026. The water abstracted is saline and only used for dust suppression. The abstraction of 600m3/day is below the safe allowable limit. Rössing Water Management Plan (JA10/MMP/001) Khan river Vegetation Monitoring (JE65/OWM/002) Rössing Water Management Plan (JA10/MMP/001). Operation and monitoring of the Seepage Control systems (JA50/OWM/SCP/002).	Monthly	Khan River Abstraction Permit Industrial and Domestic Effleunt Disposal Exemption Permit	
Radiation	Release of uranium dust and radioactive residue enter atmospheric pathways.	Radioactive contamination	Radioactive contamination of atmospheric and downstream aquatic pathways may lead to exposures of employees and neighbouring communities	Low	Rare	Class I	• The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, 1992 • ICRP, (1993): Protection Against Radon-222 at Home and at Work. • ICRP, (1994): Dose Co-efficients for Intakes of Radionuclides by Workers. • ICRP, (1995): Age-Dependent Doses to Member of the Public from the Intake of Radionuclides: Part 4 Inhalation Dose Coefficients. • IAEA, (1996): International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources • ICRP, (1998): Radiation Protection Recommendations as Applied to the Disposal of Long-lived Solid Radioactive Waste. • IAEA, (2004): Occupational Radiation Protection in the Mining and Processing of Raw Materials • IAEA Safe Management of Wastes from the Mining and Milling of Uranium and Thorium Ores (Safety Series No. 85 of 2004)	• Water Act 54 of 1956 and Regulations • Atmospheric Pollution Prevention Ordinance 11 of 1976. • Atomic Energy and Radiation Protection Act 5 of 2005 and Regulations • Environmental Management Act 7 of 2007 and Regulations (promulgated in 2012) • Water Resources Management Act 11 of 2013	• E5 - Water usage and quality management • E1 Standard - Air quality, Noise control and Greenhouse Gases (GHG) and accompanying Guidance E3 - Biodiversity, rehabilitation and Land use management • RUL Closure Management Plan & Draft Mine Closure Framework. • E2 - Hazardous materials and non-mineral waste control and minimisation • H6 - Radiation • H7 - Carcinogenic substances	The mine Radiation Management Plan (JK20/MMP/001), approved by the NRPA and its implementation regularly audited by the same institution, details Radiation Safety Management at Rössing, including the public dose monitoring program. Existing critical groups are assessed to be exposed to less than 0.25 mSv/a as a result of operating conditions, or after mine closure. Comprehensive water management procedures are in place to prevent groundwater contamination. Measures include a borehole monitoring, seepage entrapment and a dewatering system with cut-off trenches and abstraction boreholes. No contaminated (radioactive) waste is allowed to leave site and this is disposed at a demarcated waste site situated on the tailings facility. Rössing applied for a license of this site from the NRPA, in alignment with the Radiation Management Plan. Records are kept monthly. Disposal of Contaminated Items (JK65/PRD/003) Non-Mineral Waste Management (JE50/WMP/001)	Annualy (isokinetic), Continuous on automated systems	No Permit Requirement	Environmental Advisor
	Leakages, spillages and overflows of contaminated water as well as constant seepage from the tailings facility can amplify the possibility of groundwater (radioactive) contamination.			High	Possible	Class IV					AD-HOC	Industrial and Domestic Effleunt Disposal Exemption Permit	Processing: Tailings Dam & Water Management
	Spillage of ore and tailings from conveyor belts can cause radioactive contamination of soil, water and air.			Low	Unlikely	Class I					Monthly (Dust fallout and PM10) monitoring	No Permit Requirement	Environmental Advisor
	Contaminated (radioactive) waste is generated and disposed daily			High	Rare	Class III							
	Equipment may be exposed to radioactive contamination			Low	Almost certain	Class II					AD-HOC	No Permit Required	Radiation Safety Advisor
Operational activities	Land use disturbance (footprint) of Rössing as a result of the dimensional growth of mineral waste is constantly increasing.	Visual intrusion	Vertical growth of the tailings facility and the waste rock dumps are instrusive to the sense of place of Rössing's surroundings.	Very Low	Likely	Class II	Global Industry Standard on Tailings Management (GISTM)	• Environmental Management Act 7 of 2007 and Regulations (promulgated in 2012)	• E3 - Biodiversity, rehabilitation and Land use management • E4 - Mineral waste, acidic and other impacted drainage control • RUL Closure Management Plan & Draft Mine Closure Framework.	The Mineral Waste Management Plan (JE20/MMP/009) guide the disposal of mineral waste around the SJ Pit while deposition of tailinngs are guided by an Operational Manual.	AD-HOC	No permit required	Environmental Advisor
	Operational activities within the existing footprint (e.g. blasts, explosion, demolition, vehicular movement, earth moving, construction, crushing) and continuous extensions (as a result of exploration drilling, patrolling, inspection, maintenance, etc.) create dust, noise, vibration, scars	Loss of sense of place	Dust, noise, vibration and scars are intrusive to the sense of place of Rössing and surroundings.	Very Low	Possible	Class I	• United Nations Convention on Biological Diversity, 1992	• Explosives Act 26 of 1956 and Regulations • Constitution of the Republic of Namibia 1 of 1990 • Environmental Management Act 7 of 2007 and Regulations (promulgated in 2012)		The management and continuous improvement of environmental noise and vibration is guided by a Noise and Vibration Management Plan (JE20/MMP/008).			
	Bird collisions with infrastructures such as solar panels arrays, fences, guyed masts and associated powerline infrustructures	Biodiversity loss	Collission & electrocution of birds & insects as they come into contact with infrustructure.	Low	Unlikely	Class I		• Environmental Management Act 7 of 2007 and Regulations (promulgated in 2012)		Environmental Impact Assessment (EIA) for proposed solar PV Power plant - gap the earth wire near top of pole. - regular clean-up to present nesting.	Quarterly		
Night light pollution	Night light pollution	Light pollution	Night lights limit the habitat ranges of nocturnal species.	Very Low	Almost certain	Class II				Night lighting is predominantly yellow to mitigate the effects on nocturnals.	N/A	Environmental clearance certificate	Environmental Advisor
Footprint extension	Operational activities can encroach into areas with archaelogical and heritage assets	Archaeological, heritage losses Biodiversity loss	Archaeological and heritage assets can be lost or damaged.	Moderate	Rare	Class II		• National Heritage Act 27 of 2004 • Environmental Management Act 7 of 2007 and Regulations (promulgated in 2012)		Land Use Management Plan (JE20/MMP/013) Biodiversity Action Plan (JE20/MMP/006)	N/A	Environmental clearance certificate	Environmental advisor

Consequence / Likelihood	1-Minor	2-Medium	3-Serious	4-Major	5-Catastrophic
A-Almost certain	Moderate	High	Critical	Critical	Critical
B-Likely	Moderate	High	High	Critical	Critical
C-Possible	Low	Moderate	High	Critical	Critical
D-Unlikely	Low	Low	Moderate	High	Critical
E-Rare	Low	Low	Moderate	High	High

Rating	Class	Risk management response
Critical	*Class IV*	*Risks that significantly exceed the risk acceptance threshold and need urgent and immediate attention.*
High	*Class III*	*Risks that exceed the risk acceptance threshold and require proactive management. Includes risks for which proactive actions have been taken, but further risk reduction is impracticable. However active monitoring is required and the latter requires the signoff by Business Unit senior management.*
Moderate	*Class II*	*Risks that lie on the risk acceptance threshold and require active monitoring. The implementation of additional measures could be used to reduce the risk further.*
Low	*Class I*	*Risks that are below the risk acceptance threshold and do not require active management. Certain risks could require additional monitoring.*

Consequence	MINOR	MEDIUM	SERIOUS	MAJOR	CATASTROPHIC
Non-Economic (Social and Environmental)					
HEALTH	Reversible health effects of little concern, requiring first aid treatment at most. Can include minor irritations of eyes, throat, nose and or skin, or minor unaccustomed muscular discomfort.	Reversible health effects of concern that would typically result in medical treatment. Can include temperature effects; travel effects; stress; and sunburn.	Severe, reversible health effects of concern that would typically result in a lost time illness. Can include acute / short-term effects associated with extreme temperature effects; or musculo-skeletal effects; vibration effects; nervous system effects; some infectious diseases; and non falciparum malaria.	Single fatality or irreversible health effects or disabling illness. Can include effects of suspected carcinogens, mutagens, teratogens and reproductive toxicants, progressive chronic conditions and/or acute / short-term high-risk effects	Multiple fatalities or serious disabling illness to multiple people. Can include effects of known human carcinogens, mutagens, teratogens and reproductive toxicants, and life-threatening respiratory sensitization and falciparum malaria
SAFETY	Low level short term subjective inconvenience or symptoms. Typically a first aid and no medical treatment.	Reversible injuries requiring treatment, but does not lead to restricted duties. Typically a medical treatment.	Reversible injury or moderate irreversible damage or impairment to one or more persons. Typically a lost time injury.	Single fatality and/or severe irreversible damage or severe impairment to one or more persons.	Multiple fatalities or permanent damage to multiple people.
ENVIRONMENT (on site)	Near-source confined and promptly reversible impact (Typically a shift)	Near-source confined and short-term reversible impact (Typically a week)	Near-source confined and medium-term recovery impact (Typically a month)	Impact that is unconfined and requiring long-term recovery, leaving residual damage (Typically years)	Impact that is widespread-unconfined and requiring long-term recovery, leaving major residual damage (Typically years)
ENVIRONMENT (off site)	Not applicable	Near-source confined and promptly reversible impact (Typically a shift)	Near-source confined and short-term reversible impact (Typically a week)	Near-source confined and medium-term recovery impact (Typically a month)	Impact that is unconfined and requiring long-term recovery, leaving residual damage (Typically years)
COMMUNITY (community trust)	Tangible expressions of trust / mistrust amongst a handful of community members with no influence on public opinion and decision-makers.	Tangible expressions of trust / mistrust amongst a few community members with some influence on public opinion and decision-makers.	Tangible expressions of trust / mistrust amongst some community members with moderate influence on public opinion and decision-makers.	Tangible expressions of trust / mistrust amongst most community members with significant influence on decision-makers.	Widespread loss / gain of trust across the community setting the agenda for decision-makers and key stakeholders.
COMMUNITY (stakeholder relationship)	Key stakeholder(s) express support / dissatisfaction informally.	Key stakeholder(s) express support / dissatisfaction formally.	Key stakeholder(s) threaten to oppose or disengage / strengthen offers to support or engage.	Key stakeholder(s) actively oppose or actively refuse to engage / actively support and engage.	Key stakeholder(s) oppose and actively get others to oppose / engaged and actively get others to support.
COMMUNITY (cultural heritage)	Reparable damage to site or item of low cultural significance occurs/avoided.	Irreparable damage to site or item of low cultural significance occurs/avoided.	Repairable damage to site or item of cultural significance occurs/avoided.	Irreparable damage to site or item of cultural significance occurs/avoided.	Irreparable damage to site or item of international cultural significance occurs/avoided.
REPUTATION	Community complaint resolved via existing site procedures. Impact on reputation of several work areas within an operation. One off public exposure in local media, word of mouth or local mythologies.	Impact on reputation of Business Unit. Significant public exposure in local media.	Impact on reputation of Product Group. Comment from national NGO which impacts credibility with neighbours/regional government. Public exposure in national media.	Impact on reputation of Rio Tinto Group. Comment from international NGO. Public exposure in international media.	Severe impact on reputation of Rio Tinto Group. Severe prolonged comment from international NGO. Greater than three years public exposure in international media.
CONFORMANCE / COMPLIANCE	Non-conformance with internal requirement with very low potential for impact. Non-compliance with external / community commitment goes unnoticed by external party/parties, requiring minimal effort to correct.	Non-compliance with external or non conformance with internal requirement with low potential for impact. Non-compliance with community commitment, requiring limited effort to correct.	Non-compliance with external or non conformance with internal requirement with moderate potential for impact. Moderate penalties for breach of legislation, contract, permit or licence. Non-compliance with community commitment reported formally, requiring significant effort to correct.	Breach of licences, legislation, regulation or repeated non-compliance with high potential for prosecution. Breach of contract with significant penalty clauses imposed. Systemic non-conformance with Rio Tinto work cycles or standards with high potential for impact.	Suspended or severely reduced operations imposed by regulators. Breach of community commitment results in direct loss of established consents with widespread secondary effects.
Economic Consequence types (Operational)					
Capital Costs	< 1.6%	1.6% - 5%	5% - 10%	10% - 30%	> 30%
Schedule	< 2.5%	2.5% - 7.5%	7.5% - 15%	15% - 45%	> 45%
Operation & Maintenance Costs	< 0.6%	0.6% - 2.5%	2.5% - 7.5%	7.5% - 15%	> 15%
Production Volumes	< 0.6%	0.6% - 2.5%	2.5% - 7.5%	7.5% - 15%	> 15%
Business Unit Revenue	< 0.25%	0.25% - 1%	1% - 3.5%	3.5% - 7%	> 7%

Likelihood	Likelihood description	Frequency	Substance Exposure
ALMOST CERTAIN	Recurring event during the life-time of an operation / project	Occurs more than twice per year	Frequent (daily) exposure at > 10 x OEL
LIKELY	Event that may occur frequently during the life-time of an operation / project	Typically occurs once or twice per year	Frequent (daily) exposure at > OEL
POSSIBLE	Event that may occur during the life-time of an operation / project	Typically occurs in 1-10 years	Frequent (daily) exposure at > 50% of OEL Infrequent exposure at > OEL
UNLIKELY	Event that is unlikely to occur during the life-time of an operation / project	Typically occurs in 10-100 years	Frequent (daily) exposure at > 10% of OEL Infrequent exposure at > 50% of OEL
RARE	Event that is very unlikely to occur during the life-time of an operation / project	Greater than 100 year event	Frequent (daily) exposure at < 10% of OEL Infrequent exposure at > 10% of OEL

CNNC
Rössing Uranium
Working for Namibia

ANNUAL ENVIRONMENTAL MANAGEMENT REPORT
2024

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Acronyms and Abbreviations

µm	micrometre, 10^{-6} m
dB	decibel
cm	centimetre
CO	carbon monoxide
CO_2-e	carbon dioxide equivalent
CSIR	Council for Scientific and Industrial Research
DWA	Department of Water Affairs
EMS	Environmental Management System
FPR	Final Product Recovery plant
GHG	greenhouse gas
GIS	Geographic Information Systems
GJ	gigajoule
GJ/kt	gigajoules per kilotonne
HSE	health, safety and environment
HSE MS	Health, safety and environment management system
IUCN	International Union for Conservation of Nature
km	kilometre
L	litre
m	metre
M	mega, one million
m^3	cubic metre
mamsl	metres above mean sea level
MAWLR	Ministry of Agriculture, Water and Land Reform
mg	milligram
mg/kg	milligram per kilogram
mg/L	milligrams per litre
mg/m^3	milligram per cubic metre
mg/m^2	milligram per square metre
ML 28	Rössing Uranium Limited's Mining Licence 28
m/s	metre per second
m^3/s	cubic metres per second
MSDS	material safety data sheets
m^3/t	cubic metre per tonne
NO_x	nitrogen oxide
PM_{10}	particulate matter smaller than 10 microns in diameter
ppm	parts per million
SANS	South African National Standards
SO_2	sulphur oxide
SOP	standard operation procedure
TPH	total petroleum hydrocarbon
TPM	total particulate monitors
TSF	Tailings Storage Facility
UN	United Nations
UNSCR	United Nations Security Council Resolution
U_3O_8	uranium oxide
yellowcake	ammonium diuranate

1 INTRODUCTION

1.1 Location

Rössing Uranium Limited operates a large-scale, low-grade uranium mine in the Namib Desert, located in the sparsely populated Erongo Region of Namibia (Figure 1).

The mine is situated 12 km from the town of Arandis, which lies 70 km inland from the coastal town of Swakopmund.

The mine site covers a mining licence and accessory works area of about 180 km², of which 25 km² is used for mining, waste disposal, and processing. Rössing mine is located approximately 25 km upstream of the confluence of the Khan and Swakop rivers.

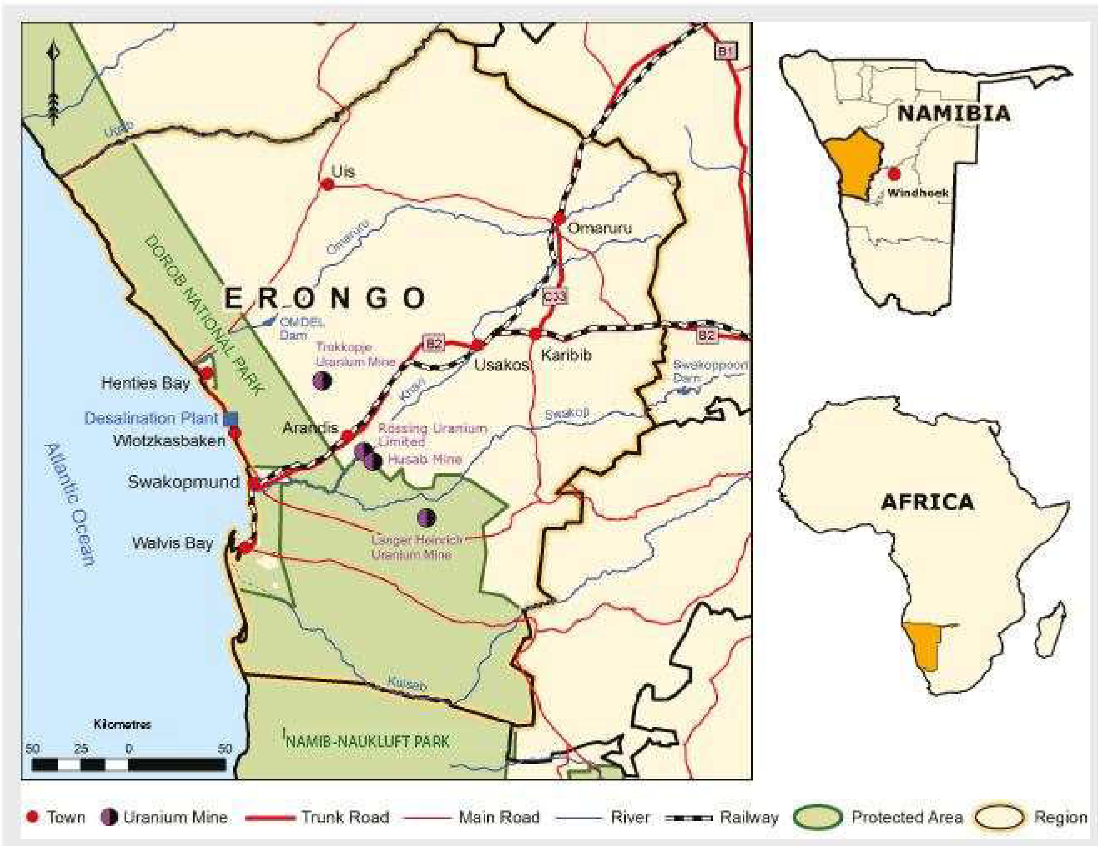

Figure 1: Location of Rössing mine

1.2 Shareholding

Rössing Uranium Limited's majority shareholder is China National Uranium Corporation Limited (CNUC), which holds 68.6% of the company's shares.

The Namibian Government maintains a 3% shareholding but possesses majority voting rights (51%) on matters of national interest.

The Industrial Development Corporation of South Africa owns a 10% stake in the company, while the Iranian Foreign Investment Company holds 15% of shares, an investment dating back to the company's establishment in the early 1970s.

The remaining 3% of shares are distributed among individual shareholders.

1.3 Scale of operation

Rössing is the world's longest-running open-pit uranium mine, operating continuously 24 hours a day, 365 days a year. It is one of two uranium mines currently active in Namibia and contributes significantly to global uranium oxide production.

In 2024, the production of uranium oxide for the year is 2,600 metric tonnes compared to 2,920 metric tonnes in 2023. A total of 30,334,678 metric tonnes (2023: 16,683,199 metric tonnes) of ore were mined from the open pit, while 8,486,056 metric tonnes (2023: 9,301,890 metric tonnes) of ore were milled.

1.4 Current life-of-mine

The current life-of-mine plan is ending in 2036 however, there are studies underway to inform feasibility of extending beyond 2036.

2 BRIEF DESCRIPTION OF THE ENVIRONMENT

2.1 Geology

The Rössing uranium deposit is situated within the central portion of the late-Precambrian Damara orogenic belt, a geological formation about 50 km wide that stretches northeast for more than 100 km in west-central Namibia. The Damara belt is characterized by folded, steeply inclined meta-sedimentary rocks-including gneiss, schist, quartzite, and marble-arranged in a northeast-southwest trending zone.

The geology of the Rössing mining area is dominated by a dome structure and features pegmatitic granite, known as alaskite, which intruded into the surrounding meta-sediments. Uniquely, Rössing hosts the world's largest known uranium deposit found in granite. The uranium ore varies greatly in both nature and grade, occurring as large masses or as narrow bands interspersed within barren meta-sediments.

Most of the primary and secondary uranium mineralisation is found within the alaskite, although not all alaskite is mineralised; much of it contains little or no uranium or is of sub-economic grade. Uraninite is the principal ore mineral, accounting for 55% of the uranium content, with secondary uranium minerals making up 40%, and the refractory mineral betafite comprising the remaining 5%. The average ore grade at Rössing is very low, at just 0.035%. The uranium ore is composed of 70–90% alaskite and is further classified into four types based on the host rock composition.

2.2 Climate

Rössing is situated in an arid area and receive very low annual precipitation. In 2024, the total annual rainfall received on the mine was 4 mm. The annual rainfall, and the long-term rainfall average, is displayed in Figure 2.

Rössing rainfall measurements indicate an average annual rainfall of about 27 mm over the years.

In terms of temperature, the variation between daily minimum and maximum temperatures are wide. The lowest temperatures are recorded during June and the highest temperatures are recorded in March, as shown in Figure 3. The coldest months usually begins in April and continues to July before temperatures start picking up again during summer.

In 2024, at Rössing the predominant winds experienced were blowing from west-southwest.

The combination of the low rainfall, high temperatures, the wide temperature ranges and prevalent winds result in high evaporation rates that vary between 6 and 15 mm per day. The potential evaporation is thus around 3,000 mm per annum.

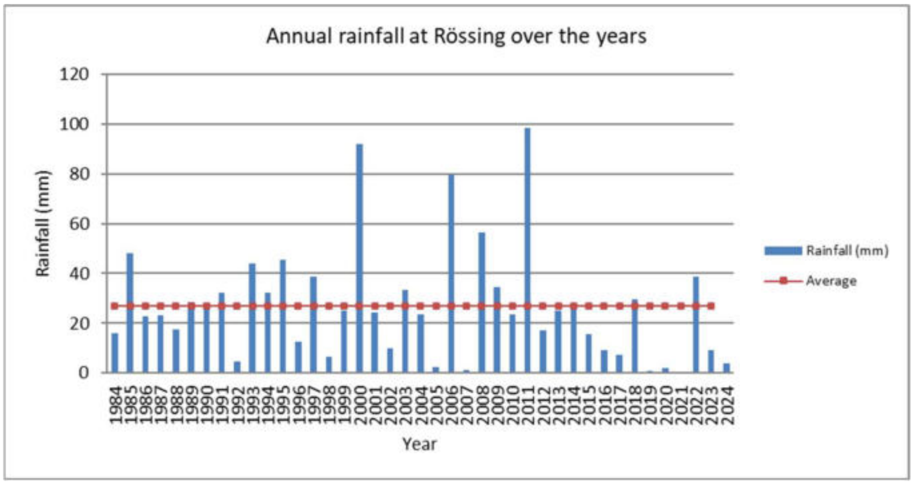

Figure 2: Variation in annual rainfall at Rössing, (1984-2024)

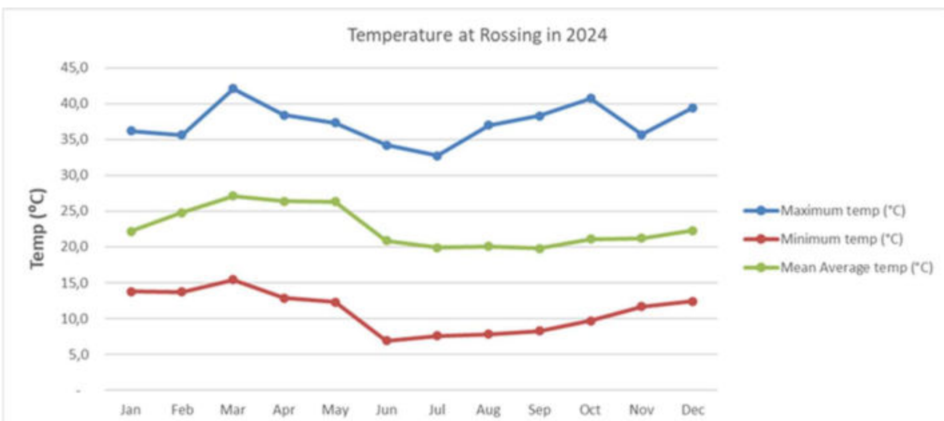

Figure 3: Temperatures measured at Rössing mine, 2024

2.3 Topography and soils

The Rössing tenement is situated at an average altitude of 575 meters above sea level. The western, northern, and northeastern parts of the area mainly consist of broad peneplains characterized by flat terrain. This landscape is intersected by shallow drainage lines and stormwater gullies that channel water into the Khan River. Moving closer to the Khan River, the flat plains transition into more undulating terrain, which becomes increasingly rugged approaching the Swakop River.

Soils around Rössing are generally shallow, typically less than 25 cm deep, and contain a high proportion of coarse fragments and occasional concretions. These soils exhibit high pH values and commonly feature hard surface and near-surface crusts. Such crusts reduce rainfall infiltration, leading to increased surface runoff.

In sheltered locations, sand deposits of varying depths occur, consisting of a mixture of dark to light brown grit, quartz, and feldspar fragments. Coarse materials are also found on the slopes of some hills, with deposit thicknesses varying up to approximately 1.5 meters.

The deepest soils are found along drainage lines and mainly consist of infertile, almost sterile alluvial deposits of varying thickness. Across much of the hill slopes and gravel plains within the mine tenement, the topsoil is shallow, poorly developed, infertile, and often absent.

2.4 Biogeography

On the gravel plains at Rössing, vegetation is dominated by sparsely-scattered dwarf shrubs and ephemeral grasslands. This is also the case for the undulating hills and mountains with sparse grass cover. A total of 21 biotopes are discernible to identify landform boundaries in association with ecosystem functions and characteristic plant species. To date, a total of 241 plants species have been identified in the mine vicinity.

Sparse riparian vegetation marks the drainage lines, in particular the Khan River. In general, vegetation relates strongly to the frequency, intensity and duration of flooding events. A few species dominate: Anaboom (Faidherbia albida, previously Acacia albida), Camel thorn tree (Vachellia erioloba, still more commonly known as Acacia erioloba), Tamarisk (genus Tamarix) and thickets of the Mustard tree (Salvadora persic). The relative denser riparian vegetation provides food and shelter to many animal species and sustains important migration and dispersal routes as a result.

A total of 272 species of ground-living insects are recorded at Rössing; this excludes flying groups such as moths and lacewings. The rocky hillsides, in particular those located along the Khan River, are regarded as the most important habitats of invertebrates.

The Namib Desert is known for its reptile diversity, particularly of lizards and geckos. At Rössing, 33 reptile species are expected to occur. Two species, Merolis sp. Nov and Pedioplanis husabensis, are of special concern. Three species of frogs are known to occur at Rössing. From a local perspective, the Khan River has the highest bird species diversity, indicating the importance of water availability and consequent-supported plant life, as well as the diversity of cliff habitats.

Mammal diversity at Rössing is not very high, as is typical in the central Namib. Climatic variation is closely coupled with marked changes in the abundance of animal species. Many of the animal species that occur around use a wide range of habitats or may cross a wide range in the course of migrating from one habitat to another. Common animal species include klipspringer, oryx, springbok, ostrich, kudu, Hartmann's zebra, dassie (rock hyrax), black-backed jackal, baboon and rodents (particularly gerbils).

2.5 Surface and groundwater

Open-surface water in the Namib Desert is a rarity and may occur only ephemerally during the rainy season. Flowing surface water on the mining licence area only occurs after heavy rainfall. Run-off in the drainage lines is an episodic, brief event and peaks and periods of run-off vary widely.

Due to their alluvium beds, the tributaries of the Khan River contain subsurface water flow for most of the year. Permeability of the alluvium is high, and the alluvium has also a high storage capacity with the water table being within 2 to 3 m of the surface.

Seasonal springs and small pools may occasionally form in the Khan River and in the gorges that drain into the Khan River. Only one natural perennial spring occurs in the Rössing area and is located in a side-arm of Panner Gorge.

Groundwater flows and rainfall seepage at Rössing is mainly along fractures and focus towards the gorges that drain into the Khan River.

Super-imposed on the natural groundwater system are sources and sinks created by mining. The open pit, more than 300 m deep, cross-cuts the hydrogeological connection between the existing Processing

Plant and the Khan River receiving environment. It acts as a cut-off trench and enables the interception and subsequent evaporation of potentially contaminated water moving downstream from the plant area.

The open pit also creates a cone of groundwater table depression that cuts off groundwater flow through bedrock and alluvial channels. Around the open pit, hydrogeological parameters of storage and permeability are very low.

The current elevation of the bottom of the open pit is substantially lower than the level of the Khan River (3 km to the south), and the regional water table (about 20 m below ground). The Khan River is also separated from the open pit by a low-permeability rock mass and the possibility of water from the Khan River entering the pit void is significantly reduced this way.

The natural groundwater quality in the vicinity of Rössing is very saline with total dissolved solids concentrations of 20,000 – 40,000 milligrams per litre (mg/L). The only groundwater potentially suitable for agricultural use near Rössing is found in the Khan River. This water is brackish and only suitable for livestock watering.

As a result of the high salinity of the water in the Khan River, the only beneficial uses of the water are for industrial purpose, such as dust suppression. Despite its salinity, the very hardy natural vegetation along the river depends on this water and abstraction is closely linked to monitoring of the water table.

2.6 Air quality

Rössing experiences high wind speeds, especially during winter, with historical gusts reaching up to 34.9 m/s. In 2024, the average daily wind speed was measured at 1.7 m/s, with the highest one-hour wind speeds recorded at 8.5 m/s during March and June. These elevated wind velocities contribute to the potential for airborne dust and other impurities.

The transport of dust and pollutants toward inhabited areas depends on the relative positions of receptor points and prevailing wind directions, as summarized in Table 1. While deposited dust generally does not pose a direct health risk, its visibility can lead to public complaints. Suspended dust particles smaller than 10 micrometres (PM10) can be inhaled and may affect human health depending on concentration and exposure duration.

Dust also poses environmental risks, as heavy metals can settle onto soil and plant foliage, causing ecological harm. To address concerns about nuisance dust potentially affecting lands adjacent to Rössing's mining licence area (ML 28), dust deposition is monitored at multiple stations around the mine.

Most dust generated in the open pit is fugitive, but blasting activities serve as point sources for particulate emissions. Large blasts occur approximately every two weeks, with smaller blasts two to three times weekly. As the pit deepens, the size and impact of blast dust plumes decrease. Dust from smaller blasts tends to settle within the pit on benches and roads, where it can be remobilised by wind and vehicle traffic.

Among eight common air impurities identified, five (SO_2, CO, NO_x, PM10, and dust deposition) are emitted at Rössing. However, only PM10 and dust deposition are considered significant and are regularly monitored. Annual monitoring of SO_2, CO, and NO_x is conducted, especially in relation to emissions from the yellow cake roasting process at the Final Product Recovery (FPR) plant. Greenhouse gas emissions, expressed as CO_2-equivalent, are estimated monthly based on fuel consumption, electricity use, and explosives for blasting.

Noise and vibration from mining and processing activities, including material handling and on-site transport, are also monitored to mitigate impacts on local communities and wildlife. Monitoring includes spot checks, targeted surveys, and regular risk assessments. Air blasts and ground vibrations are additionally tracked for geotechnical purposes, such as assessing the stability of man-made landforms.

Table 1: Geographical position of localities relative to wind direction

Locality	Distance from mine	Direction	Relative to wind direction
Arandis Town	5 km	Northwest	Does not lie in the direction of E, NE, or SW winds
Arandis Airport	6 km	West	Lies in the direction of E wind
Swakopmund small holdings	50 km	Southwest	Lies in the direction of NE wind at a distance
Swakopmund Town	60 km	Southwest	Lies in the direction of NE wind at a distance
Walvis Bay	75 km	South-southwest	Lies in the direction of NE wind at a distance
Henties Bay	88 km	Northwest	Does not lie in the direction of E, NE, or SW winds

2.7 Sites of archaeological and cultural interest

A total of 49 archaeological and historical sites have been recorded within the Rössing area. While there is some evidence of occupation dating back to the upper Pleistocene, most sites are from the last 5,000 years. Notably, a cluster of sites is associated with grass-seed digging activities in well-drained soils derived from weathered granite, estimated to date post-AD 1000. These seed-digging sites are mainly found around low-lying granite outcrops with shallow depressions that may hold water after rains. Such locations are linked to traditional seed-gathering practices still observed by Damara-speaking communities today.

Historical sites in the area include remnants of the narrow-gauge railway that operated between Khan Mine and Arandis siding until approximately 1918.

Overall, the Rössing tenement is not considered an area of outstanding archaeological significance and lacks the dense site clusters typical of other regions of the Namib Desert escarpment and ephemeral river systems. The highest heritage value sites are located outside the main mining focus areas, where disturbance is minimal. Within the mining area and zones of high disturbance, heritage value is generally low, and the sites show low vulnerability to disturbance. Most archaeological and historical sites here are of low individual significance.

2.8 Land use

Apart from the town of Arandis, there is no significant active land use in the immediate vicinity of the Rössing mining licence area. Water resources in the region are extremely limited, making agriculture largely unfeasible-even along the ephemeral Khan and Swakop rivers. The nearest commercial farmland is situated approximately 15 km to the east, while communal land borders lie about 15 km to the north.

Closer to the coast, along the lower Swakop River, several smallholdings engage in commercial farming, producing asparagus, olives, mushrooms, and vegetables, primarily to supply Swakopmund and Walvis Bay. These areas also support tourism and leisure activities.

The Rössing mining licence area is located within the #Gaingu Conservancy. Population density in the conservancy, especially south of the main road, is very low. Approximately 720 hectares of the mining licence overlap with the Namib-Naukluft Park on the southern bank of the Khan River. The Dorob National Park lies about 10 km to the west of the mining area. Both parks are classified as Category 2 protected areas by the International Union for Conservation of Nature (IUCN).

3 ENVIRONMENTAL MANAGEMENT AT RÖSSING

3.1 The management system

All operational activities at Rössing are managed to ensure that impacts on both the biophysical and socio-economic environment are kept within acceptable limits. The mine operates under all relevant national legislative and regulatory frameworks, and its activities are guided by an integrated Health, Safety, and Environment Management System (HSE MS). This system aligns with international standards ISO 14001, ISO 45001, and ISO 9001, with Rössing holding ISO 14001 certification since 2001.

The HSE MS is designed to identify key health, safety, and environmental risks and aspects, guide operational procedures, and drive continuous improvement. All potential impacts are recorded in a business or site risk register, along with corresponding mitigation and operational controls.

Serving as a key tool for achieving Rössing's objectives and legal obligations, the HSE MS promotes efficient resource use and can yield financial benefits, resulting in a win-win for both environmental and business performance. The system is subject to regular external ISO audits, and in 2021, Rössing was successfully recertified for ISO 14001:2015, valid until 2024.

Since 2005, Rössing has also implemented Health, Safety, and Environmental Performance Standards to foster annual employee commitment to improving impact management. Under its current ownership, Rössing maintains these high standards and continues to apply robust systems for managing HSE risks across all facilities.

The overarching goals of environmental management at Rössing include:

- Assessing environmental impacts throughout all phases of mining, from design to decommissioning
- Developing and managing monitoring systems to maximize avoidance, minimization, and rehabilitation of adverse impacts
- Ensuring compliance with environmental regulations and management plans
- Reducing the use of non-renewable resources
- Maximizing positive environmental outcomes
- Avoiding, minimizing, and rehabilitating negative impacts
- Preventing contamination through containment, recycling, and removal measures
- Protecting and enhancing cultural, heritage, and archaeological resources
- Keeping communities informed and involved in decision-making
- Promoting awareness, training, and responsibility in environmental management

The formalized, integrated HSE MS enables Rössing to coordinate operations, personnel, equipment, and processes in line with best practices for environmental management. The system incorporates planning, implementation, checking, corrective action, and management review, supporting the identification of key environmental aspects and the development of standard operating procedures for continual improvement.

Annual HSE management reviews, conducted by senior leadership, are a vital part of this process. These reviews ensure the effectiveness of the HSE MS, help focus management attention, and authorize actions or resources needed to further improve HSE performance and compliance.

3.2 Environmental monitoring localities

The comprehensive environmental monitoring network at Rössing includes ambient dust fallout buckets, lithops monitoring, water quality monitoring boreholes, environmental noise and vibration and weather stations for meteorological parameters (see Appendix 5).

4 ENVIRONMENTAL PERFORMANCE IN 2024

Rössing's Environmental Management Plan contains a concise description of the management of environmental aspects and impacts at the mine, covering the various mine phases, from the designing to the decommissioning phase.

No significant environmental incidents occurred during 2024 and no deviation from the Environmental Management Plan was reportable to the respective authorities. In 2024 exploration activities in the Z20 area has commenced, park entry permits are in place from the Ministry of Environment, Forestry and Tourism (MEFT).

As a resource-intensive industry, Rössing's operations have the potential to impact on natural resources and the environment. For this reason, Rössing focuses continuously on improving environmental management programmes to maximise benefits and to minimise negative impacts. Key environmental management programmes include:

- Energy efficiency and greenhouse gas emissions
- Air quality control (including emissions of dust, other impurities, noise and vibration)
- Water management
- Waste management (both mineral and non-mineral waste)
- Chemical substance management, and
- Land-use management (including biodiversity, rehabilitation and closure).

As part of continuous improvement, there were notable improvements in the environmental monitoring space, as well as awareness on environmental aspects, such as waste management, air quality monitoring and water quality management. To mention a few:

- The Rössing access road, speed limit was reduced from 100km/h to 80Km/h to minimise vehicle/wildlife collisions.
- Snake and scorpion handling training aimed at safe capture and relocation of these animals.
- The use of Environmental stable isotopes as an additional tool to support existing methods of groundwater quality monitoring.
- Various progressive rehabilitation and clean-up projects were identified for action, these are aimed at minimising mine closure liabilities.
- A tailor-made training programme for each working area in addition to the annual HSE training & inductions.

The performance in 2024 with regard to the environmental management programmes is discussed in the next sub-sections.

Environmental awareness and training are integral components of our environmental management system.

4.1 Environmental awareness and training

4.1.1 World Environment Day

In 2024, World Environment Day was themed "Land Restoration, Desertification, and Drought Resilience." This theme highlights the critical need to address land degradation, combat desertification, and enhance our resilience to droughts. As part of our commitment to the environmental stewardship, tokens of "Sustainably Harvested Bamboo Utensil Sets" were distributed to the workforce. In promotion of the 3R's, these tokens symbolize our dedication to sustainability and reducing single use plastics.

Figure 4: Tokens of Sustainably Harvested Bamboo Utensil sets

4.1.2 Birdwatching event

The Rössing annual birdwatching event was hosted at the scenic Walvis Bay Lagoon. The event aims to give participants an opportunity to view the unique birdlife, and to promote a long-term interest in birds, linked to conserving local and wilderness biodiversity.

The 2024 event attracted 114 learners from schools in Walvis Bay, Swakopmund, and Arandis. With the aid of a professional birdwatching guide, participants could identify different bird species and get insight into associated facts (differentiating physical features and reasons for their evolutionary adaptations, diets, migration routes, etc).

Learners were provided with binoculars and a printout with pictures of bird and their names, with which they could spot and identify different birds along the lagoon. A fun quiz was arranged for learners to participate and win prizes.

Figure 5: Team of enthusiastic learners, birdwatching at the Walvis Bay Lagoon.

4.1.3 Snake Handling training

Snakes and scorpions, which frequently wander into operational areas, are captured and relocated within the mining licence boundary. To ensure safe handling of the critters, the business annually offers a voluntary snake and scorpion handling course. In 2024, 10 employees received snake handling training from an external service provider. The course equips the volunteers with theoretical knowledge and practical skills required to safely capture and relocate the reptiles. Only trained and certified employees are permitted to handle snakes on the mine.

Figure 6: Snake handling training

4.1.4 In-house waste management training

The Rössing Environmental Performance Standard requires all employees who are involved with hazardous materials handling and waste handling to be trained so that they understand the environmental hazards and risks for routine activities and emergency actions.

To ensure compliance on waste management, regular inspections are carried out in workshops, storage, and disposal areas. The outcome of inspections from operations indicates that waste management is a challenge in most areas and there is a lack of basic understanding in waste sorting and segregation. This was addressed through customised training modules on waste management, in addition to the HSE trainings conducted among all employees. An estimate of over 300 employees including contractors attended the e-learning module and face to face Hazardous Material and Waste management training.

4.2 Clean-ups & Donations

4.2.1 Wapaleka

The “Lekka Wapaleka clean-up campaign” continued throughout the year as it’s of vital importance to always maintain housekeeping to avoid any possible HSE incidents (**Figure 7).**

Figure 7: Teams participating in "Wapaleka Campaign".

A mini clean-up initiative in celebration of the World Environment Day was held on the 05 June 2024, involving 60 employees who cleared litter along the access road from the mine entrance to the Arandis T-junction (**Figure 8**).

Figure 8: Environment Day Mini Clean-up Campaign

4.2.2 Project Shine

As part of our social responsibility, Rössing continue to support the Project Shine clean-up campaign under the management of Swakopmund municipality. Rössing was a founding member of the Project Shine initiative and with input from various stakeholders the mine sustained this project successfully since its inception.

Project Shine has been successfully managed since it was first launched in 2007 on World Environmental Day. The project aimed at minimizing negative impacts of pollutants on the environment and to encourage environmental cleanliness in Swakopmund and has been successfully achieved for over 10 years.

The project was launched on 08 March 2024 at the Swakopmund Municipal Council Chambers and runs over a period of 6 months. A total of 1340 bags were collected by the groups and disposed of at the landfill site.

In 2024, Rössing donated N$50 000 to the continuation of the project. The funds were earmarked for supporting projects shine to execute its mandate of cleaning-up the roads and an awareness/education campaign. Rössing has also committed to support the project with an evaluator and a 4x4 vehicle on monthly evaluation sessions. By supporting such initiatives, Rössing aim's to be the leader in environmental stewardship in Namibia.

Figure 9: Swakopmund community members during the clean-up sessions.

4.2.3 Donations to the community

RUL continue to promote the 3R's by supporting community projects through donation of timber (100 tonnes) to the vocational training centres (COSDEF, NIMT), Erongo Constituency offices, Sonstraaltjie kindergarten, Arandis Town Council, and the Urban Agricultural Project under the management of Swakopmund Municipality **(Figure 10)**.

Figure 10: RAD truck offloading wooden pallets at COSDEC & Urban Agricultural project in Swakopmund.

4.3 Energy efficiency and greenhouse gas emissions

As part of the environmental commitment and priority given to protecting the environment, Rössing measures and manages its greenhouse gas ("GHG") emissions and energy intensities. This assists in improving energy efficiencies and reduce GHG emissions. The sources of GHG emissions at Rössing include electricity and fuel consumption, the transporting of reagents and uranium oxide, blasting (use of explosives), waste management areas (the sewage plant, rubbish disposal, and landfill site), and the extraction and processing of ore. The intensity of emissions reported per unit of uranium oxide produced.

In 2024, the total energy consumption of the mine was 1,534,366 GJ for 2,600 tonnes of uranium oxide drummed. This converts to an annual energy consumption of 590 GJ per tonne (GJ/t) of uranium oxide produced, which is 14% below the projected internal target of 688 GJ/t uranium oxide produced (see **Figure 11).**

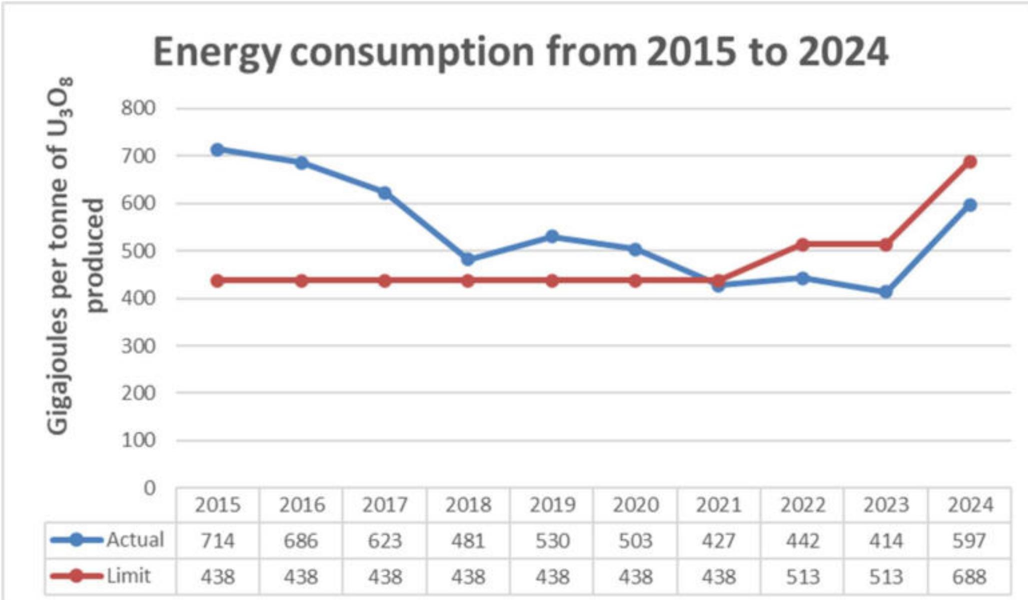

Figure 11:: Energy consumption, 2011-2024 (gigajoules per tonnes of U3O8 produced)

In the reporting year, emissions of carbon dioxide (CO2) per unit of production amounted to 65 tonnes of CO2 equivalent per tonne (CO2-e/t) of uranium oxide, which is 22% below the internal threshold of 83 tonnes CO2-e/t of uranium oxide for the year (**see Figure12).**

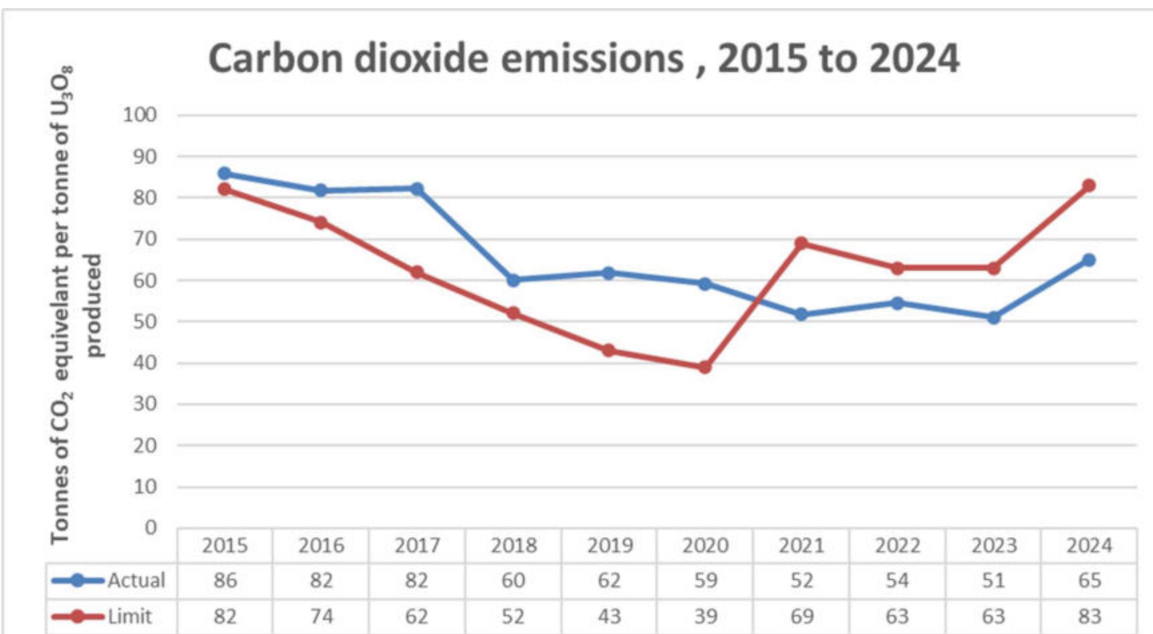

Figure 12: Carbon dioxide emissions, 2015-2024 (tonnes of CO2 equivalent per tonne of U3O8 produced)

Both the energy consumption per ton of uranium oxide and carbon dioxide emissions per unit of production exceeded internal targets due to the two-month shutdown in March and April. During this period, while production was halted, energy use and emissions continued, leading to high energy intensity per ton of uranium oxide and CO2 equivalent per tonne of uranium oxide.

4.4 Air quality management

Rössing Uranium over the years has setup an Air-quality Management programme that guides how to manage the environmental dust around the mine. The AQM Program in place helps in quantify dust and mitigation when necessary. Rössing Uranium commits to help protect the environment from the harmful effects of air pollution caused by mining activities. Therefore, Air emissions are listed in an inventory, and all air-quality standards applied at the mine are documented.

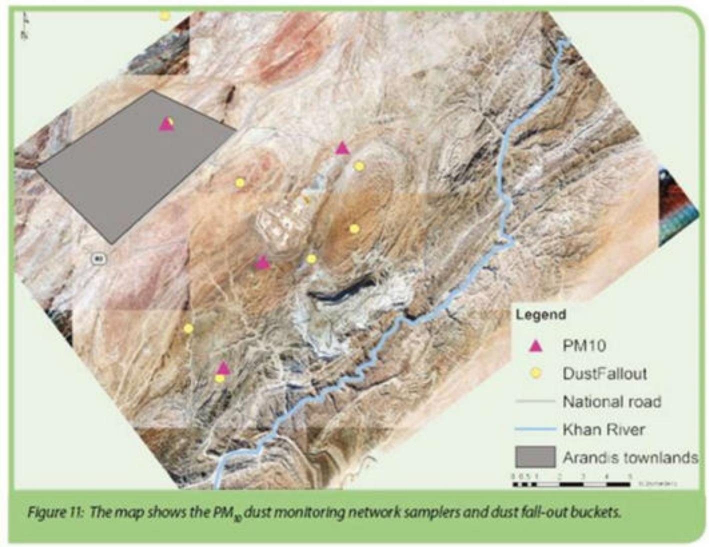

Figure 13: PM10 dust monitoring network samplers and dust fall-out buckets

4.4.1 Environmental dust

Rossing Uranium is situated in a desert environment, where it is windy during winter months. During the windy times dust can be transported up to several kilometres. Hence, dust is expected during the mining operations such as ours and of great public concern especially to the residents of Arandis and Swakopmund.

The AQM Program in place helps in quantify dust fallout and allow mitigation when necessary. The measures are taken to ensure that exposure levels do not exceed the adopted occupational limits and that the controls efficiently detect differentiations resulting from process changes etc.

There are two types of dust measured: firstly, a very fine inhalable dust invisible to the naked eye that is comprised of particulate matter less than 10 micron (known as PM10), and secondly, fallout dust, which is visible on the ground and comprised of lager particles, including PM10.

The measure of PM10 is the weight of particles less than or equal to ten micrometres in diameter in one cubic metre of air. When inhaled, these tiny particles are not filtered out by the body and therefore reach the lungs.

We monitor PM10 dust levels onsite at three dust monitor stations and at one station in the nearby town of Arandis **(see Figure 14).**

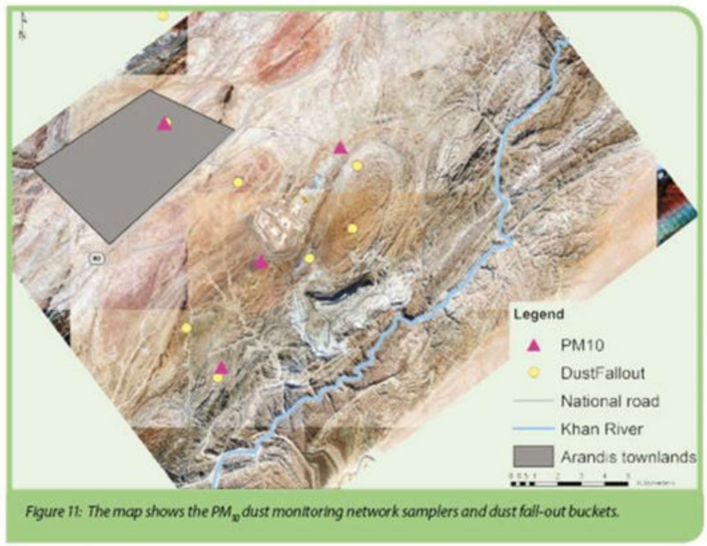

Figure 14: PM10 dust monitoring network samplers and dust fall-out buckets

The levels measured in 2024 showed that the PM10 dust concentrations at the available stations were all below the adopted World Health Organization standard of 75µg/m3 (see Figure 12). Monitoring equipment availability was a challenge in 2024, as our aging units became faulty – a replacement strategy has been approved. Availability of the Arandis, Boundary and Tailings stations were prioritised, in that sequence. The station at the Communications Management Centre (CMC) was sacrificed, as it is located upwind of the predominant wind direction – replacement unit is expected in early 2025.

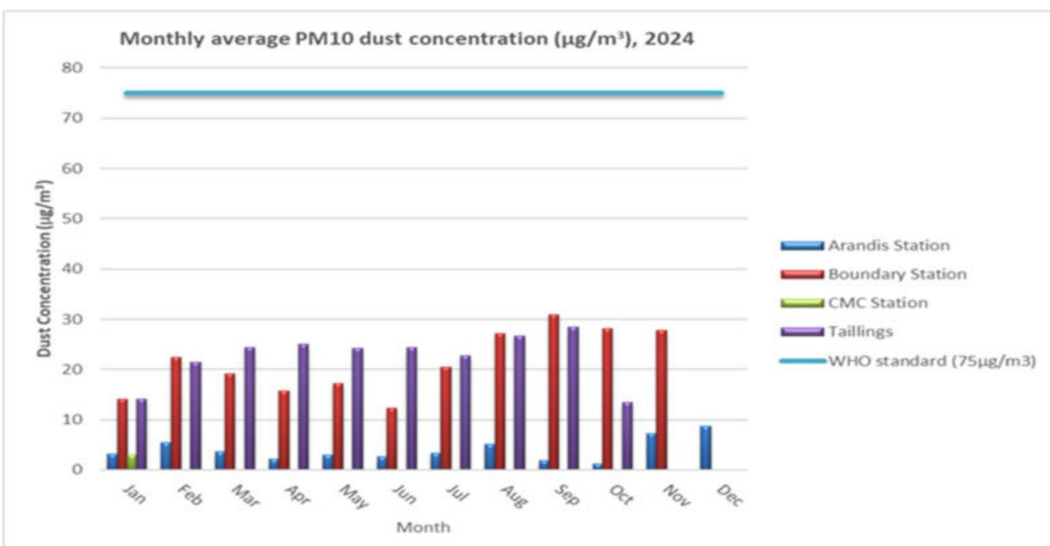

Figure 15: Monthly average PM10 dust concentration, 2024

4.4.2 Ambient dust fallout

Dust fallout is measured as aspect of the air quality management at Rössing as a result of our mining activity which may adversely affect the surrounding environment and residential inhabitants.

Rössing has adopted to the South African National Dust-control Regulation (SA NDCR) and World Health Organisation in the absence of Namibian legislation, the limits are 600 mg/m2 per day for residential and 1,200 mg/m2 per day for non-residential areas with an annual average target of 300 mg/m2 per day.

Fallout dust is measured at six stations at different locations along the mine The dust fallout limit is 600mg/m2 per day , as required by the adopted South African National Dust-Control Regulation ("SA NDCR") standard.

During 2024, values measured at the six stations ranged between 3 and 93 mg/m2 per day (see Figure 16). All measured deposition rates were well below the selected or adopted South African dust-control regulation. All measured deposition rates were well below the adopted SA NDCR.

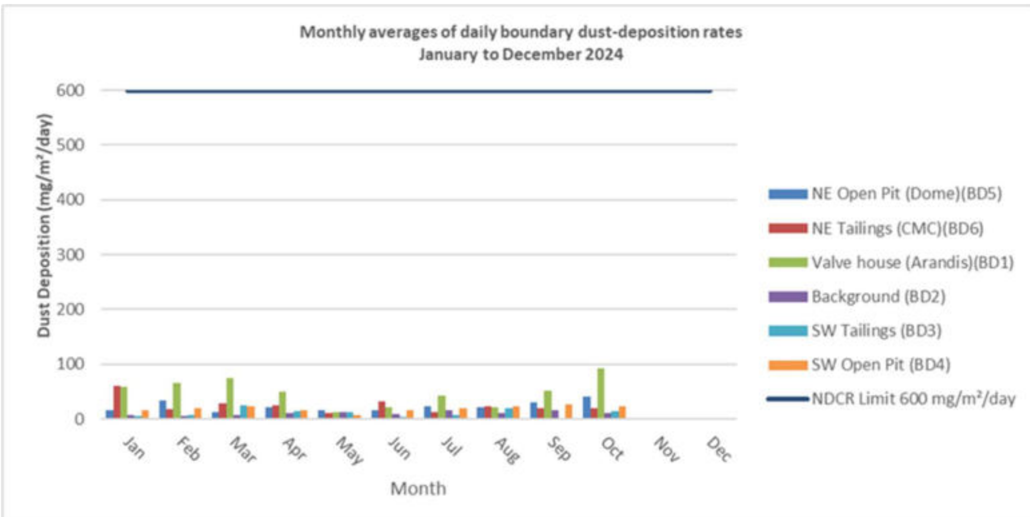

Figure 16: Monthly averages of daily boundary dust-deposition

4.4.3 Noise and vibration

As part of the Environmental Management Programme, Rössing Uranium limited (RUL) monitors Noise and Vibration among other activities. Namibia has no legislation on Environmental Noise and Vibration; therefore, RUL have adopted to the best practice or s**tandard**s of United States Bureau of

Mines (USBM) RI 8507 criteria for safe blasting, and for operational noise to the relevant South African National Standards Code of Practice, SANS 10103:2008 (SANS, 1992).

Ground vibration and air blasts is monitored during every blasting event. Blasting have a possibility of impacting on the general living conditions or lifestyle of a mine's neighbours. Thus, to monitor ground vibration and air blast, measuring points were established at the mine and in Arandis.

During 2024, both air-blast and ground vibration levels have been consistently below the limits of 134 dB and 12.5 mm/s respectively see **figure 17.**

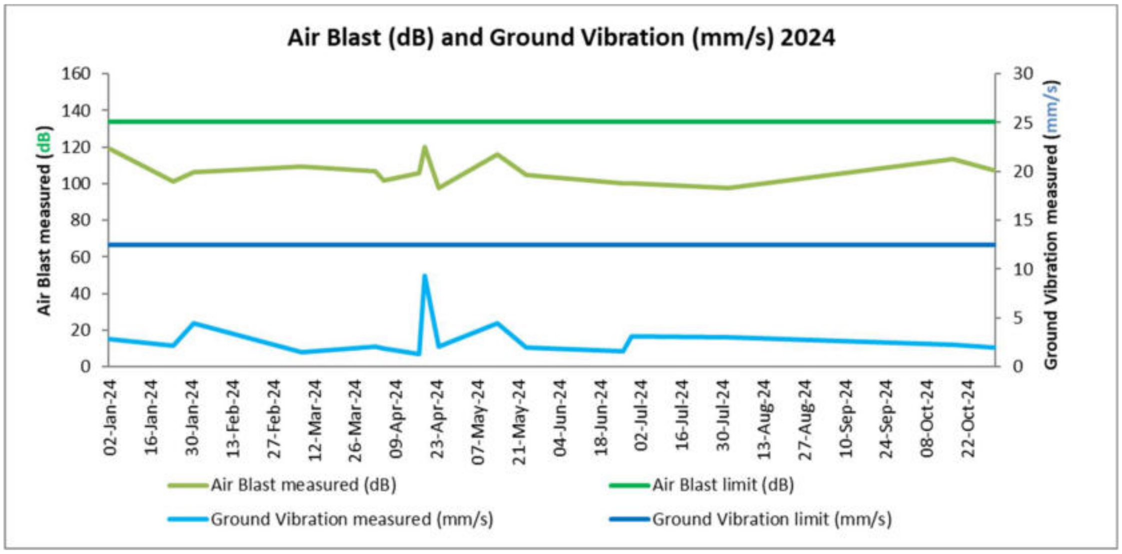

Figure 17: Air blast and Ground Vibration, 2024

Environmental noise is monitored and reported monthly. Environmental noise is measured over snapshots of ten minutes at six stations around the mine boundary. There were a few exceedances in 2024 during which noise levels, as recorded at the sampling points on the mine boundary, were above 45 dB(A) and, thus, has exceeded the standard (Figure). The events during which noise levels exceeded the standard are not attributed to the operational activities at the mine but are the result of natural sounds (windy) during the monitoring session.

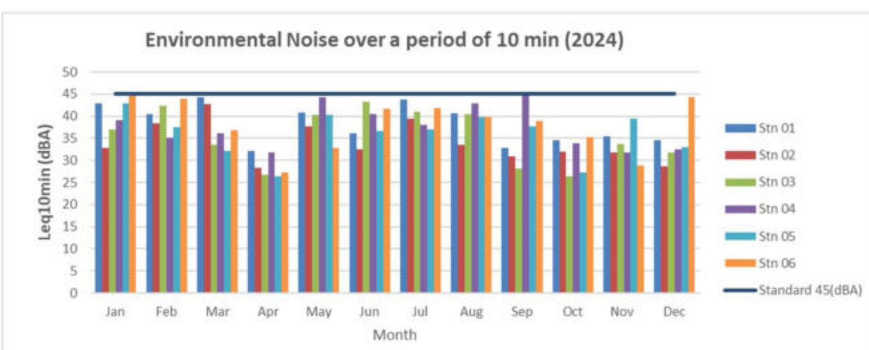

Figure 18: Environmental noise over a period of 10 minutes, 2024

4.5 Water management

Water management at Rössing is guided by a formal water strategy and Water Management Plan, which are developed according to our Performance Standard on "Water quality protection and water management".

Water management covers all activities connected to water abstraction, transport, storage, usage (potable and process), impounded water and groundwater. The intent of the Standard is to ensure efficient, safe and sustainable use and protection of water resources and ecosystems.

In accordance with the Namibian legislation, specifically the Water Resources Management Act No. 11 of 2013, the Ministry of Agriculture, Water and Land Reform (MAWLR) serves as the custodian of all water resources in the country. Under this mandate, MAWLR issued two permits to Rössing Uranium Limited (RUL). However, these permits are set to become obsolete on 28 February 2025 and will be replaced by new licenses. RUL has since submitted its application for the new licenses in compliance with the legislative requirements.

- Industrial and Domestic Effluent Disposal Exemption Permit # 674, and
- Khan River Water Abstraction Permit # 10 200.

4.5.1 Total water usage

The monthly freshwater usage (Figure 19) totals to 2.68 Mm^3 for 2024, this amount is 3.3 per cent below the planned 2.77 Mm^3 for the year. The planned fresh water annual volumes are based on planned tonnes to be milled for that year. Fresh water consumed per tonne of ore milled was 0.316 m^3/t and the ratio of fresh water to total water consumed was 0.36.

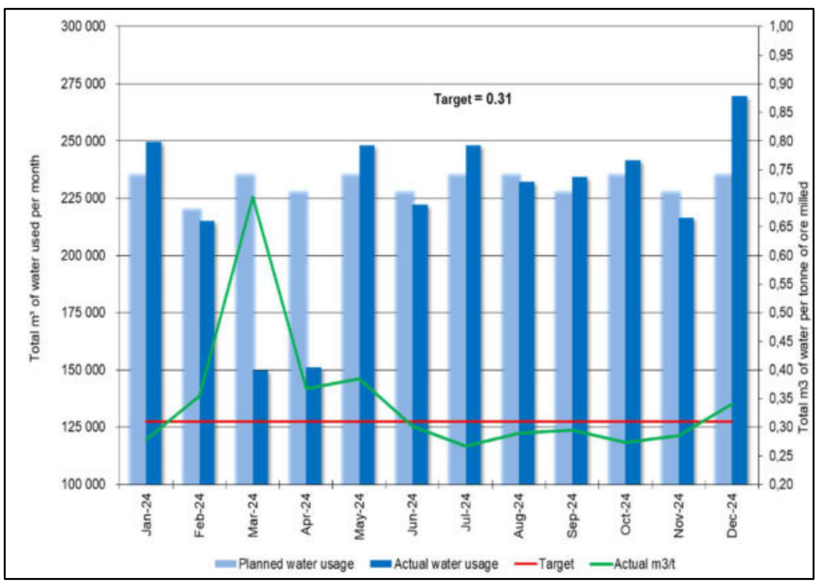

Figure 19: Freshwater use per month, 2024 (cubic meter)

Monthly freshwater usage was below the planned water usage for most of the months. Worth noting, is the actual water usage for March and April, which was severely affected by our annual maintenance shutdown Also, we had interruptions in water supply in November due to sulphur outbreak after which production was interrupted by several unprecedented pipe bursts, resulting in lower water usage against the planned target.

Monthly freshwater usage exceeded planned levels in January, May, July, September, October, and December, Figure 18. This deviation from plan was primarily caused by reduced seepage inventories due:

- Low Return Dam Solution (RDS) Recovery: Challenges in recovering solution from active paddocks.
- Transition to New Paddocks: Movement operations introduced inefficiencies.
- Water Entrainment in Slime: Increased water retention in residual materials.
- Pump Unavailability: Reduced water recycling efficiency.

Reduced seepage recovery required sustained freshwater input to meet the processing plants water demand during those months.

4.5.2 Khan River water usage

Saline groundwater from the Khan River aquifer, in conjunction with biodegradable dust suppressant polymers, is used to suppress haul-road dust in the open pit. However, no saline ground water was abstracted from the Khan River in 2024.

Although we didn't abstract the permitted volume, we continue to monitor the vegetation and water levels in the Khan River to prevent over-abstraction, based on the ecosystem response. In compliance with the abstraction permit conditions, annual reports derived from the water-level and vegetation-monitoring programmes are sent to the Ministry of Agriculture, Water and Land Reform.

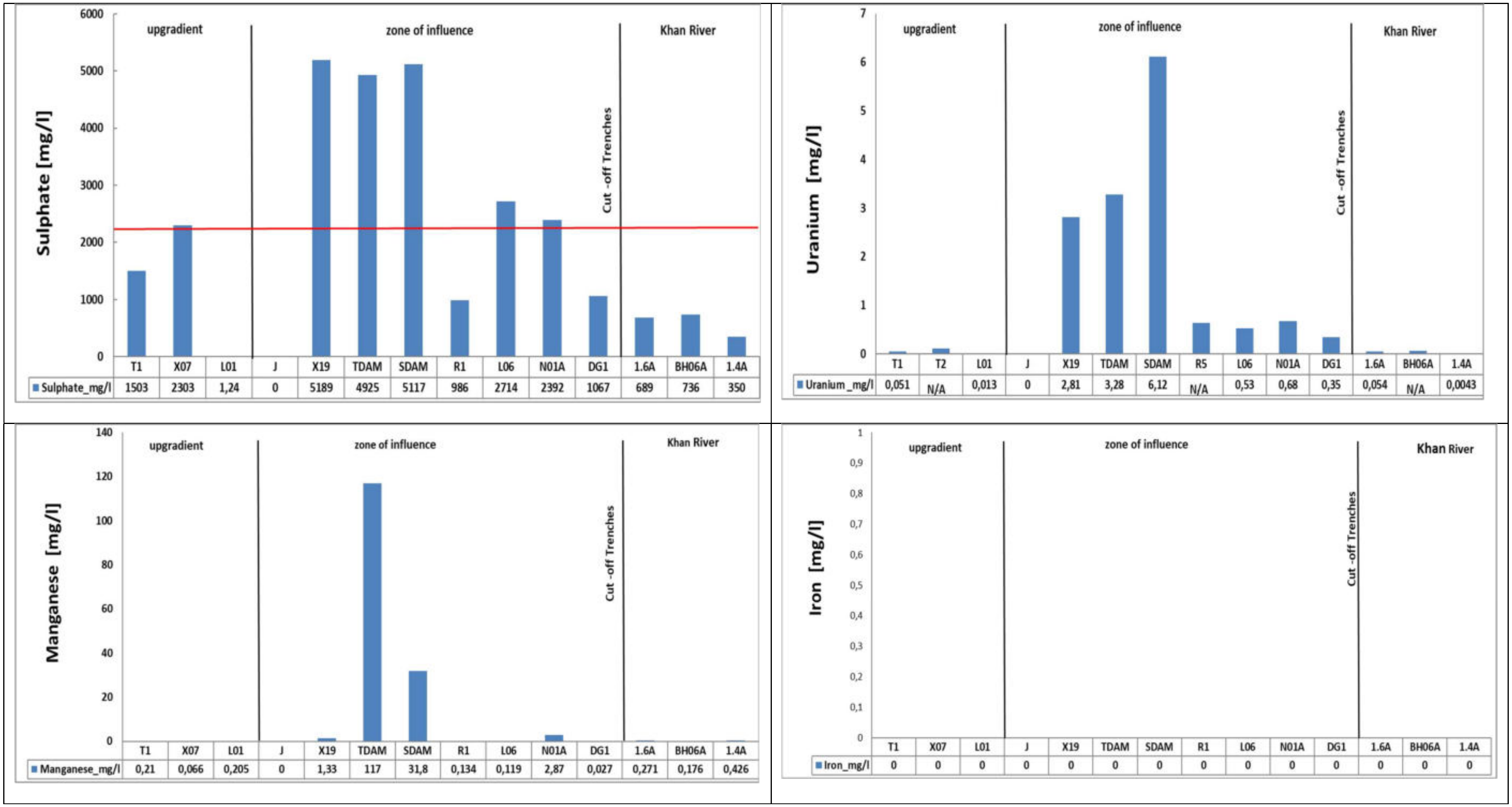

Figure 20: Water quality overview for 2024

Rössing developed a Non-Mineral Waste Plan (JE20/MMP/001) and a Non-mineral Waste Procedure (JE50/WMP/001) that addresses all non-mineral wastes generated through operational phases to ensure sound management through minimisation of waste generation and safe handling, treatment, and disposal of waste.

In 2024, waste was managed through an integrated waste management contractor appointed since 2016, ensuring proper treatment and disposal in line with permits licensing requirements and best practice. The waste contractor manages both hazardous and non-hazardous waste streams onsite and ensuring proper treatment and disposal.

As part of good corporate governance, RUL monitors all waste streams taken offsite for recycling purposes and disposal. All offsite facilities managing RUL waste, must be verified through an inspection assessment to confirm legal compliance of the facility and that waste is being managed properly. During 2024, the verification assessment was carried out at the Swakopmund Landfill Site, Rent-A-Drum and GAC facility with no major findings observed.

We continue to support the circular economy through the recycling and reuse of suitable waste streams. In 2024, 2,002 tonnes of recyclable waste were processed offsite, split as follows:

- 213 tonnes hazardous waste (mainly used oil and batteries)
- 1,789 tonnes non-hazardous waste (e.g. scrap metal, pallets, plastic, and packaging)

Key highlights:

- Used oil recycled: 206.4 tonnes
- Scrap metal recycled: 1,438.9 tonnes
- Wooden pallets donated: 201 tonnes to local schools, training centres, and community projects as part of the company's 3Rs (reduce, reuse, recycle) programme in support of local communities
- Tyres reused: 88.6 tonnes repurposed by a fishing company for harbour use

Onsite waste disposal/storage

- Certain contaminated waste streams (e.g. radioactive materials, air filters, processed mineral waste) are not permitted to leave the site. These are disposed of within approved, regulated zones onsite.
- In 2024:
- 59.9 tonnes of radioactive mechanical waste were safely disposed at the approved site
- 6,133 tonnes of hazardous contaminated waste (mining, plant, rubble) were placed at the TSF
- 168.9 tonnes of used tyres were stored onsite due to the absence of national recycling options
- We also safely stored radioactive contaminated grease and diesel drums from processing operations, pending the development of approved disposal routes.
- 1000 tonnes of hydrocarbon contaminated soil was successfully treated at the bioremediation facility and recycled back into operation for dressing.

During the year, 457.55 tonnes of hydrocarbon contaminated soil/sludge was transported to the facility for storage. Rent-A-Drum partnered up with SpillTech to treat the contaminated soil backlog (2684.23 tonnes) stored at the facility. For the first trial, two batches were treated, and the sampled results (C10 – C40) were 9 100mg/kg which is within the acceptable limits of Rossing (10 000mg/kg) and the South African soil screening values for total petroleum hydrocarbons. A total of 1000 tonnes of hydrocarbon contaminated soil was successfully treated and recycled back into operation for dressing.

Due to a lack of recycling facilities nationally, 171.05 tonnes of both light vehicle and HT tyres generated were collected and stored at the designated areas onsite. Due to a shortage of a storage capacity for the potentially radioactive contaminated hydrocarbons, a new yard was identified in the processing plant and commissioned. Contaminated grease and diesel drums generated from Final Product Recovery (FPR) are currently being stored at the new yard while the business investigates a long-term solution.

Garden and medical waste

Further enhancements in waste housekeeping were made in 2024. All historic and current garden refuse (1,352.3 tonnes) was cleared from dormant sites and disposed of at the Swakopmund municipal landfill.

Medical waste generated onsite (0.08 tonnes) was managed and incinerated through a registered facility.

Off-site disposal

The mine generates different types of hazardous waste streams, these includes used paper oil filters, hydraulic hoses, used grease, contaminated PPE, fluorescent tubes and others. RUL continuously ensure that our hazardous wastes are managed correctly and disposed of accordingly with a legally registered facility.

All non-recyclable and hazardous waste that qualifies for offsite disposal was transported to approved landfills.

- Hazardous waste: 27.9 tonnes (Walvis Bay Hazardous Landfill)
- Non-hazardous waste: 1,610.1 tonnes (Swakopmund Landfill)

To ensure that there are no footprints left in the environment, all off-site movements were accompanied by valid disposal certificates.

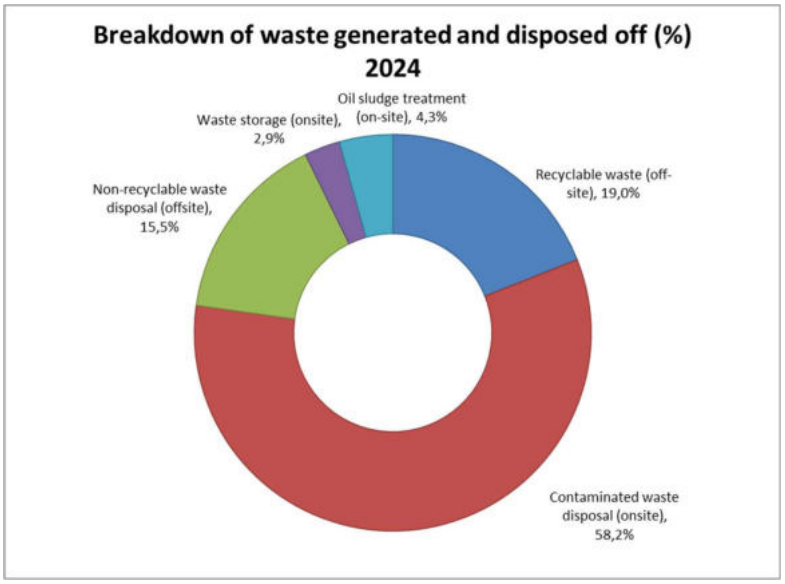

Figure 21: Waste generated, recycled, and disposed during 2024.

4.5.3 Management of mineral waste

In 2024, total mineral waste generated amounted to 28.3 million tonnes, comprising:

- 8.49 million tonnes of tailings
- 19.77 million tonnes of waste rock

The increase in waste rock, compared to 6.78 million tonnes in 2023, was due to the opening of two mining areas: Pit Bottom and Phase 4, with the latter contributing the bulk through overburden stripping.

By maximising in-pit dumping and placing waste on existing rock piles, we continued to limit land disturbance and improve operational efficiency.

Cumulative mineral waste generated over the past 48 years (as of Dec 2024):

- Total mineral waste inventory: 1,550.49 million tonnes consisting of:
  - Waste rock: 1,039.94 million tonnes
  - Tailings: 510.55 million tonnes

Total footprint: ~1,633.85 ha south-east of Arandis Town and north of the Khan River.

An updated inventory of mineral waste at Rössing is kept by mining engineers, Table 2 depicts volumes since 2018.

Table 2: Mineral waste disposed in 2018-2024 (volume in tons)

Year	2018	2019	2020	2021	2022	2023	2024
Waste rock dumps	11,459,319	13,289,588	10,000,000	10, 541, 648	7, 363, 794	6,783, 467	8,498, 486
Tailings storage facility	8,851,288	8,006,059	8,700,000	9,622, 798	8, 972, 926	9, 301, 893	19,770, 160

4.5.4 Chemical substance management

Rössing uses existing Namibian legislation, international standards such as ISO 14001:2015, as well as the Rössing Performance Standard E2 (Hazard materials and non-mineral waste control and minimisation) for conformances and compliance in terms of chemical substance management.

Rössing strives to ensure that all hazardous materials are handled safely and controlled responsibly, and all risks to the environment are mitigated. Thus, procedures are in place to prevent spillages and environmental contamination from the transport, use, storage, and disposal of hazardous materials. A Hazardous material and contamination control management plan (JE20/MMP/002) is in place at Rössing. The plan guides:

- safety and responsibility of usage and control of hazardous material handled by Rössing.
- control measures to minimise the risks and the environmental impacts due to spill or other escapes, and
- properly characterise and manage cases of contamination on site.

The plan also entails controls to prevent or minimise spillages during the handling and storage of chemical substances, conducting of routine inspections, monitoring procedures for leaks, integrity testing for deterioration of storage tanks and pipelines, spill and leakage detection equipment and emergency response plans. Regular internal and external audits, inspections and monitoring is conducted.

The Rössing standard requires an inventory of all hazardous substances and locations onsite to be maintained and valid material safety data sheet (MSDS) to accompany the hazardous material during storage, handling and transportation.

All employees who handle hazardous material are required to attend a compulsory training on hazardous material substances on an annual basis. Stakeholders (suppliers, service providers and end-users) are engaged to provide support in purchasing of chemicals and to ensure continuous improvement. Furthermore, the plan identifies the needs for engineering controls to prevent spillages into the environment, for example by means of constructing secondary containment bunds.

For the site preparedness, an acid derailment and ammonia drills were held on the mine access road and onsite to ensure that mitigation measures are in place. Both drills were a success with no major concerns/observation identified.

The biannual Environmental Monitoring Report for the operation of the existing consumer fuel installation was compiled by the Geo Pollution Consultants and submitted to MEFT in April and in September 2024 in compliance to the ECC. There were no major environmental non-conformance of hazardous material spillages/leakages reported in 2024.

4.6 Biodiversity management

The protection of environmental quality, including biodiversity, is important at Rössing. We take pride in the conservation of biodiversity within the ambit of the Rössing mining licence, in the surrounding communities, as well as in Namibia at large. Biodiversity management is a practice of protecting and preserving the wealth and variety of species, habitats, ecosystems, and genetic diversity on the planet, which is important for our health, wealth, food, and the services we depend on.

In 2024, Rössing continued to enshrine biodiversity protection in the Health, Safety, Environment and Communities (HSSEC) policy by assessing and considering ecological values and land-use aspects in investment, operational and closure activities. We continued to be proud members of the Namibia Environmental and Wildlife Society (NEWS).

Our goal remains to create a positive impact on biodiversity and contribute to conservation in Namibia at large. Rössing was involved in various biodiversity awareness campaigns, surveys, and assessments aimed at creating awareness and strengthening understanding about the importance of biodiversity amongst the workforce, communities and the Namibian population.

4.7 Progressive rehabilitation

Rehabilitation and land-use planning are critical to reducing environmental liability and ensuring the long-term sustainability of Rössing's mining footprint. Our approach prioritises progressive rehabilitation during operations rather than deferring action until closure, in line with international best practices.

Progressive rehabilitation involves the clean-up and restoration of disturbed areas throughout the life of mine. This proactive approach reduces future closure costs, limits environmental impact, and allows mining to continue uninterrupted.

In 2024, rehabilitation activities focused on:

- Clean-up of decommissioned or underutilised sites
- Waste removal from legacy storage areas for proper disposal
- Transporting waste to designated disposal zones to prevent long-term accumulation

Of 11 planned clean-up projects, three were completed, while nine were deferred to 2025 pending regulatory approvals - which have since been secured. One notable example includes the successful excavation and removal of redundant kerosene tanks from the solvent extraction (SX) plant.

Excavated and disposed redundant kerosene tanks which was buried at SX Plant

Figure 22: Completed Progressive Rehabilitation Projects

ECC – APP2767

UNITY LIBERTY JUSTICE

REPUBLIC OF NAMIBIA

MINISTRY OF ENVIRONMENT, FORESTRY AND TOURISM

OFFICE OF THE ENVIRONMENTAL COMMISSIONER

ENVIRONMENTAL CLEARANCE CERTIFICATE

ISSUED

In accordance with Section 37(2) of the Environmental

Management Act (Act No. 7 of 2007)

TO

Rössing Uranium Limited
Private Bag 5005, Swakopmund

TO UNDERTAKE THE FOLLOWING LISTED ACTIVITY

The Proposed PV Power Plant of Rössing Uranium Limited near Arandis, Erongo Region

MINISTRY OF ENVIRONMENT, FORESTRY AND TOURISM
Private Bag 13306
WINDHOEK, NAMIBIA
29 SEP 2022
ENVIRONMENTAL COMMISSIONER
REPUBLIC OF NAMIBIA

ENVIRONMENTAL COMMISSIONER

Issued on the date: **2022-09-29**

Expires on this date: **2025-09-29**

(See conditions printed over leaf)

Reduce
Reuse
Recycle

NAMIBIA IS NOT A TRASH BIN
RIGHT THING BIN

This certificate is printed without erasures or alterations

ECC –

CONDITIONS OF APPROVAL

1. This environmental clearance is valid for a period of 3 (three) years, from the date of issue unless withdrawn by this office
2. This certificate does not in any way hold the Ministry of Environment, Forestry and Tourism accountable for misleading information, nor any adverse effects that may arise from these activities. Instead, full accountability rests with the proponent and its consultants
3. This Ministry reserves the right to attach further legislative and regulatory conditions during the operational phase of the project
4. .
5. All applicable and required permits are obtained and mitigation measures stipulated in the EMP are applied particularly with respect to management of ecological impacts.
6. Strict compliance with national heritage guidelines and regulations is expected throughout the life-span of the proposed activity, therefore any new archaeological finds must be reported to the National Heritage Council for appropriate handling of such.

REPUBLIC OF NAMIBIA

MINISTRY OF ENVIRONMENT, FORESTRY AND TOURISM

Tel: (00 26461) 284 2111
Fax: (00 26461) 232 057

Cnr Robert Mugabe &
Dr Kenneth Kaunda Street
Private Bag 13306
Windhoek
Namibia

OFFICE OF THE ENVIRONMENTAL COMMISSIONER

NOTIFICATION OF DECISION

REF NUMBER: ECC- APP2767 **DATE OF ISSUE: 29 SEPTEMBER 2022**

DETAILS OF PROPONENT:

Rössing Uranium Limited
Private Bag 5005
Swakopmund
Namibia

Dear Sir/ Madam

SUBJECT: NOTIFICATION ON APPLICATION FOR ENVIRONMENTAL CLEARANCE TO UNDERTAKE THE PROPOSED LISTED ACTIVITY: The Proposed PV Power Plant of Rössing Uranium Limited near Arandis, Erongo Region.

Notice is herewith given in accordance with section 37(2) of the Environmental Management Act, Act 7 of 2007 and Environmental Impact Assessment Regulations of 2012 (GG 4878): that a decision in respect to your application No. **APP 2767** for Environmental Clearance Certificate to undertake a listed activity has been reached.

DECISION

An Environmental Clearance Certificate (ECC) to undertake the listed activities specified in the environmental assessment report and draft management plan dated July 2022, is granted (**ECC- APP2767**). The_applicant / proponent is therefore advised to comply with conditions of approval set out in **Section C** of this notification.

A. DETAILS OF THE PROPOSED ACTIVITY

A1: TITLE OF THE PROPOSED ACTIVITY

The Proposed PV Power Plant of Rössing Uranium Limited near Arandis, Erongo Region.

A2: DETAILS OF ASSESSMENT PRACTITIONER

Namisun Environmental Projects & Development
Werner Petrick
P O Box 8127, Swakopmund
Mobile: 0811405968
Email: wpetrick@slrconsulting.com

A3: LOCATION OF PROPOSED ACTIVITY

(Annexure A – proposed site map)

B. RELEVANT LISTED ACTIVITIES

Legislation	Description of Listed Activity	Relevance to Proposed Activity
Regulation 29(sub-regulation 5) of Government Notice No. 29 of 2012	INFRASTRUCTURE 10.1 The construction of- (a) oil, water, gas and petrochemical and other bulk supply pipelines; (b) public roads; (c) railways and harbours; (d) airports and airfields; (e) any structure below the high water mark of the sea; (f) cableways; (g) communication networks including towers, telecommunication and marine telecommunication lines and cables; (h) motor vehicle and motorcycle racing and test tracks; (i) the outdoor racing sites of motor powered vehicles including - (i) motorcars; (ii) trucks; (iii) motorcycles; (iv) quad bikes; (v) boats; and (vi) jet skis; (j) masts of any material or type and of any height, including those used for telecommunication broadcasting and radio transmission, but excluding - (i) flag poles; and (ii) lightning conductor poles. 10.2 The route determination of roads and design of associated physical infrastructure where - (a) it is a public road; (b) the road reserve is wider than 30 meters; or (c) the road caters for more than one lane of traffic in both directions.	The Proposed PV Power Plant of Rössing Uranium Limited near Arandis, Erongo Region.

C. CONDITIONS

C1: Conditions of Approval

1. This certificate does not in any way hold the Ministry of Environment and Tourism accountable for misleading information, nor any adverse effects that may arise from these activities. Instead, full accountability rests with the proponent and its consultants.

2. This Ministry reserves the right to attach further legislative and regulatory conditions during the operational phase of the project.

3. Regular environmental monitoring and evaluations on environmental performance should be conducted. Targets for improvements should be established and monitored throughout this process.

4. This environmental clearance is valid for a period of 3 (three) years, from the date of issue unless withdrawn by this office.

C2: Clearance Certificate Validity

1. On expiry of the ECC, the proponent is required to submit within a period not exceeding one month, and in the prescribed form and manner an application to the Office of the Environmental Commissioner for the renewal of the ECC.
2. Failure to renew an expired environmental clearance certificate shall result in permanent termination of the environmental clearance certificate.
3. In terms of Section 3 (2)C of the Environmental Impact Assessment, you are instructed to, within 14 days of this notice issuance date, ensure that all registered interested and affected parties (" I&APs") are notified that an environmental clearance certificate has been issued in respect to your application and of their right to appeal

C3: Compliance with authorization under other laws

4. All other applicable and required permits or authorization from relevant competent authorities must be obtained prior to commencing the proposed activities and accordingly adhered to.

C4: Implementation and Monitoring

5. The granting of the Environmental Clearance Certificate (ECC) constitute, an approval for the implementation of mitigation measures proposed in your approved Environmental Management Plan (EMP), hence making the approved EMP legally binding document.
6. The proponent shall appoint a suitably experienced environmental control officer, or site agent where appropriate, before the commencement of any listed activities to ensure compliance with the conditions of approval and mitigation stipulated in the approved EMP
7. A copy of the Environmental Clearance Certificate (ECC), EMP, Environmental Audit and monitoring reports must be kept at the site of the authorized activity and readily available for inspection by officials of the Ministry and registered Interested and affected Parties (I&APs) on request.
8. Should any heritage remains be exposed during excavations or any other actions on the site, these must immediately be reported to the National Heritage Council of Namibia. Heritage remains uncovered or disturbed during earthworks must not be further disturbed until the necessary approval has been obtained from National Heritage Council.
9. Using the best and affordable methodology, the Proponent must ensure that all listed activity's operations footprints are thoroughly rehabilitated prior to closure of the operation. Wherever possible, the Proponent must proceed with the rehabilitation process concurrently with the progression of the project rather than wait until the damage is far beyond the available means of management.
10. The general standard for all rehabilitation processes must at all costs aim at restoring the natural character of the environment to the satisfaction of the Ministry of Environment and Tourism. Such rehabilitation processes shall be inspected and certified satisfactory or unsatisfactory by the Ministry of Environment and Tourism. Where a certificate of unsatisfactory is issued, the Proponent shall be advised to carry-out certain tasks to meet the

requirements. Failure to meet the basic rehabilitation requirements shall be regarded by this Ministry as a breach of this contract and of which serious consequences shall follow.

11. Officials of the environmental commissioner's office may from time-to-time conduct spot-inspection (non-auditing) without prior notice and or Auditing Inspection (dates to be agreed prior to arrival to the site), hence access to the site and the aforementioned documentation must be granted to any authorized official representing the Office of the Environmental Commissioner and Registered Interested and Affected Parties (I&APs)

12. Any changes to, or deviations from the scope of the alternative described in section B above must be accepted or approved, in writing, by the Office of the Environmental Commissioner before such changes or deviations may be implemented. In assessing whether to grant such acceptance/ approval or not, the Competent Authority may request information in order to evaluate the significance and impacts of such changes or deviations, and it may be necessary for the holder to apply for further authorization in terms of the applicable legislation.

13. Officials representing the Office of the Environmental Commissioner must be, in possession and or by request and for the purpose of inspection referred to in C4(11) present their staff identification card in order to gain entry to the premises

14. The proponent is required, from the date of commencing implementation of project activities, to compile and submit environmental monitoring reports (on project progress and the environmental management profile) on a bi-annual basis to Office of Environmental Commissioner

15. Any changes to, or deviations from the scope of project activities approved in respect to the assessment received and reviewed for the purpose or granting this ECC Number (**ECC- APP2767**) are subject to an amendment application and approval by the Environmental Commissioner prior to adopting / implementing any such changes / deviations.

16. For the purpose of amending and or transferring the ECC, the proponent submit in the prescribed form and manner an application to the Office of the Environmental Commissioner, clearly indicating the need for amendment and or transfer of the ECC

17. Non-compliance with a condition of this Environmental Clearance Certificate or EMP may render the Proponent liable to criminal prosecution.

D. DISCLAIMER

1. The decision taken by the Office of Environmental Commission is based mainly on information provided by the proponent or their representative, therefore, it must be noted here that the proponent is accountable for any wrong and misleading information that may have been presented in the environmental assessment documents.

Yours sincerely.

MINISTRY OF ENVIRONMENT, FORESTRY AND TOURISM
Private Bag 13306
WINDHOEK NAMIBIA
29 SEP 2022
ENVIRONMENTAL COMMISSIONER

Timoteus Mufeti
ENVIRONMENTAL COMMISSIONER

ANNEXURE A: APP2767 - SITEMAP / SITE LAYOUT

Renewal of the Environmental Clearance Certificate for continuation of uranium mining

Stamp

MINISTRY OF ENVIRONMENT, FORESTRY AND TOURISM
Private Bag 13306
WINDHOEK NAMIBIA
29 SEP 2022
ENVIRONMENTAL COMMISSIONER
REPUBLIC OF NAMIBIA

CURRICULUM VITAE

Of

Stefaans Amandus MuAntago Gaeseb

P.O. Box 5336
Mondesa
Swakopmund
Namibia

Cell phone: +264 812002769
Tel: +264 64 520 2741
Email: Stefaans.Gaeseb@rossing.com.na

PROFILE

Hardworking, team player, self-motivated, good communicator and dedicated Environmental Scientist with over 15 years working experience in Environmental Management, Hydrogeology, Hydrochemistry, Engineering & Economic Geology. Academically I hold a Bachelor of Science with Honours in Hydrogeology (University of the Free State) and Bachelor degree in Geology & Chemistry (University of Namibia). Have excellent computer skills, familiar with GIS and may adapt easily with any other software's. Have very good experience in project management in several sectors. Have strong interpersonal character, very good communication skills at all levels, adaptable to all weather conditions and enjoy travelling and field work. I have a valid driver's license (Code B).

WORK EXPERIENCE – FULL TIME

Timeline: *2016 – Present*
Company: Rössing Uranium Limited
Positions: Project Hydrogeologist (2016 - 2021)
Specialist Environment (2022 - present)

Task / Main Responsibilities:

Health, safety and environmental leadership; People management; Lead environmental develop plans and translate strategies into actions; Determine environmental footprint and improvements; Groundwater monitoring governance; Groundwater monitoring network designs, drilling projects supervision through all phases; Manage all environmental and asset resource information; Assess environmental aspects and impacts; Identify and manage impact assessments, projects and programmes; Risk management and audits; Land use management; Costing & budgeting and Drive business improvement.

Timeline: *2010 – 2016*
Company: Namib Hydrosearch cc
Position: Hydrogeologist

Task / Main Responsibilities:

Groundwater exploration (various geophysical techniques); Drilling supervision for groundwater (air percussion and mud rotary); Drilling supervision for mineral exploration (RC drilling, chip logging and sampling); Borehole rehabilitation supervision; Pumping test (supervision, data capture, evaluation/interpretation and reporting); Environmental Impact Assessments (EIA); Hydro census and water quality sampling for environmental work; Acid Base Accounting (ABA) sampling

Major projects:

Annual Drilling Tender 2010 in Caprivi & Erongo Regions (MAWF); Mineral Exploration Drilling Supervision at Swakop Uranium / Husab (2011); Test pumping of the Oanob aquifer in Rehoboth (2011); Groundwater Quality baseline hydro census survey at Okanjande Graphite (2012 – 2013); Quarterly groundwater quality monitoring for Tschudi Mine (2013 -2015); Borehole Rehabilitation Supervision 2013 in Kunene Region (MLR); Borehole Rehabilitation Supervision 2014 in Omusati Region (MAWF); Drilling and Test Pumping Supervision in Etosha National Park (MET); Annual Drilling Tender 2014 in Erongo Region (MAWF); Borehole siting in Omaheke Region (MET under Kalahari Namib Projects); Siting, Drilling and Test Pumping Supervision in Khaudum National Park (MET); Annual Drilling Tender 2015 in Erongo Region (MAWF).

EDUCATION AND QUALIFICATIONS

Bachelor of Science (with Hons) in Geohydrology (2012)
University of the Free State (UFS)
Institute for Groundwater Studies (IGS)

Bachelor of Science in Geology & Chemistry (2009)
University of Namibia (UNAM)

GRADE 12 - SENIOR CERTIFICATE (H/IGCSE) IN 2000
Delta Secondary School Windhoek (DSSW)

GRADE 10 - JUNIOR CERTIFICATE (JCSE) in 1998
Delta Secondary School Windhoek (DSSW)

REFERENCES

i. Jacklyn Mwenze
Manager: HSE & PS
Rössing Uranium Limited
Telephone: +264 81 140 5893
Email: jacklyn.mwenze@rossing.com.na

ii. Dr Danie Vermeulen
Head of Department
Institute for Groundwater Studies (IGS)
Telephone: +27 51 401 2317
vermeulenD@ufs.ac.za

iii. Diganta Sarma
Chief Geohydrologist
Namib Hydrosearch cc
Telephone: +264 81 275 3927
Email: diganta@geonamibia.com

iv. Prof. Benjamin Mapani
Professor: Mining Engineering
Namibia University of Science and Technology
Telephone: +264 81 298 7534
Email: bmapani@nust.na

PERSONAL DETAILS

Surname:	Gaeseb
First Names:	Stefaans Amandus Mu Antago
ID Number:	83072910650
Nationality:	Namibian
Gender:	Male
Religion:	Christian
Driving License:	Code B
Postal Address:	P.O. Box 5336
	Swakopmund, Mondesa
Contact Details:	gaeseb@gmail.com
	+264 81 2002769
	+264 81 1626191
Health:	Very Good
Spoken & Written Languages:	Damara Nama, English, Afrikaans