Zhonghe Resources (Namibia) Development (Pty) Ltd

MEFT ECC APPLICATION REF. No.
APP-002802

Environmental Impact Assessment (EIA) and Environmental Management Plan(EMP) Report to Support the Renewal of the Environmental Clearance Certificate (ECC) for Mining License (ML) No. 177, Karibib / Swakopmund Districts, **ERONGO REGION, NAMIBIA**

July 2021

Zhonghe Resources (Namibia) Development (Pty) Ltd
29 Charles Cathrall Street,
Olympia, P. O. Box 40903,
Ausspannplatz,
WINDHOEK, NAMIBIA

PROPONENT, LISTED ACTIVITIES AND RELATED INFORMATION SUMMARY

TYPE OF AUTHORISATIONS REQUIRING ECC
Mining License (ML) No. 177

MEFT ECC APPLICATION REF. No.
APP-002802

NAME OF THE PROPONENT
Zhonghe Resources (Namibia) Development (Pty) Ltd

COMPETENT AUTHORITY
Ministry of Mines and Energy (MME)

ADDRESS OF THE PROPONENT AND CONTACT PERSON
Zhonghe Resources (Namibia) Development (Pty) Ltd
29 Charles Cathrall Street,
Olympia, P. O. Box 40903,
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WINDHOEK, NAMIBIA

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PROPOSED PROJECT
Proposed Uranium Mining and Ongoing Exploration in the Mining License (ML) No. 177

PROJECT LOCATION
Swakopmund / Karibib Districts, Erongo Region
(Latitude: -22.430833, Longitude: 15.112500)

ENVIRONMENTAL CONSULTANTS
Risk-Based Solutions (RBS) CC
(Consulting Arm of Foresight Group Namibia (FGN) (Pty) Ltd)
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ENVIRONMENTAL ASSESSMENT PRACTITIONER (EAP)
Dr. Sindila Mwiya
PhD, PG Cert, MPhil, BEng (Hons), Pr Eng

Summary Profile and Qualifications of the Environmental Assessment Practitioner (EAP) / International Resources Consultant – Dr Sindila Mwiya

Dr Sindila Mwiya has more than eighteen (18) years of practical field-based technical industry experience in Environmental Assessment (SEA, EIA, EMP, EMS), Energy (Renewable and Non-renewable energy sources), onshore and offshore resources (minerals, oil, gas and water) exploration / prospecting, operation and utilisation, covering general and specialist technical exploration and recovery support, Health, Safety and Environment (HSE) permitting for Geophysical Surveys such as 2D, 3D and 4D Seismic, Gravity and Electromagnetic Surveys for mining, energy and petroleum (oil and gas) operations support, through to engineering planning, layout, designing, logistical support, recovery, production / operations, compliance monitoring, rehabilitation, closure and aftercare projects lifecycles. He continues to work internationally in the resources (mining and petroleum) and energy sectors, from permitting through to exploration and production. From the frontier regions (high risk hydrocarbons exploration zones) of South Africa and Namibia, to the prolific oil and gas fields of the Middle East, Angola and the West African Gulf of Guinea, Dr Mwiya has been directly involved in field-based aerial, ground and marine geophysical (gravity, magnetics and seismic) surveys, been onboard exploration drilling rigs, onboard production platforms, conducted public and stakeholder consultations and engagements, and worked with highly technical and well organised and committed clients and third-party teams from emerging and well established global resources and energy companies from many countries such as the UK, France, USA, Russia, Canada, Croatia, Norway, the Netherland, Spain, Brazil, China, South Africa, Equatorial Guinea, Angola and Nigeria. He is fully aware of all the competing interests and niche donation-based business environmental advocacy opportunism that exists in the resources sector from the local, regional, and international perspectives.

Through his companies, Risk-Based Solutions (RBS) CC and Foresight Group Namibia (FGN) (Pty) Ltd which he founded, he has undertaken more than 200 projects for Local (Namibia), Continental (Africa) and International (Global) based clients. He has worked and continue to work for Global, Continental and Namibian based reputable resources (petroleum and mining / minerals) and energy companies such as Dundee Precious Metals (Namibia / Canada), Headspring Investment (Namibia/ Russia), Green Energy (Namibia/UK/Russia), EMGS (UK/ Norway), Lepidico (Australia / UK), Best Sheer / Bohale (Namibia / China), CGG Services UK Limited (UK/ France/Namibia), BW Offshore (Norway/Singapore /Namibia), Shell Namibia B. V. Limited (Namibia/ the Netherlands), Tullow Oil (UK/Namibia), Debmarine (DBMN) (Namibia), Reconnaissance Energy Africa Ltd (ReconAfrica) (UK/Canada/Namibia), Osino Resource Corporation (Canada/USA/Namibia), Petrobras Oil and Gas (Brazil) / BP (UK)/ Namibia, REPSOL (Spain/ Namibia), ACREP (Namibia/Angola), Preview Energy Resources (UK), HRT Africa (Brazil / USA/ Namibia), Chariot Oil and Gas Exploration (UK/ Namibia), NABIRM (USA/ Namibia), Serica Energy (UK/ Namibia), Eco (Atlantic) Oil and Gas (Canada / USA/ Namibia), ION GeoVentures (USA), PGS UK Exploration (UK), TGS-Nopec (UK), Maurel & Prom (France/ Namibia), GeoPartners (UK), PetroSA Equatorial Guinea (South Africa / Equatorial Guinea/ Namibia), Preview Energy Resources (Namibia / UK), Sintezneftegaz Namibia Ltd (Russia/ Namibia), INA Namibia (INA INDUSTRIJA NAFTE d.d) (Croatia/ Namibia), Namibia Underwater Technologies (NUTAM) (South Africa/Namibia), InnoSun Holdings (Pty) Ltd and all its subsidiary renewable energy companies and projects in Namibia (Namibia / France), HopSol (Namibia/Switzerland), Momentous Solar One (Pty) Ltd (Namibia / Canada), OLC Northern Sun Energy (Pty) Ltd (Namibia) and more than 100 local companies. Dr Sindila Mwiya is highly qualified with extensive practical field-based experience in petroleum, mining, renewable energy (Solar, Wind, Biomass, Geothermal and Hydropower), Non-Renewable energy (Coal, Petroleum, and Natural Gas), applied environmental assessment, management, and monitoring (Scoping, EIA, EMP, EMP, EMS) and overall industry specific HSE, cleaner production programmes, Geoenvironmental, geological and geotechnical engineering specialist fields.

Dr Sindila Mwiya has undertaken and continue to undertake and manage high value projects on behalf of global and local resources and energy companies. Currently, (2020-2023) Dr Sindila Mwiya is responsible for permitting planning through to operational and completion compliance monitoring, HSE and engineering technical support for multiple major upstream onshore and offshore petroleum, minerals, and mining projects, Solar and Wind Energy Projects, manufacturing and environmentally sustainable, automated / smart and Climate Change resilient homes developments in different parts of the World including Namibia. He continue to worked as an International Resources Consultant, national Environmental Assessment Practitioner (EAP) / Environmentally Sustainable, automated / smart and Climate Change resilient homes developer, Engineering / Technical Consultant (RBS / FGN), Project Manager, Programme Advisor for the Department of Natural and Applied Sciences, Namibia University of Science and Technology (NUST) and has worked as a Lecturer, University of Namibia (UNAM), External Examiner/ Moderator, NUST, National (Namibia) Technical Advisor (Directorate of Environmental Affairs, Ministry of Environment, Forestry and Tourism / DANIDA – Cleaner Production Component) and Chief Geologist for Engineering and Environment Division, Geological Survey of Namibia, Ministry of Mines and Energy and a Field-Based Geotechnician (Specialised in Magnetics, Seismic, Gravity and Electromagnetics Exploration and Survey Methods) under the Federal Institute for Geoscience and Natural Resources (BGR) German Mineral Exploration Promotion Project to Namibia, Geophysics Division, Geological Survey of Namibia, Ministry of Mines and Energy.

He has supervised and continue to support a number of MScs and PhDs research programmes and has been a reviewer on international, national and regional researches, plans, programmes and projects with the objective to ensure substantial local skills development, pivotal to the national socioeconomic development through the promotion of sustainable natural resources coexistence, management, development, recovery, utilisation and for development policies, plans, programmes and projects financed by governments, private investors and Namibian development partners. Since 2006 until 2017, he has provided extensive technical support to the Department of Environmental Affairs (DEA), Ministry of Environment, Forestry and Tourism (MEFT) through GIZ in the preparation and amendments of the Namibian Environmental Management Act, 2007, (Act No. 7 of 2007), Strategic Environmental Assessment (SEA) Regulations, Environmental Impact Assessment (EIA) Regulations as well as the SEA and EIA Guidelines and Procedures all aimed at promoting effective environmental assessment and management practices in Namibia. Among his academic achievements, Dr Sindila Mwiya is a holder of a PhD within the broader fields of Engineering Geology/Geotechnical / Geoenvironmental / Environmental Engineering and Artificial Intelligence with a research thesis titled Development of a Knowledge-Based System Methodology (KBSM) for the Design of Solid Waste Disposal Sites in Arid and Semiarid Environments, MPhil/PG Cert and BEng (Hons) (Engineering Geology and Geotechnics) qualifications from the University of Portsmouth, School of Earth and Environmental Sciences, United Kingdom. During the 2004 Namibia National Science Awards, organised by the Namibian Ministry of Education, and held in Windhoek, Dr Sindila Mwiya was awarded the Geologist of the Year for 2004, in the professional category. Furthermore, as part of his professional career recognition, Dr Sindila Mwiya is a life member of the Geological Society of Namibia, Consulting member of the Hydrogeological Society of Namibia and a Professional Engineer registered with the Engineering Council of Namibia.

WINDHOEK JULY 2021

Content List

List of Figures

List of Tables

List of Plates

EXECUTIVE SUMMARY

1. Introduction

Zhonghe Resource (Namibia) Development (Pty) Ltd holds exclusive nuclear fuel mineral rights under the Mining License (ML) No. 177 measuring 12, 863 Ha. The ML No. 177 granted on the 30/11/2012 and will expire on the 29/11/2031 is situated in Karibib / Swakopmund Districts in the Erongo Region. To date no mine construction related activities have taken place in the ML area due to low global demand and prices of uranium.

The development of the proposed mine in the ML No. 177 will require a valid ECC to be in place before the start of the construction activities. In accordance with the provisions of the Environmental Management Act, 2007, (Act No. 7 of 2007) and the EIA Regulations, 2012, this updated summary Environmental Impact Assessment and Environmental Management Plan (EMP) Report has been prepared to support the application for the renewal of the ECC granted on the 28th January 2019 and expiring on the 28th January 2022. A compressive detailed EIA Report prepared in 2011 is available on request from the Proponent.

The uranium being targeted for mining comprises uraninite hosted in the granite sheeted leucogranite / alaskite hosted primary deposits. Within the ML area, these uraniferous leucogranites, known as alaskites, occur preferentially in and around anticlinal and dome structures on both sides of the Khan River Valley. A number of these deposits have been delineated within the ML No. 177 area. Detailed exploration that has been undertaken by Zhonghe Resource (Namibia) Development (Pty) Ltd indicated that some of these deposits are economically viable. Zhonghe Resource (Namibia) Development (Pty) Ltd intends to develop a medium size uranium mining project within the ML Area with an estimated total investment of between 600-700 million USD.

The overall objective of the proposed project development by Zhonghe Resources (Namibia) Development (Pty) Ltd is too full define the economic potential of the uranium deposit and open a new uranium mine in the ML No. 177 with an annual output of between 700 – 1000 tons of uranium oxide. Once operational, the expected life of the proposed mine is between 10 -15 years and may even be extended further depending on the results of the ongoing exploration. The average grade of the uranium to be mine is 230 ppm with a cut-off grade of 100 ppm. The project is expected to create 2000 and 600 potential direct and indirect permanent employment / contract opportunities.

The following is the summary of the indicative sizes of the various proposed development areas within the ML No. 177:

(i)	Proposed Mining Licenses (ML) Area:	151 035 m^2.
(ii)	Proposed PIT 1	3 000 m^2.
(iii)	Proposed PIT 2	1 800 m^2.
(iv)	Proposed PIT 15	700 m^2.
(v)	Proposed PIT 18 (Main Pit):	6 700 m^2.
(vi)	Administration, Plant and Heap Leaching Area:	22 000 m^2.

2. Rational to the Proposed Uranium Project

The drive to reduce Climate Change and other global environmental benefits associated with the use of nuclear energy sources compared to dirty coal energy sources is driving much of the developed and developing countries such as China and India to invest heavily in the construction of new nuclear reactors as well as the likely increased capacities from the existing facilities. Consequently, world uranium demand is projected to increase over the 10 to 20 years, reflecting the expected dramatic increase in the number of new nuclear reactors. The international uranium market has projected a greater shortage of uranium oxide (U_3O_8) due to the demand for uranium for use in nuclear reactors

exceeding supply. The mining industry remains the most prominent industry to economic development in Namibia. The mining sector accounts for 20% of the GDP and employs over 3% of the national population. The country is the world's fourth-largest producer of uranium and among the largest gem-quality diamond producers in value terms. By developing the delineated uranium resources within the ML No. 177, the socioeconomic benefits to Namibia will be great supported by the ever-increasing demand for uranium oxide worldwide.

3. Project Developmental Stages

This project is divided into the following development stages:

- **Project Identification**: Covering the actual project definition, strategic development including forecasting, alternative location assessments, investment levels, review of historical data sets, including uranium resources and regulatory requirements.

- **Feasibility Study** (covering all the technical studies such as uranium resources in terms of grade and tonnages, geotechnical evaluation, mine plans covering design and layout and Environmental Assessment covering scoping, Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP).

- **Preconstruction** (covering site preparation, bundling of the construction camp, material and equipment mobilisation for the development of the pit area, processing facilities and all supporting infrastructures).

- **Construction** (covering the actual site excavations for the pit area, processing facilities, office, administration and all related facilities and installation of all the supporting services, roads, electricity and water infrastructures.

- **Operation and Ongoing Rehabilitation** (covering the actual production of uranium oxide covering mining and mineral processing activities including ongoing rehabilitations of the pit area and processing plant including the tailings and waste rock facilities).

- **Rehabilitation and Closure (Decommissioning)** (the stage of removal of the installations covering the pit area, processing plant, tailing, waste rock as well as all the physical supporting infrastructure that has reached its useful life-span).

- **Aftercare** (covering a specific period after decommissioning that the developer or operator may still be held liable for any environmental damage such as contamination as a results of collapsed rehabilitated infrastructure. Although the regulatory framework is not yet in force with respect to the enforcement of environmental liabilities for aftercare stage, changes / amendment to Environmental Management Act, Act No. 7 of 2007 (not yet implemented) as well as new regulations that may be associated with the regulation of the uranium mining and processing in Namibia are likely to enforced the aftercare environmental liabilities.

4. Summary of Impacts Conclusions

The impact assessment presented in this report is based on the studies undertaken by the Proponent in 2011 and the assessment has been undertaken in accordance with the Terms of Reference (ToR), provisions of the Environmental Management Act, 2007, (Act No. 7 of 2007). The development could have the following potential impacts on the existing and surrounding land uses especially:

- Disturbance of sense of place and tranquillity due to light pollution, noise pollution, increased traffic, earth tremors caused by drilling and blasting.

- Disturbance of visual views impacting negatively on the attractiveness of the area for nature tourism with great landscapes of Khan River Ephemeral channel.

- ❖ Dust dispersion from the operations at the mine as well as transport of ore along dirt roads and dust deposition on surrounding land may render the land less suitable for other uses such as tourism resulting in loss of income.

- ❖ Potential increase in poaching and stock theft could contribute to loss of income, and.

- ❖ Potential increase of trespassing and increase in crime.

The proposed mine development would have the following socioeconomic effects on Towns of Arandis and Usakos as well as and the Erongo Region in general:

(i) Positive Impact

- o Alternative employment opportunities.

- o The urban locality is highly dependent on wages and salaries as the main source of income for most residents and the employment of residents would contribute to their livelihoods.

- o Potential employees may obtain the opportunities to improve or develop employable skills.

- o The local economy would be boosted and diversified with the increased availability of money and the utilisation of local services and products.

- o Potential of community upliftment projects once the mine becomes operational and profitable as part of the mine's social responsibility programme, and.

- o Contribution to Namibia's Development Goals through the provision of employment and the improvement of the quality of life.

(ii) Negative Impacts:

- o Land use changes from landscape tourism and limited agriculture to mining and exploration.

- o Large construction developments could cause sudden in-flux of jobseekers to Arandis, increasing the already large informal populations with resultant higher HIV/Aids risks, crime rates, poaching incidences, demands on state health services.

- o An increase in workforce will result in an increase in the need for housing, school placements, infrastructure, and health services in nearby towns.

- o Increased demand for water and the wise use of water needs to be promoted, and.

- o Increased traffic, especially heavy vehicles using public roads and road safety concerns.

It is hereby recommended that the proposed mine development shall go ahead and be issued with a renewed Environmental Clearance Certificate (ECC). The Proponent shall:

(i) Negotiate an Access Agreements with the land owner/s.

(ii) Pay a fair and negotiate compensation to the affected land owners where the proposed mining operations will be situated. The proposed mine will negatively affect the wellbeing and socioeconomic asserts of the land owners.

(iii) The Proponent shall adhere to all the provisions of the EMP and conditions of the Access Agreement to be entered between the Proponent and the land owner/s in line with all applicable national regulations, and.

(iv) Before entering any private property such as a private farm, the Proponent must give advance notices and obtain permission to access private properties at all times.

5. The EMP, Mitigations and Recommendations

The EMP as detailed in this report provides the management actions with roles and responsibilities requirements to be implemented by Zhonghe Resource (Namibia) Development (Pty) Ltd through the contractor who will be undertaking the mining activities. The EMP gives commitments including financial and human resources provisions for effective implementation of the EMP and management of the likely environmental liabilities during and after the proposed mining and metals procession plant project. Regular assessments and evaluation of the environmental liabilities during the mining phase will need to be undertaken and will ensure adequate provision of the necessary resources towards good environmental management at various stages of the project development.

Overall, the EMP forms the basis for the Environmental Contract to be signed between Zhonghe Resource (Namibia) Development (Pty) Ltd and the Government of the Republic of Namibia, hereby represented by the Ministry of Environment, Forestry and Tourism (MEFT). The following are the recommended actions to be implemented by the Zhonghe Resource (Namibia) Development (Pty) Ltd (Proponent) as a part of the management of the impacts through implementations of the EMP:

(i) Undertake separate EIAs for all linear infrastructures such as water pipeline, main mine access roads and power line as well as a Specialist Study on Occupational Radiation and the development of a Radiation Management Plan (RMP) to be linked to this EMP.

(ii) Radiation Management Plan (RMP) in accordance with the provisions of the Atomic Energy and Radiation Protection Act, 2005, (Act No. 5 of 2005.

(iii) Contract an Environmental, Social, Governance (ESG) Coordinator, Environmental Coordinator / Consultant / suitable in-house resources person to lead and further develop, implement and promote environmental culture through awareness raising of the workforce, contractors and sub-contractors in the field during the whole duration of the proposed project.

(iv) Provide with other support, human and financial resources, for the implementation of the proposed mitigations and effective environmental management during the planned mine project life cycle.

(v) Develop a simplified environmental induction and awareness programme for all the workforce, contractors and sub-contractors.

(vi) Where contracted service providers are likely to cause environmental impacts, these will need to identified and contract agreements need to be developed with costing provisions for environmental liabilities.

(vii) Implement internal and external monitoring of the actions and management strategies developed during the project duration and a final Environmental Monitoring report to be prepared by the Environmental Coordinator / Consultant / Suitable in-house resource person and to be submitted to the regulators and to end the proposed mine project.

(viii) Develop and implement a monitoring programme that will fit into the overall company's Environmental Management Systems (EMS) as well as for any future EIA for drilling and production phases.

All the responsibilities to ensure that the recommendations are executed accordingly, rest with the **Zhonghe Resource (Namibia) Development (Pty) Ltd**. The company must provide all appropriate resource requirements for the implementation of the EMP. It is the responsibility of **Zhonghe Resource (Namibia) Development (Pty) Ltd** to make sure that all members of the workforce including contractors and subcontractors are aware of the EMP and its objectives.

1. INTRODUCTION

1.1 Project Overview

Zhonghe Resources (Namibia) Development (Pty) Ltd is a Namibian registered company founded in 2008. The main investors are China Uranium Corporation Limited (CUC) (58%) a wholly owned subsidiary by China National Nuclear Corporation (CNNC), and a private enterprise, Namibia-China Mineral Resources Investment and Development (Pty) Ltd (Nam-China) (42%).

Zhonghe Resource (Namibia) Development (Pty) Ltd holds exclusive nuclear fuel mineral rights under the Mining License (ML) No. 177. The ML No. 177 granted on the 30/11/2012 and will expire on the 29/11/2031. Since the granting of the ML No. 177 in 2012 and the previous and current Environmental Clearance Certificates (ECCs) in June 2011 and January 2019 respectively, no mine construction related activities have taken place within the ML area mainly due to globally depressed uranium prices that makes the proposed mine development not viable at the current global uranium prices. However, once there are some improvements on the global demand and price of uranium, the proposed mine in ML No. 177 will be developed.

The proposed mining activities in the ML No. 177 are listed in the Environmental Management Act, 2007, (Act No. 7 of 2007) and cannot be undertaken without valid Environmental Clearance Certificate (ECC). To obtain the ECC for the listed activities, the Proponent was required to have undertaken Environmental Assessment comprising Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) Reports for the proposed mining operations. In fulfilment of the environmental requirements, the Proponent appointed Risk-Based Solutions (RBS) CC as the Environmental Consultant, led by Dr Sindila Mwiya (Annex1) as the Environmental Assessment Practitioner (EAP) to prepare the EIA and EMP Reports to support the application for Environmental Clearance Certificate (ECC).

The current ECC granted by the Environmental Commissioner in the Ministry of Environment , Forestry and Tourism (MEFT) dated 28th January 2019 and will expire on the 28th January 2022 (Fig. 1.1). This updated summary EIA and EMP Report has been prepared by Risk-Based Solutions on behalf of the Proponent to support the application for the renewal of the ECC granted on the 28th January 2019 as shown in Fig. 1.1. The Environmental Assessment process was undertaken in accordance with the provisions of the Environmental Impact Assessment Regulations, 2012 and the Environmental Management Act, 2007, (Act No. 7 of 2007).

1.2 Proposed Project Objectives

The overall objective of the proposed project development by Zhonghe Resources (Namibia) Development (Pty) Ltd is to open a new uranium mine in the ML No. 177. The company intends to define the full economic potential of the uranium deposit found in the ML No. 177. The company intends to develop a uranium mine within the ML No. 177 area with an annual output of between 700 – 1000 ton of uranium oxide. The following is the summary of the indicative sizes of the various proposed development areas within the proposed Mining License in the ML No. 177:

(i)	Proposed Mining Licenses (ML) Area:	151 035 m^2.
(ii)	Proposed PIT 1	3 000 m^2.
(iii)	Proposed PIT 2	1 800 m^2.
(iv)	Proposed PIT 15	700 m^2.
(v)	Proposed PIT 18 (Main Pit) (Figs 1.3 and 1.4):	6 700 m^2, and.
(vi)	Administration, Plant and Heap Leaching Area:	22 000 m^2.

1.3 Location and Access

1.3.1 Location of the Mining License Area

The ML No. 177 is situated in Karibib / Swakopmund Districts in the Erongo Region (Figs. 1.2 and 1.3). The ML No. 177 is in the internationally well-known uranium mining province of Namibia approximately 30 km east of Arandis, 55 km south of the town of Usakos and 90 km east of Swakopmund in straight line distance (Fig. 1.3). The main targeted mining area (Anomaly No. 18) is situated to the east of Rössing Mine, just across the Khan River (Fig. 1.4). Other future pit areas have also been delineated with three (3) such targets situated just to the north of the Rössing Mine on the western side of the Khan River. The heap leaching area, the processing plant, administration, and office blocks will be situated just to the east of the anomaly No. 18. Apart from Rössing Mine, the proposed uranium project is also located near to several other uranium projects such as the Husab Mine (Former Rössing South) and Langer Heinrich Uranium Mine both situated to the south and Valencia Mine situated to the north of the proposed new mine in the ML No. 177.

1.3.2 Access to the Proposed Mining License Area

The license area can be reached through the B2 main road to Swakopmund, on the Valencia Mine Road turn off. Access inside the ML area and, to the main pit area (anomaly No. 18) is currently very challenging. Currently, the exploration team are using the Valencia Mine Road from the B2. At the Khan River, the access road follows the Khan River Channel. This access cannot be utilised during the mining stage of the proposed new uranium mine because it passes along the highly sensitive and potential seasonal flooding Khan River Channel. Any accidental chemical / fuel spillage will have devastating negative effects to the downstream environment and communities. The more favourable proposed access road alternative includes the following:

(i) Using the existing Valencia Mine main access road (with permission from the Valencia Mine) and upgrading / creating a link road to the D1914 road (Fig. 1.3). A new access from the D1914 to the main mining site comprising processing plant, administration, office, heap leaching with a link road to the main pit area (anomaly No. 18) will need to be created.

(ii) Using the existing Rössing Mine Road (with permission from the Rössing Mine) and creating a new link with a bridge across the Khan River connecting the pit area (anomaly No. 18) and the main mining site comprising processing plant, administration, office, and heap leaching, and.

(iii) Using the existing Husab Mine main access road (with permission from the Husab Mine) and upgrading / creating a new link to the D1914 road (Fig. 1.3). However, the road will mean driving through the Namib Naukluft Park because part of the current existing Husab Mine Road passes through the park resulting in challenging logistical arrangement and permitting requirements with the Ministry of Environment, Forestry and Tourism (MEFT).

Of the above three road access options, the uses of the existing Valencia Mine Road seemed to be the most favourable options. While the Rössing Mine link is the shortest of all the available potential options, the cost of building a new bridge across the Khan River will require substantial capital investment and is likely to have high negative environmental impacts.

The development of any of three (3) road access options is likely to have some negative impacts on the environment throughout the proposed project lifecycle. It is hereby recommended that, a feasibility study as well as a separate Environmental Impact Assessment (EIA) and development of an Environmental Management Plan (EMP) be undertaken to select the most economically favourable and environmentally friendly road access option for the new proposed uranium mine in the ML No. 177. The feasibility, EIA and EMP must cover the preconstruction, construction, operation, and ongoing rehabilitation, decommissioning and final rehabilitation and aftercare stages.

REPUBLIC OF NAMIBIA

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Dr Kenneth Kaunda Street
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22 January 2019

OFFICE OF THE ENVIRONMENTAL COMMISSIONER

The Manager
Zhonghe Resources (Namibia) Development (Pty) Ltd
P O Box 40903
Ausspannplatz
Windhoek

Dear Sir/Madam

SUBJECT: ENVIRONMENTAL CLEARANCE CERTIFICATE FOR THE PROPOSED MINING ACTIVITIES WITHIN MINING LICENSE (ML) NO. 177, IN SWAKOMUND/KARIBIB DISTRICT, ERONGO REGION

The Environmental Scoping report and Environmental Management Plan submitted are sufficient as these have made an adequate provision of the environmental management for the proposed activities. From this perspective, regular environmental monitoring and evaluations on environmental performance should be conducted. Targets for improvements should be established and monitored throughout this process.

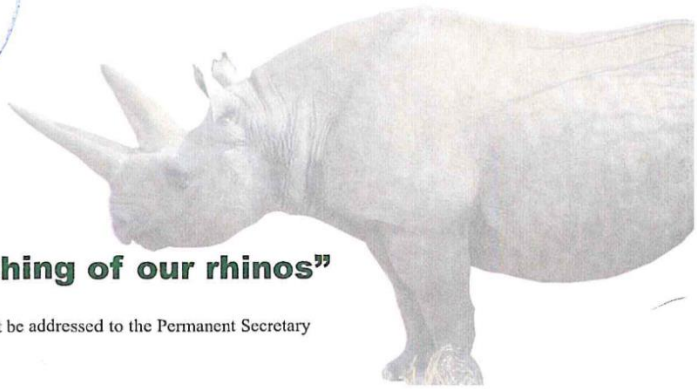
This Ministry reserves the right to attach further legislative and regulatory conditions during the operational phase of the project. From this perspective, I issue this clearance with the following condition: All relevant permits are obtained prior to the commencement of the proposed activities.

On the basis of the above, this letter serves as an environmental clearance certificate for the project to proceed. However, this clearance letter does not in any way hold the Ministry of Environment and Tourism accountable for misleading information, nor any adverse effects that may arise from this project's activities. Instead, full accountability rests with Zhonghe Resources (Namibia) Development (Pty) Ltd and their consultants.

This environmental clearance is valid for a period of (three) 3 years, from the date of issue unless withdrawn by this office.

Yours sincerely,

Teofilus Nghitila
ENVIRONMENTAL COMMISSIONER



"Stop the poaching of our rhinos"

All official correspondence must be addressed to the Permanent Secretary

Figure 1.1: Copy of the ECC for the ML No. 177 issued on the 28th January 2019 and expiring on the 28th January 2022.

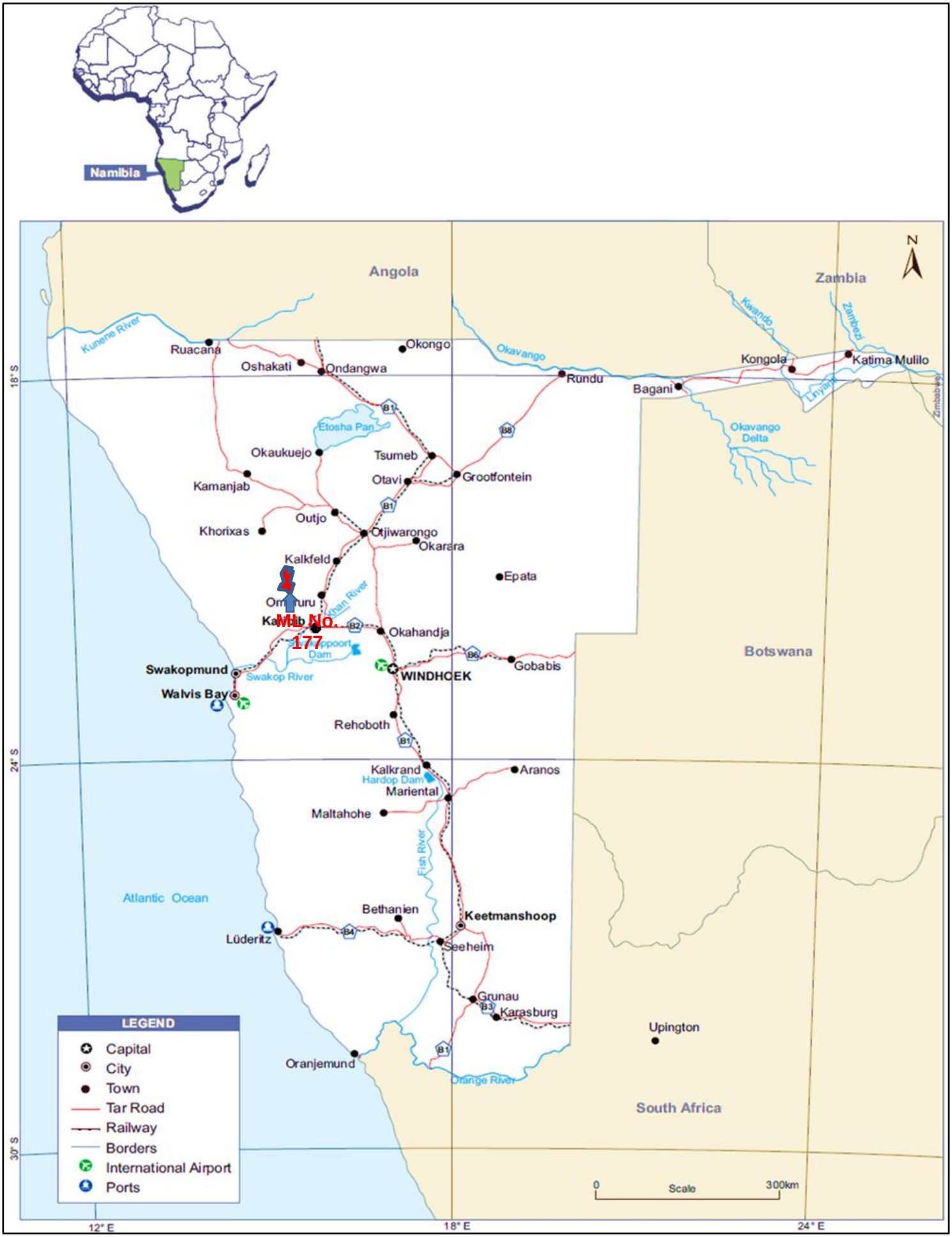


Figure 1.2: Regional location of the ML No. 177.

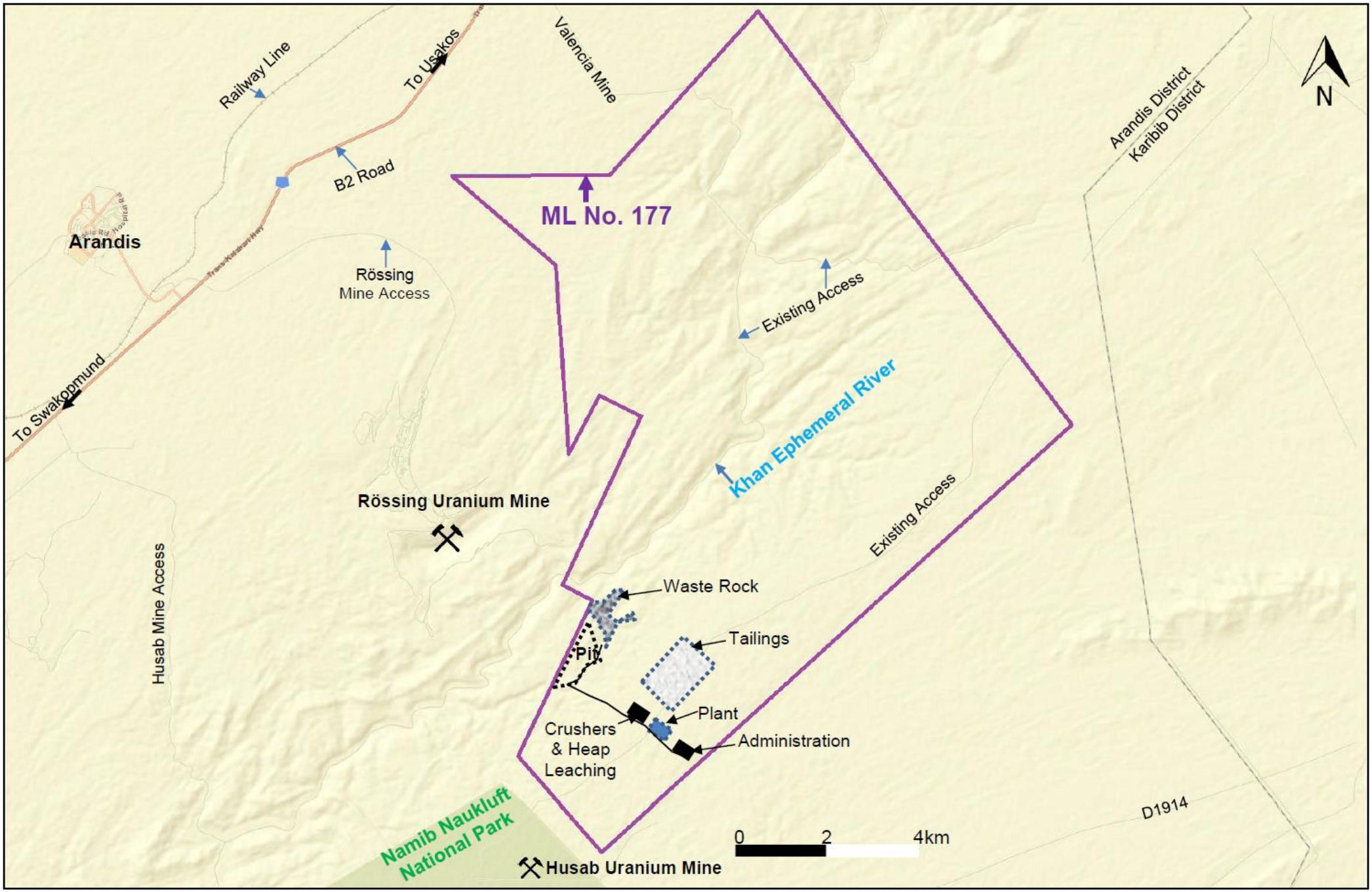


Figure 1.3: Detailed location of the ML No. 177 showing key infrastructures over the main anomaly No. 18 (Pit No. 18), and access (Source: https://maps.landfolio.com/Namibia).

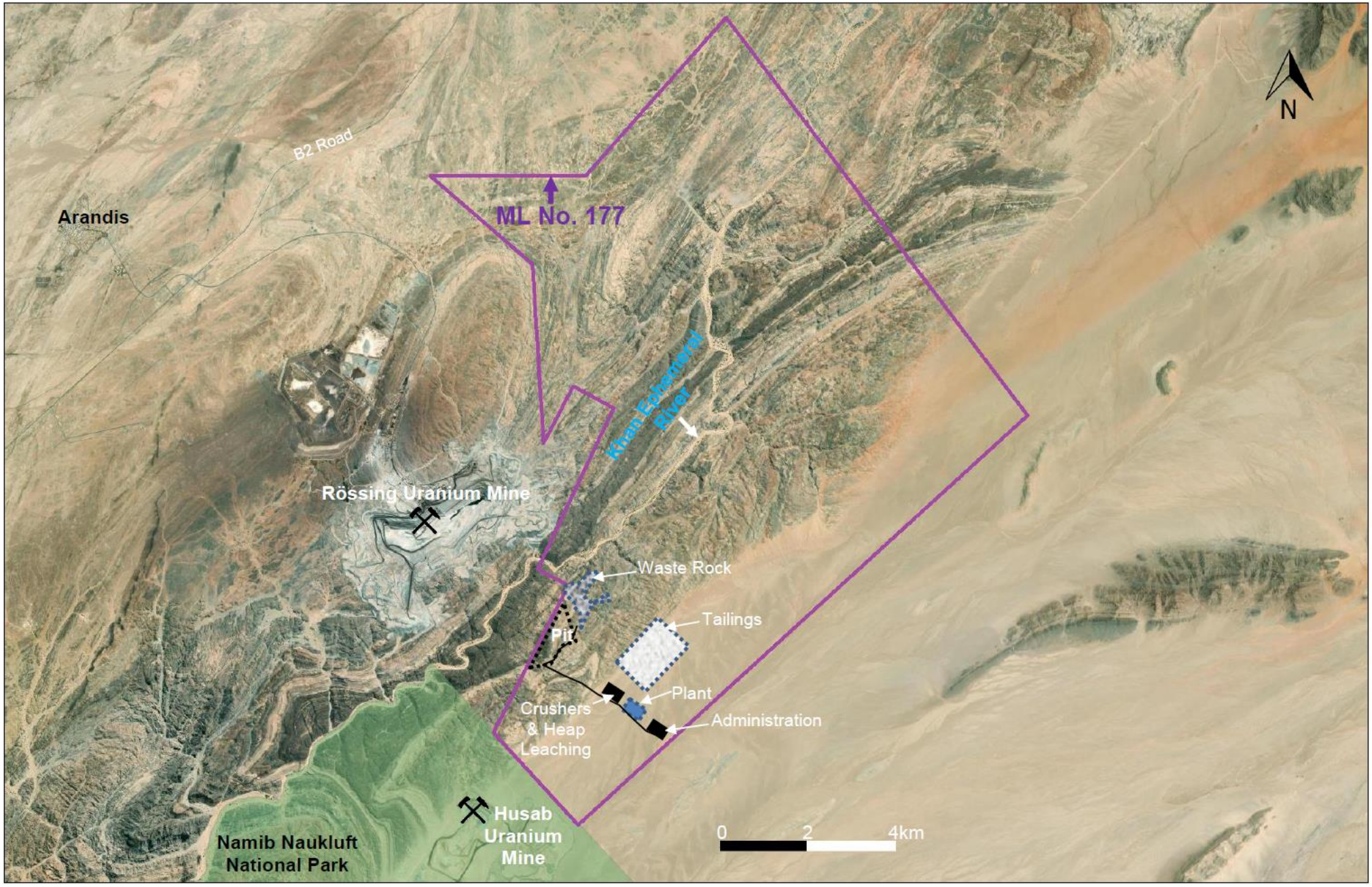


Figure 1.4: Detailed location of the ML No. 177, key infrastructures over anomaly No. 18 (Pit No. 18), and other mining operations in the area (Source: https://maps.landfolio.com/Namibia).

1.4 Overview of the Nuclear Fuel Cycle (NFC)

1.4.1 Current and Likely Future Government Policy

Currently, exploration and mining of uranium are the only stages of the Nuclear Fuel Cycle (NFC) that are undertaken in Namibia (Fig. 1.5). However, the Namibia Government is seeking to develop a nuclear energy programme to make use of the country's rich uranium resources.

Current Government Policy of undertaking uranium exploration and mining as the only stages of the NFC is changing. Nuclear energy experts from Finland's Nuclear and Radiation Authority have been helping the Ministry of Mines and Energy (MME) in the development of a Nuclear Fuel Cycle Policy (NFCP).

The policy is a comprehensive document, which includes sections on setting up a nuclear waste management fund, increasing black Namibians' participation in the uranium sector and limiting the use of the country's uranium to peaceful purposes.

Namibia which is the world's fourth largest uranium mining country has no nuclear power plant of its own and relies on imports from neighbouring South Africa for about half its electricity. Namibia is set to develop its rich uranium resources and through the Nuclear Fuel Cycle Policy, the entire nuclear fuel cycle, including uranium exploration, mining, milling and nuclear energy (generation) will be considered for future development. The following is the summary of some of the likely changes that may take places in the short and long-term with respect to uranium operations in Namibia:

- Nuclear Fuel Cycle Policy and relevant laws currently being developed and covering the entire nuclear fuel cycle.
- The country will consider options in pursuing uranium enrichment locally. and
- A plan to build a nuclear power plant for generating electricity has been mentioned and is likely to affect the export of uranium because the new power plant will also require uranium to be enriched locally and used as fuel for generating electricity.

1.4.2 Exploration Stage

Exploration is the first stage of the nuclear fuel cycle (Fig. 1.5). Exploration, which is the search for minerals, is the first stage that leads to a mineral discovery before the start of any mining activities. The exploration is often a very risky and expensive exercise, costing millions of dollars before a discovery that can lead to a development of mine. An exploration programme often involves developing a hypothetical depositional model/s and testing it in specific area by undertaking, a detailed desktop work followed preliminary and detailed fieldwork utilising a variety of techniques. The overall aim of the exploration programme is to validate a hypothetical depositional model/s by evaluating the mineral potential of an area for possible development of a viable uranium-mining project. Before testing of the depositional model/s can be done, a specific area is selected and an application for an Exclusive Prospecting License (EPL) is prepared by a geologist and submitted to the Ministry of Mines and Energy. Only the Minister of Mines and Energy is empowered to issue mineral rights to a company or natural person because all mineral rights belong to the State. Its only after the EPL application has been granted, often valid for three (3) years with possible twice, two (2) years period renewable subject to performance, that an exploration programme can be implemented. In general, an exploration programme can be divided into following three (3) phase and these are:

(i) Scoping comprising desktop and preliminary fieldwork.

(ii) Prefeasibility comprising detailed field work, and.

(iii) Feasibility comprising fieldwork that is much more detailed aimed at determining the viability of a project.

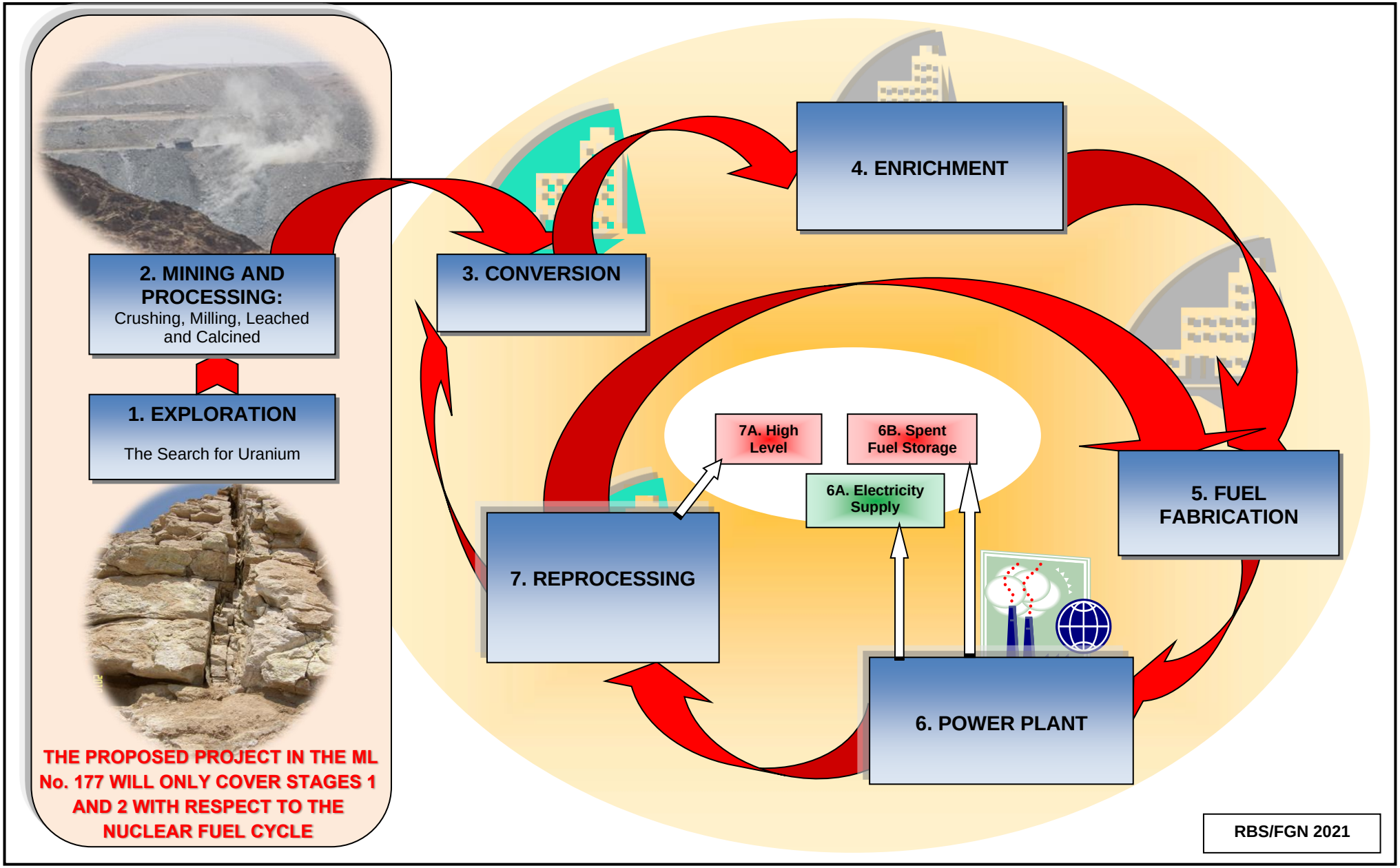


Figure 1.5: Illustration of the nuclear fuel cycle.

The techniques are employed during the scoping phase include review of all published and unpublished reports satellite mapping, aeromagnetic data interpretation and regional geological mapping as well as environmental assessments of an EPL and ML areas. The detailed exploration programme covers prefeasibility and feasibility studies and will often take many forms based on the findings and targets delineated during the scoping phase with respect to specific mineral commodity groups. Techniques that are often used includes but not limited to the following:

- Prospector walking through the bush with a geological hammer mapping the local geology and sampling the soils and rocks at different localities.
- Ground geophysical measurements.
- Geochemical sampling.
- Trenching and sampling.
- Limited and detailed drilling and sampling.
- Laboratory testing, and.
- Possible test mining.

The detailed exploration programme will continue to get deeper as more data become available. Larger samples that can be checked in the laboratory will also be collected in order to fully understand the type and extent of the potential mineral resources in the area. Basic geosciences surveys, such as geological mapping, satellite mapping and aerial and ground geophysical survey are often used to guide the field search for potential economic mineral deposits within an EPL based on specific depositional model /s.

Following the completion of the data collection process under the prefeasibility and feasibility phases, an evaluation exercise will be implemented. All information including samples testing results and survey information will be carefully reviewed to see if the work that has been done is encouraging enough to continue with more detailed and expensive activities, such as detailed drilling and bulk sampling, and then advance to test mining and possible mine development, construction and possible operation. Apart from the technical evaluations of the potential mineral deposits within an EPL Area, other external factors such as markets and commodity price fluctuations will also need to be taken into consideration at every stage of the exploration programme.

1.4.3 Uranium Mining and Milling Stage

Once a specific project proves viable within an EPL, the EPL holder can then apply for a Mining License (ML) from the Ministry of Mines and Energy by preparing all the necessary documentations including a feasibility report with mine plans and environmental assessment reports as well as proof of financial resources to construct and operate a mine. Once the ML has been granted, the developer may start with the development of a mine covering the preconstruction and construction stages. Exploration can take many years before a decision to open a mine can be made and very few exploration projects can actually lead to a mining project. The time it takes to construct a mine after a ML has been issues can vary from 3 years to more than five years depending on the size and type of commodity as well as many other technical and engineering challenges of building a mine and all other supporting infrastructures.

The actual mine operation which is the production of the mineral resources starts once all the construction and testing has been completed. In the case of uranium, the ore is usually mined using open-cut techniques, depending on the location of reserves. The mineralised rock is crushed, milled, and leached by adding chemicals such as acid or alkaline to dissolve the uranium. The resultant solution is further treated to precipitate uranium compounds that are ultimately dried and calcined to form uranium ore concentrate, conventionally referred to as uranium oxide (U_3O_8) which contains about 85% uranium. Uranium cannot be fed directly into a power station but must be prepared as special fuel through the next stage of the nuclear fuel cycle called conversion, not done in Namibia (Fig. 1.5). The uranium oxide (U_3O_8) is first purified and then converted into uranium hexafluoride (UF_6), which in

gaseous form is required for the enrichment stage. The proposed project in the ML No. 177 will only produce uranium oxide (U_3O_8) and no further processing of uranium as outline in Fig. 1.5 is undertaken in Namibia. The production of uranium oxide also called yellowcake is the final stage of the nuclear fuel cycle currently being undertaken in Namibia.

1.4.4 Conversion Stage

For uranium to be enriched, the U_3O_8 must be purified and chemically converted to uranium hexafluoride (UF_6) gas (Fig. 1.5). This process uses standard industrial chemical steps, some of which use hazardous gases, and the application of moderate heat. Conversion is a chemical process whereby U_3O_8 is converted into UF_6, which can be a solid, liquid or gas, depending on the temperature and pressure. At atmospheric pressure, UF6 is solid below 57°C and gaseous above this temperature. It is stored and transported as a solid in large secure cylinders. When UF_6 contacts water, it is highly corrosive and chemically toxic. The siting, environmental and security management of a conversion plant is subject to the same regulations as any industrial processing plant involving fluorine-based chemicals.

1.4.5 Enrichment Stage

Most nuclear power plants require fissile material that is more concentrated than the level present in natural uranium, in order to sustain a reaction. Natural uranium contains approximately 0.7 % of the fissile U-235 isotope, the balance being non-fissile U-238. Enrichment increases this proportion to 3–5 per cent, producing low-enriched uranium (LEU).

Established commercial processes for enrichment include gas centrifuge, the current method of choice, and gaseous diffusion, which is very energy intensive and is being phased out. New technologies under development include laser activated isotope separation. The enrichment process involves increasing the proportion of U-235 from 0.7 per cent to between 3 - 5% (Fig. 1.9). In the process, approximately 85 % of the feed is left over as depleted uranium (tails). Typically, the depleted uranium remains the property of the enrichment plant. While depleted uranium has some industrial uses, most is stored for possible re-enrichment or future use as fuel in fast breeder reactors. Although several enrichment processes have been developed, only the gaseous diffusion and centrifuge processes operate commercially.

The output of an enrichment plant is expressed as ‘kilogram separative work units’, or SWU. It is indicative of energy used in enrichment and measures the quantity of separative work performed to enrich a given amount of uranium when the feed and product quantities are expressed in kilograms. The U-235 tails assay can be varied. The lower the tails assay, the greater the amount of U-235 that has been separated in the enrichment process and the greater the amount of energy or SWU needed. A lower tails assay means that less natural uranium is required but more enrichment effort, or SWU is required. A higher tails assay requires a greater amount of natural uranium but less SWU.

It takes approximately 8 kg of uranium oxide (U3O8) and 4.8 SWU to produce one kilogram of enriched uranium fuel (enriched to 3.5 %) at 0.25 % tails assay. The primary factors in determining the tails assay are the relative prices paid for uranium and enrichment. An increase in the price of uranium will make lower tails assays attractive as less uranium is required (unless this is offset by an increase in the price of enrichment) and vice versa. Given the trend of uranium and enrichment prices in recent years, Western enrichment companies have chosen to re-enrich depleted uranium (or tails) resulting from previous enrichment processes.

1.4.6 Fabrication Stage

Enriched uranium in the form of UF_6 is transferred to a fuel fabrication plant where it is transformed to another oxide of uranium, UO_2 (Fig. 1.5). UO_2 is a black powder that is compressed into small pellets, which are sintered (baked) and then ground to a precise shape and loaded into thin zirconium alloy or

steel tubes (cladding) to create fuel rods. These rods are then bundled into fuel assemblies for insertion into the reactor. Fuel fabrication is a process by which reactor fuel assemblies are produced. Enriched uranium is manufactured into uranium dioxide (UO_2) fuel pellets. Typically, the pellets are loaded into zirconium alloy or stainless steel tubes to form fuel rods that are then made into fuel assemblies to form the reactor core.

A 1000 MW reactor operates with approximately 75 tonnes of fuel loaded at any one time, with approximately 25 tonnes replaced each year. However, fuel cycles vary and used fuel may be replaced from every 12 to 24 months. Used fuel rods are sometimes send for reprocessing or stored in specially designed radioactive waste repositories (Fig. 1.5).

1.4.7 Radioactive Waste

In Namibia, Radioactive waste management is regulated thorough the Atomic Energy and Radiation Protection Act (Act No. 5 of 2005), Regulations for Protection Against Ionizing Radiation and for the Safety of Radiation Sources and the Regulations for the Safety and Secure Management of Radioactive Waste under the Ministry of Health and Social Services. The Act provides for adequate protection of the environment and of people in current and future generations against the harmful effects of radiation by controlling and regulating the production, processing, handling, use, holding, storage, transport and disposal of radiation sources and radioactive materials, and controlling and regulating prescribed non-ionising radiation sources. to establish an Atomic Energy Board and to provide for its composition and functions. to establish a National Radiation Protection Authority. to amend the Hazardous Substances Ordinance, 1974 (Ordinance 14 of 1974). and to provide for related matters. In the Act nuclear material means *inter alia:-*

(i) Uranium enriched in isotope uranium-235, or uranium containing the mixture of isotopes as occurring in nature other than in the form of ore or ore residue.

(ii) Any substance or device that may be necessary or useful in the manufacture of nuclear weapons, prescribed to be nuclear material, and.

(iii) Any mixture or compound that contains nuclear material, except any naturally occurring mineral containing uranium that has not been processed in any manner to concentrate the uranium contents or change the isotopic mixture of the uranium. Provided that the regulations may prescribe that any material included in this definition is not regarded as nuclear material for the purpose of this Act.

Radioactive wastes arise from a wide range of uses of radioactive materials. Those originating from nuclear power production are more significant in terms of volume and concentrations of activity, while medical, research and industrial uses of radioactive materials give rise to relatively small amounts of waste with comparatively moderate levels of activity. A number of developed countries have a significant legacy of radioactive waste arising from weapons development activities. Overall, the volume of radioactive waste is small compared with the volume of other industrial waste. Radioactive waste is characterised by its physical, chemical, radiological and biological properties. Radioactive waste is classified to facilitate its safe management, for example, according to the degree of containment and isolation required to ensure that it does not adversely impact on people or the environment. Radioactive waste is generally classified in terms of the following:

(i) Low-Level Waste (LLW) — the level of radioactivity is sufficiently low that it does not require special shielding during normal handling and transport (it is customary to exclude waste that contains more than minor concentrations of long-lived radionuclides). LLW comprises materials that may be lightly contaminated, suchas paper, glassware, tools and clothing.

(ii) Intermediate-Level Waste (ILW) — long and short-lived waste, including reactor components, chemical residues, sealed radioactive sources from medicine and industry and used metal fuel cladding. ILW requires special handling and shielding of radioactivity, but not cooling.

(iii) High-level waste (HLW) — contains large amounts of radioactivity and requires cooling and special shielding, handling and storage. HLW includes spent nuclear fuel intended for disposal and the solidified residues from reprocessing spent nuclear fuel.

Radioactive waste management includes all activities, administrative and operational, in handling, treatment, conditioning, transport, storage and disposal. The final step of disposal involves safely isolating waste from people and the environment in purpose-built facilities while it decays to harmless levels.

1.4.8 Radioactive Reprocessing Stage

Reprocessing is a key stage, which closes the nuclear fuel cycle (Fig. 1.5). Reprocessing is the physical and chemical processing of spent fuel to enable the separation of its components. The principal reason for reprocessing has been to recover unused uranium and plutonium for use as nuclear fuel. Reprocessing also reduces the volume of High-Level Waste (HLW) for disposal by a factor of between five and ten, compared to direct disposal of spent nuclear fuel, although it leads to a significant increase in the volume of Intermediate-Level Waste (ILW) and Low-Level Waste (LLW).

Commercial reprocessing plants use the PUREX process in which plutonium, uranium and fission products are separated. Thus reprocessing plants, like uranium enrichment plants, are nuclear proliferation sensitive. Other processes (UREX, UREX+), which do not separate out plutonium or other actinides are under development. For most fuels, reprocessing occurs 5–25 years after its removal from the reactor. The HLW liquid remaining after plutonium and uranium are removed contains approximately 3 % of the used fuel as minor actinides and highly radioactive, heat producing fission products. HLW liquids are conditioned by drying and incorporating the dry material into a durable waste form, which is stored pending disposal. Commercial reprocessing plants operate in France (Cap La Hague), the United Kingdom (Sellafi eld), Russia (Ozersk) and Japan (Rokkasho).

1.4.9 Findings and Recommendations on the New NFCP

Once the current ongoing development of the new Nuclear Fuel Cycle Policy (NFCP) and regulatory framework has been completed and implemented, a much more detailed and clear Government Strategy to overcome all the likely challenges on the implementation of the nuclear fuel cycle in Namibia is likely to emerge. Current Government Policy on Nuclear Fuel Cycle is supportive and favourable to the proposed new uranium mine in the ML No. 177.

Its hereby recommended that, throughout the development stages of the proposed new uranium mine in the ML No. 177 covering the ongoing exploration (feasibility), preconstruction, construction, operation, and ongoing rehabilitation, decommissioning and final rehabilitation as well as the aftercare stages, the developer must continuously engage the Ministry of Mines and Energy and other key Government Departments and Agencies in order to keep up with all new developments.

1.5 Summary of the Terms of Reference for the EIA and EMP

1.5.1 Overview

The impact assessment process has been undertaken in accordance with the Terms of Reference (ToR) and the requirements of the Environmental Impact Assessment Regulations, 2012 and the Environmental Management Act, 2007, (Act No. 7 of 2007). The proposed project activities have been reassessed against the receiving environment covering the physical, biological, socioeconomic and ecosystem services (function, use values and non-use).

A Background Information Document (BID) was prepared and used for project registration on the MEFT Portal (Annex 2). This was followed by the review of the reports prepared in 2011 and 2018 and the preparation of this updated EIA and EMP Report to support the application for the renewal of the ECC for the proposed uranium mining and exploration activities in the ML No. 177.

Table 1.1: Summary of the proposed activities, alternatives and key issues considered during the Environmental Assessment (EA) process covering Scoping, EIA and EMP process.

<table>
<tr><th colspan="2">ACTIVITIES</th><th>ALTERNATIVES TO BE CONSIDERED</th><th colspan="2">KEY ISSUES EVALUATED AND ASSESSED WITH EMP / MITIGATION MEASURES DEVELOPED</th></tr>
<tr><td rowspan="9">MINING WITH ONGOING PROSPECTING / EXPLORATION</td><td rowspan="9">The following is the summary of the proposed mine developmental stages that has been assessed in this environmental assessment process covering the EIA and the development of the EMP:

(i) Preconstruction.

(ii) Construction.

(iii) Operation, ongoing exploration, monitoring and rehabilitation, and.

(iv) Closure, decommissioning, and aftercare.</td><td rowspan="9">(i) Location for Minerals Occurrence.

(ii) Other Alternative Land Uses: Game Farming, other types of Agricultural activities, Tourism and minerals and mining operations.

(iii) Ecosystem Function (What the Ecosystem Does.

(iv) Ecosystem Services.

(v) Use Values.

(vi) Non-Use, or Passive Use.

(vii) The No-Action Alternative

(viii) Others to be identified during the public consultation process and preparation of the Scoping and EMP Report</td><td colspan="2">Potential land use conflicts / opportunities for coexistence between proposed exploration and other existing land uses such as conservation, tourism and agriculture</td></tr>
<tr><td rowspan="3">Impacts on the Physical Environment</td><td>Natural Environment such as air, noise, water, dust etc.</td></tr>
<tr><td>Built Environment such as existing houses, roads, transport systems, Buildings, energy and water and other supporting infrastructure</td></tr>
<tr><td>Socioeconomic, Archaeological and Cultural impacts on the local societies and communities</td></tr>
<tr><td rowspan="4">Impacts on the Biological Environment</td><td>Flora</td></tr>
<tr><td>Fauna</td></tr>
<tr><td>Habitat</td></tr>
<tr><td>Ecosystem functions, services, use values and non-Use or passive use</td></tr>
</table>

1.5.2 Impact Assessment Process

The overall impact assessment approach adopted the Leopold matrix framework which is one of the internationally best-known matrix assessment methodology available for predicting the impact of a project on the receiving environment.

The assessment process took into considerations the proposed activities, trade-offs, alternatives, and issues. Further inputs were provided by the specialist consultants as maybe required as well as registered stakeholders during the public consultation process.

The following specialist studies were undertaken as part of the environmental assessment process: Flora, fauna, socioeconomic, archaeology, noise, dust, and hydrogeology.

1.5.3 Evaluation of Impacts

The proposed mine development and ongoing exploration were considered as the key sources of impacts in assessing the likely impacts that the proposed project activities will have on the receiving environment as outlined in Table 1.1. In evaluating the degree of potential impacts, the following factors were taken into consideration:

(i) Impact Severity: The severity of an impact is a function of a range of considerations.

(ii) Likelihood of Occurrence (Probability): How likely is the impact to occur?

In evaluating the severity of potential environmental impacts, the following factors were taken into consideration:

- Receptor/ Resource Characteristics: The nature, importance and sensitivity to change of the receptors / target or resources that could be affected.
- Impact Magnitude: The magnitude of the change that is induced.
- Impact Duration: The time period over which the impact is expected to last.
- Impact Extent: The geographical extent of the induced change, and.
- Regulations, standards and guidelines: The status of the impact in relation to regulations (eg. discharge limits), standards (eg. environmental quality criteria) and guidelines.

1.5.4 Mitigation Measures for Significance Impacts

Based on the finding of the EIA Report, an EMP Report has been prepared detailing the mitigation measures that the Proponent shall implement in minimising and maximising the likely effects of negative and positive impacts respectively.

The following is the summary of the mitigation measures adopted in order of preference and in addressing the impacts assessed to have likely significant adverse effects on the receiving environment:

(i) Enhancement, e.g. provision of new habitats.

(ii) Avoidance, e.g. sensitive design to avoid effects on ecological receptors.

(iii) Reduction, e.g. limitation of effects on receptors through design changes, and.

(iv) Compensation, e.g. community benefits.

1.6 Environmental Assessment Process and Regulatory Framework

1.6.1 Environmental Assessment Process

The processes and steps that has been followed in the preparation of 2011 reports and this updated and summarised report took into considerations the provisions of the Environmental Impact Assessment (EIA) Regulations, 2012 and the Environmental Management Act (EMA), 2007, (Act No. 7 of 2007) as outlined in Fig. 1.6.

1.6.2 Mining Legislation and Regulations

The national regulations governing minerals prospecting and mining activities in Namibia fall within the jurisdiction of the Ministry of Mines and Energy (MME). The Minerals (Prospecting and Mining) Act (No 33 of 1992) is the most important legal instrument governing the mining industry.

1.6.3 Competent Authorities

The environmental regulatory authorities responsible for environmental protection and management in relation to the proposed / ongoing project including their role in regulating environmental protection are listed in Table 1.2.

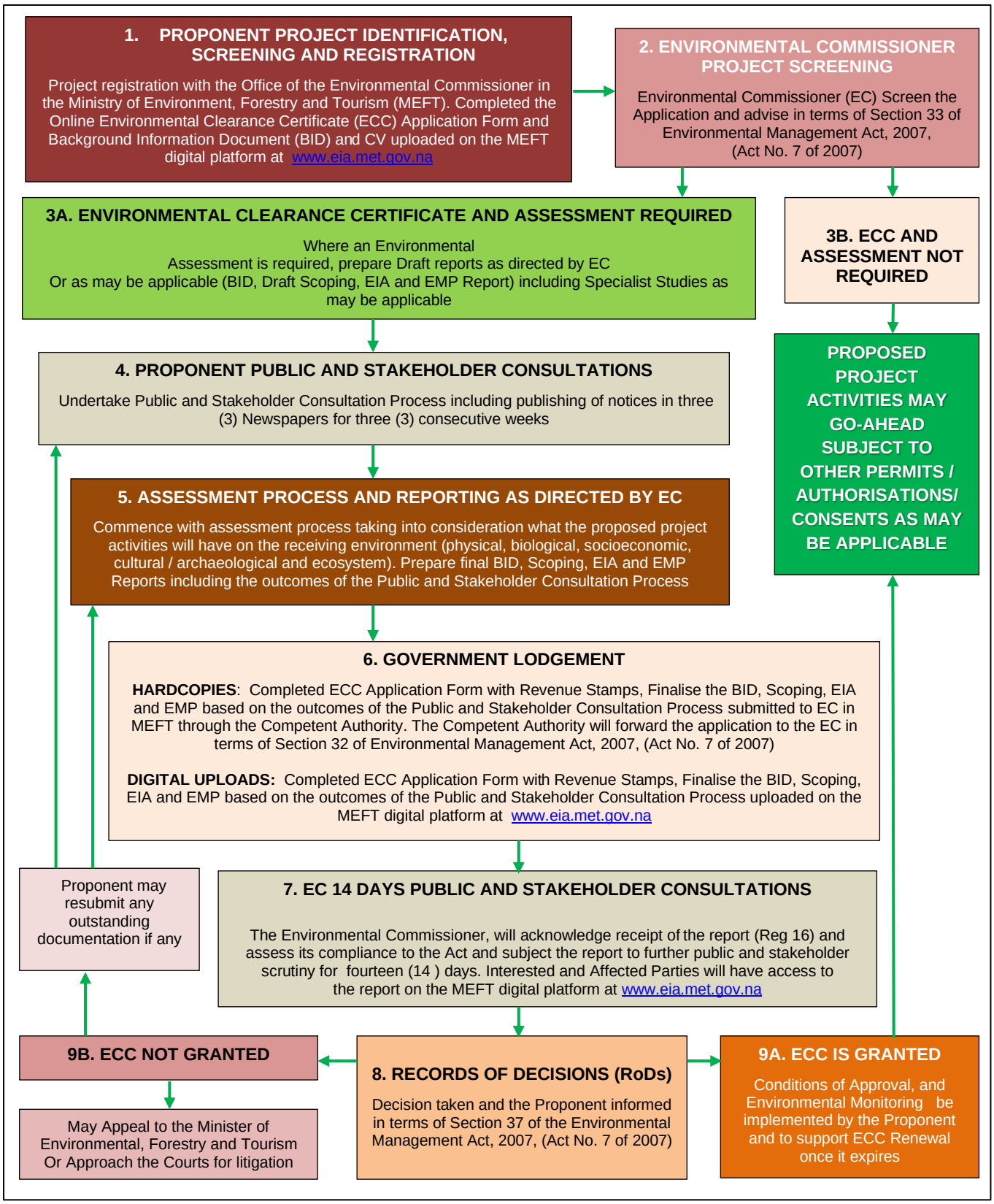


Figure 1.6: Schematic presentation of Namibia's Environmental Assessment Procedure.

Table 1.2: Government agencies regulating environmental protection in Namibia with respect to the proposed ML No. 177 mining operations, minerals processing and local supporting infrastructure.

AGENCY	RESPONSIBILITY
Ministry of Environment, Forestry and Tourism (MEFT)	Issue of Environmental Clearance Certificate (ECC) based on the review and approval of the Environmental Assessments (EA) reports comprising Environmental Scoping, Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) prepared in accordance with the Environmental Management Act (2007) and the Environmental Impact Assessment Regulations, 2012
Ministry of Mines and Energy (MME)	The competent authority for minerals prospecting and mining activities in Namibia. Issues Exclusive prospecting License (EPL), Mining Licenses (ML) and Mining Claims (license) as well as all other minerals related permits for processing, trading and export of minerals resources
Ministry of Agriculture, Water and Land Reform (MAWLR)	The Directorate of Resource Management within the Department of Water Affairs (DWA) at the MAWLR is currently the lead agency responsible for management of surface and groundwater utilisation through the issuing of abstraction permits and waste water disposal permits. DWA is also the Government agency responsible for water quality monitoring and reporting. The National Botanical Research Institute's (NBRI) mandate is to study the flora and vegetation of Namibia, to promote the understanding, conservation, and sustainable use of Namibia's plants for the benefit of all. The Directorate of Forestry (DOF) is responsible for issuing of forestry permits with respect to harvest, transport, and export or market forest resources.
National Radiation Protection Authority (NRPA), Ministry of Health and Social Services (MHSS)	The National Radiation Protection Authority (NRPA) within the provisions of the Atomic Energy and Radiation Protection, 2005, (Act No. 5 of 2005) grants Radiation Authorisation and approves Radiation Management Plan (RMPs) with respect to occupational health and safety guidelines or thresholds for management of ionisation radiation.

1.6.4 Other Applicable Legislations

The following is the summary of the applicable legalisation with respect to the proposed project ML No. 177 mining operations, minerals processing and local supporting infrastructure:

- Namibian Constitution Articles 91(c) and 95.
- Petroleum (Exploration and Production) Act, 1991 and associated Regulations.
- Environmental Management Act (No. 7 of 2007) and Regulations (2012).
- Water Act, 1956, Act No. 54 of 1956.
- Hazardous Substances Ordinance (1974).
- Health Act (No. 21 of 1988).
- Air Quality Act (No. 39 of 2004).
- Atmospheric Pollution Prevention Act (No. 45 of 1965).
- Communal Land Reform Amendment Act (No. 13 of 2013).
- Forestry Act (No. 12 of 2001) and Forest Amendment Act (No. 13 of 2005).
- The Labour Act, 1992, Act No. 6 of 1992 as amended in the Labour Act, 2007 (Act No. 11 of 2007).

- Labour Act (No. 11 of 2004) – Health & Safety Regulations (1997).
- National Heritage Act (No. 27 of 2004).
- Nature Conservation Amendment Act (No. 5 of 1996).
- Nature Conservation Ordinance (No. 4 of 1975).
- Soil Conservation Act (No. 70 of 1969), and.
- Traditional Authorities Act (No. 17 of 1995).

1.6.5 International and Regional Treaties and Protocols

Article 144 of the Namibian Constitution provides for the enabling mechanism to ensure that all international treaties and protocols are ratified. All ratified treaties and protocols are enforceable within Namibia by the Namibian courts and these include the following:

- The Paris Agreement, 2016.
- Convention on Biological Diversity, 1992.
- Vienna Convention for the Protection of the Ozone Layer, 1985.
- Montreal Protocol on Substances that Deplete the Ozone Layer, 1987.
- United Nations Framework Convention on Climate Change, 1992.
- Kyoto Protocol on the Framework Convention on Climate Change, 1998.
- Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and Their Disposal, 1989.
- World Heritage Convention, 1972.
- Convention to Combat Desertification, 1994. and
- Stockholm Convention of Persistent Organic Pollutants, 2001.
- Southern Africa Development Community (SADC) Protocol on Mining, and.
- Southern Africa Development Community (SADC) Protocol on Energy.

1.6.6 Standards and Guidelines

The only key missing components to the regulatory frameworks in Namibia are the standards, and guidelines with respect to gaseous, liquid, and solid emissions. However, in the absence of national gaseous, liquid, and solid emission limits for Namibia, the proposed project shall target the Multilateral Investment Guarantee Agency (MIGA) gaseous effluent emission level and liquid effluent emission levels (Table 1.3).

Noise abatement measures must target to achieve either the levels shown in Table 1.4 or a maximum increase in background levels of 3 dB (A) at the nearest receptor location off-site (MIGA guidelines).

Industrial effluent likely to be generated by the proposed activities must comply with provisions of the Government Gazette No 217 dated 5 April 1962 (Table 1.5) while the drinking water quality comparative guideline values are shown in Table 1.6.

Table 1.3: Liquid effluent emission levels (MIGA /IFC).

Pollutant	**Max. Value**
pH	6-9
Total suspended solids	50 mg/l
Total metals	10 mg/l
Phosphorous (P)	5 mg/l
Fluoride (F)	20 mg/l
Cadmium (Cd)	0.1 mg/l

Table 1.4: Noise emission levels (MIGA /IFC).

	Maximum Allowable Leq (hourly), in dB(A)	
Receptor	Day time (07:00 – 22:00)	Night time (22:00 – 07:00)
Residential, institutional, educational	55	45
Industrial, commercial	70	70

Table 1.5: R553 Regional Standards for Industrial Effluent, in Government Gazette No 217 dated 5 April 1962.

Colour, odour and taste	The effluent shall contain no substance in concentrations capable of producing colour, odour or taste	
pH	Between 5.5 and 9.5	
Dissolved oxygen	At least 75% saturation	
Typical faecal coli	No typical faecal coli per 100 ml	
Temperature	Not to exceed 35 °C	
Chemical demand oxygen	Not to exceed 75 mg/l after applying a correction for chloride in the method	
Oxygen absorbed	Not to exceed 10 mg/l	
Total dissolved solids (TDS)	The TDS shall not have been increased by more than 500 mg/l above that of the intake water	
Suspended solids	Not to exceed 25 mg/l	
Sodium (Na)	The Na level shall not have been increased by more than 50 mg/l above that of the intake water	
Soap, oil and grease	Not to exceed 2.5 mg/l	
Other constituents	Residual chlorine	0,1 mg/l as Cl
	Free & saline ammonia	10 mg/l as N
	Arsenic	0,5 mg/l as As
	Boron	1,0 mg/l as B
	Hexavalent Cr	0,05 mg/l as Cr
	Total chromium	0,5 mg/l as Cr
	Copper	1,0 mg/l as Cu
	Phenolic compounds	0,1 mg/l as phenol
	Lead	1,0 mg/l as Pb
	Cyanide and related compounds	0,5 mg/l as CN
	Sulphides	1,0 mg/l as S
	Fluorine	1,0 mg/l as F
	Zinc	5,0 mg/l as Zn

Table 1.6: Comparison of selected guideline values for drinking water quality (after Department of Water Affairs, 2001).

Parameter and Expression of the results			WHO Guidelines for Drinking-Water Quality 2nd edition 1993		Proposed Council Directive of 28 April 1995 (95/C/13-1/03) EEC	Council Directive of 15 July 1980 relating to the quality intended for human consumption 80/778/EEC		U.S. EPA Drinking water Standards and Health Advisories Table December 1995		Namibia, Department of Water Affairs Guidelines for the evaluation of drinking-water for human consumption with reference to chemical, physical and bacteriological quality July 1991			
			Guideline Value (GV)		Proposed Parameter Value	Guide Level (GL)	Maximum Admissible Concentration (MAC)	Maximum Contaminant Level (MCL)		Group A Excellent Quality	Group B Good Quality	Group C Low Health Risk	Group D Unsuitable
Temperature	t	°C		-	-	12	25		-	-	-	-	-
Hydrogen ion concentration	pH, 25° C	-	R	<8.0	6.5 to 9.5	6.5 to 8.5	10		-	6.0 to 9.0	5.5 to 9.5	4.0 to 11.0	<4.0 to >11.0
Electronic conductivity	EC, 25° C	mS/m		-	280	45	-		-	150	300	400	>400
Total dissolved solids	TDS	mg/l	R	1000	-	-	1500		-	-	-	-	-
Total Hardness	$CaCO_3$	mg/l		-	-	-	-		-	300	650	1300	>1300
Aluminium	Al	µ g/l	R	200	200	50	200	S	50-200	150	500	1000	>1000
Ammonia	NH_4^+	mg/l	R	1.5	0.5	0.05	0.5		-	1.5	2.5	5.0	>5.0
	N	mg/l		1.0		0.04	0.4		-	1.0	2.0	4.0	>4.0
Antimony	Sb	µ g/l	P	5	3	-	10	C	6	50	100	200	>200
Arsenic	As	µ g/l		10	10	-	50	C	50	100	300	600	>600
Barium	Ba	µ g/l	P	700	-	100	-	C	2000	500	1000	2000	>2000
Berylium	Be	µ g/l		-	-	-	-	C	4	2	5	10	>10
Bismuth	Bi	µ g/l		-	-	-	-		-	250	500	1000	>1000
Boron	B	µ g/l		300	300	1000	-		-	500	2000	4000	>4000
Bromate	BrO_3^-	µ g/l		-	10	-	-	P	10	-	-	-	-
Bromine	Br	µ g/l		-	-	-	-		-	1000	3000	6000	>6000
Cadmium	Cd	µ g/l		3	5	-	5	C	5	10	20	40	>40
Calcium	Ca	mg/l		-	-	100	-		-	150	200	400	>400
	$CaCO_3$	mg/l		-	-	250	-		-	375	500	1000	>1000
Cerium	Ce	µ g/l		-	-	-	-		-	1000	2000	4000	>4000
Chloride	Cl^-	mg/l	R	250	-	25	-	S	250	250	600	1200	>1200
Chromium	Cr	µ g/l	P	50	50	-	50	C	100	100	200	400	>400
Cobalt		µ g/l		-	-	-	-		-	250	500	1000	>1000
Copper after 12 hours in pipe	Cu	µ g/l	P	2000	2	100	-	C	TT##	500	1000	2000	>2000
		µ g/l		-	-	3000[1]	-	S	1000	-	-	-	-
Cyanide	CN^-	µ g/l		70	50	-	50	C	200	200	300	600	>600
Fluoride	F^-	mg/l		1.5	1.5	-	at 8 to 12 °C: 1.5	C	4	1.5	2.0	3.0	>3.0
		mg/l		-	-	-	at 25 to 30 °C: 0.7	P,S	2	-	-	-	-
Gold	Au	µ g/l		-	-	-	-		-	2	5	10	>10
Hydrogen sulphide	H_2S	µ g/l	R	50	-	-	undetectable		-	100	300	600	>600
Iodine	I	µ g/l		-	-	-	-		-	500	1000	2000	>2000
Iron	Fe	µ g/l	R	300	200	50	200	S	300	100	1000	2000	>2000
Lead	Pb	µ g/l		10	10	-	50	C	TT#	50	100	200	>200
Lithium	Li	µ g/l		-	-	-	-		-	2500	5000	10000	>10000
Magnesium	Mg	mg/l		-	-	30	50		-	70	100	200	>200
	$CaCO_3$	mg/l		-	-	7	12		-	290	420	840	>840
Manganese	Mn	µ g/l	P	500	50	20	50	S	50	50	1000	2000	>2000
Mercury	Hg	µ g/l		1	1	-	1	C	2	5	10	20	>20
Molybdenum	Mo	µ g/l		70	-	-	-		-	50	100	200	>200
Nickel	Ni	µ g/l		20	20	-	50		-	250	500	1000	>1000
Nitrate*	NO_3^-	mg/l	P	50	50	25	50		45	45	90	180	>180
	N	mg/l		-	-	5	11	C	10	10	20	40	>40
Nitrite*	NO_2^-	mg/l		3	0.1	-	0.1		3	-	-	-	-
	N	mg/l		-	-	-		C	1	-	-	-	-
Oxygen, dissolved	O_2	% sat.		-	50	-	-		-	-	-	-	-
Phosphorus	P_2O_5	µ g/l		-	-	400	5000		-	-	-	-	-
	PO_4^{3-}	µ g/l		-	-	300	3350		-	-	-	-	-
Potassium	K	mg/l		-	-	10	12		-	200	400	800	>800
Selenium	Se	µ g/l		10	10	-	10	C	50	20	50	100	>100
Silver	Ag	µ g/l		-	-	-	10	S	100	20	50	100	>100
Sodium	Na	mg/l	R	200	-	20	175		-	100	400	800	>800
Sulphate	SO_4^{2-}	mg/l	R	250	250	25	250	S	250	200	600	1200	>1200
Tellurium	Te	µ g/l		-	-	-	-		-	2	5	10	>10
Thallium	Tl	µ g/l		-	-	-	-	C	2	5	10	20	>20
Tin	Sn	µ g/l		-	-	-	-		-	100	200	400	>400
Titanum	Ti	µ g/l		-	-	-	-		-	100	500	1000	>1000
Tungsten	W	µ g/l		-	-	-	-		-	100	500	1000	>1000
Uranium	U	µ g/l		-	-	-	-	P	20	1000	4000	8000	>8000
Vanadium	V	µ g/l		-	-	-	-		-	250	500	1000	>1000
Zinc after 12 hours in pipe	Zn	µ g/l	R	3000	-	100	-	S	5000	1000	5000	10000	>10000
		µ g/l		-	-	5000	-		-	-	-	-	-

P: Provisional
R: May give reason to complaints from consumers

C: Current. P: Proposed. S: Secondary.
T#: Treatment technique in lieu of numeric MCL.
TT##: treatment technique triggered at action level of 1300 µ g/l

1.6.7 Recommendations on Permitting Requirements

It is hereby recommended that the developer must follow the provisions of all relevant national regulatory throughout the proposed / ongoing project lifecycle and must obtain the following permits/ authorisations as may be applicable / required as the proposed project develops:

(i) Valid Mining Licenses (MLs) as may be applicable from Department of Mines in the Ministry of Mines and Energy (MME).

(ii) Valid Environmental Clearance Certificate (ECC) from the Department of Environmental Affairs in the Ministry of Environment, Forestry and Tourism (MEFT).

(iii) Permission to drill a borehole in protected groundwater zone, fresh water abstraction permits and waste water discharge permits from the Department of Water Affairs (DWA) in the Ministry of Agriculture, Water and Land Reform (MAWLR).

(iv) Obtain Radiation Authorisation and approval of the Radiation Management Plan (RMP), and.

(v) All other permits as maybe become applicable during the proposed exploration operations.

2. DESCRIPTION OF THE PROPOSED PROJECT

2.1 Project Development Stages

The ML No. 177 area hold good uranium resources that can support a uranium mine over a period of 10-15 years. The current focus on the anomaly No. 18 which, is situated just across the Khan River opposite the Rössing Mine with the possible infrastructure support areas situated to the eastern flat plain area (Fig. 2.1. Plates 2.1 and 2.2). The proposed new uranium mine project development stages are outlined in Fig. 2.2 and summarised as follows:

- **Project Identification**: Covering the actual project definition, strategic development including forecasting, alternative location assessments, investment levels, review of historical data sets, including uranium resources and regulatory requirements.

- **Feasibility Study** (covering all the technical studies such as uranium resources in terms of grade and tonnages, geotechnical evaluation, mine plans covering design and layout and Environmental Assessment covering scoping, Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP).

- **Preconstruction** (covering site preparation, bundling of the construction camp, material and equipment mobilisation for the development of the pit area, processing facilities and all supporting infrastructures).

- **Construction** (covering the actual site excavations for the pit area, processing facilities, office, administration and all related facilities and installation of all the supporting services, roads, electricity and water infrastructures.

- **Operation and Ongoing Rehabilitation** (covering the actual production of uranium oxide covering mining and mineral processing activities including ongoing rehabilitations of the pit area and processing plant including the tailings and waste rock facilities).

- **Rehabilitation and Closure (Decommissioning)** (the stage of removal of the installations covering the pit area, processing plant, tailing, waste rock as well as all the physical supporting infrastructure that has reached its useful life-span).

- **Aftercare** (covering a specific period after decommissioning that the developer or operator may still be held liable for any environmental damage such as contamination as a results of collapsed rehabilitated infrastructure. Although the regulatory framework is not yet in force with respect to the enforcement of environmental liabilities for aftercare stage, changes / amendment to Environmental Management Act, Act No. 7 of 2007 (not yet implemented) as well as new regulations that may be associated with the regulation of the uranium mining and processing in Namibia are likely to enforced the aftercare environmental liabilities.

The following is the summary of the indicative sizes of the various proposed development areas within the ML No. 177 as shown in Fig. 2.1:

(i)	Proposed Mining Licenses (ML) Area:	151 035 m ^{2}.
(ii)	Proposed PIT 1	3 000 m ^{2}.
(iii)	Proposed PIT 2	1 800 m ^{2}.
(iv)	Proposed PIT 15	700 m ^{2}.
(v)	Proposed PIT 18 (Main Pit):	6 700 m ^{2}.
(vi)	Administration, Plant and Heap Leaching Area:	22 000 m ^{2}.

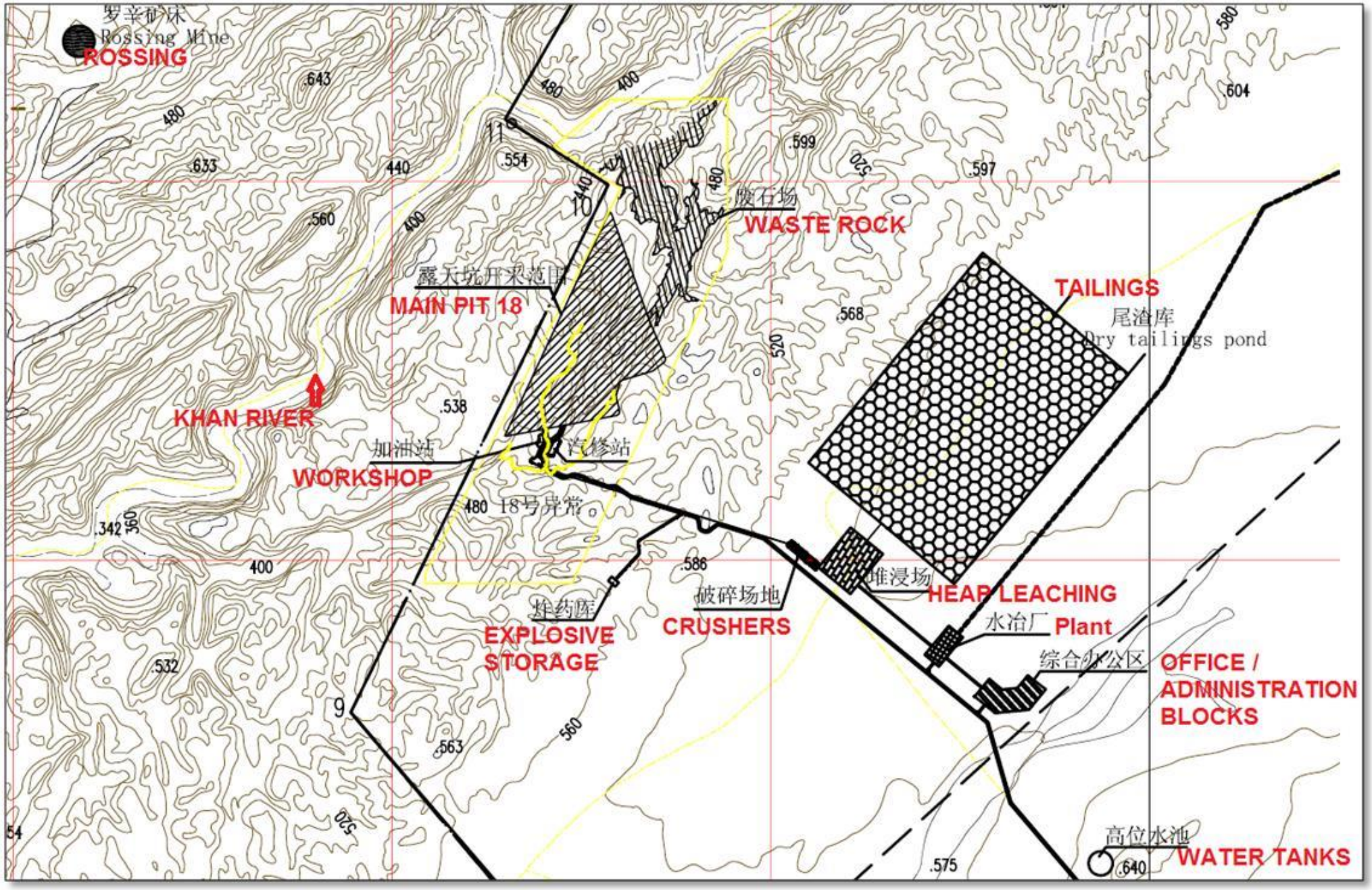


Figure 2.1: Overview of the proposed uranium project showing the main infrastructure opposite Rössing Mine.

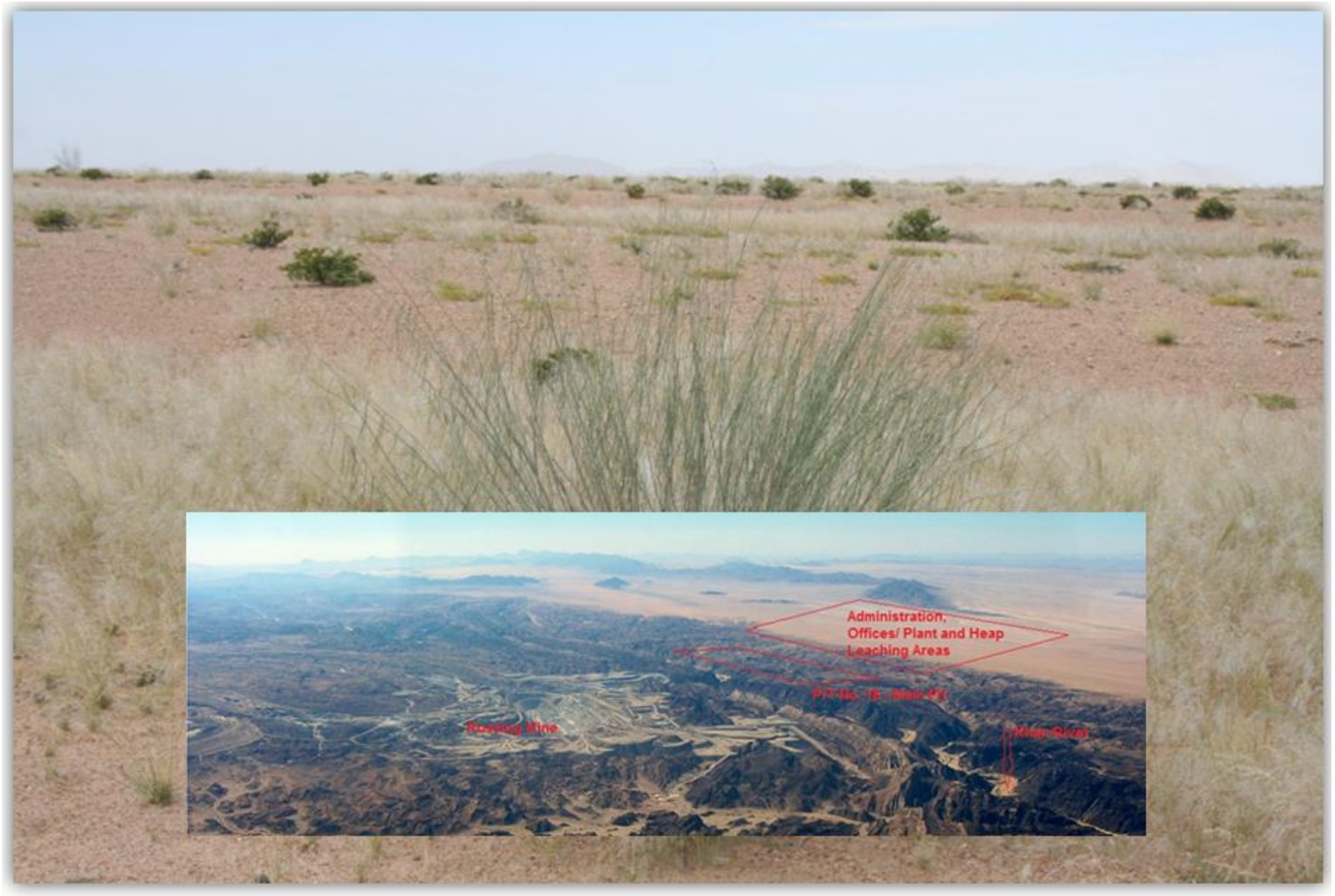


Plate 2.1: The proposed Administration Processing Plant and Heap Leaching Area is open and sparsely vegetated with no trees and larger shrubs comprising of *Callicorema capitata*, *Zygophyllum stapffii* and *Gomphocarpus filiformis*.

Plate 2.2: Main Pit Area (No. 18) in the Foreground and overlooking Rössing Mine across the Khan River.

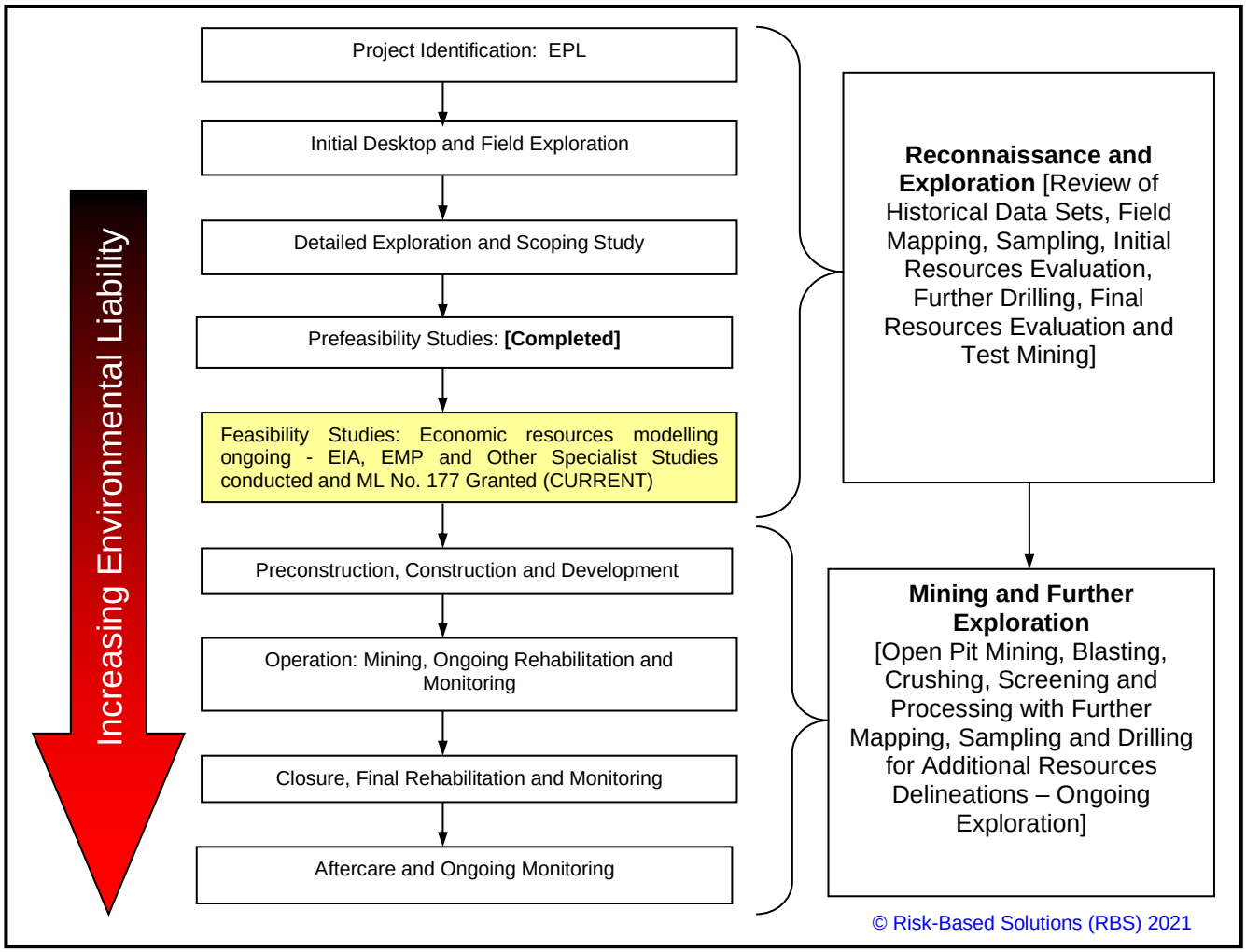


Figure 2.2: Outline of the proposed uranium project development stages.

2.2 Alternatives to the Project Development Process

Alternatives to the proposed project development process have been considered and will need continuous review at all stages of project development. This is an initial part of the process of the scoping study. The following alternatives have been considered and will continue to be reviewed during the preconstruction, construction, operation and monitoring, rehabilitation and closure as well as the aftercare stages:

- **Uranium Resources -** The ML No. 177 hold good uranium resources (average 230 ppm) that can support a uranium mine over a period of 10 – 15 years with an annual output of between 700 – 1000 tons of uranium oxide. However, the amount of resources will be fully quantified once the feasibility study has been completed and will be continuously updated during the mine operation. The continuous updating of the resources as new data becomes available is likely to increase the expected life of the proposed mine from the initial maximum of 15 years to up to 25 years. During the early exploration stages, a number of geophysical anomalies were delineated and investigated. Following the completion of the detailed exploration including drilling, all the anomalies that proved to be good uranium deposits were graded, ranked, and prioritised. The main current focus within the mining license area is on the anomaly No. 18 which is situated just across the Khan River opposite the Rössing Mine. The uranium deposit defined by the anomaly No. 18 will be the main and key pit area in the proposed Mining License Area. Other delineated future key uranium deposits included those defined by the Anomalies No. 1, 2 and 15).

- **Mining and Processing Infrastructure** – The required infrastructure include the creation of a tailings and waste rock dumps, the temporary stockpiling of low grade ore, the construction of administration and offices, the construction and operation of haul roads, the construction and operation of an acid plant, the construction of a water reservoir and the development of a road and water pipeline across the Khan River as an extension of the already existing services at Rössing Mine. An explosives magazine will also be required onsite to store and prepare the required material for blasting. **Alternatively**, the developer may consider only undertaking a mining project with the processing being undertaken at Rössing Mine, Husab Project (former Rössing South Project) or Valencia Mine. However, this will require negotiating a reasonable processing fee which the developer sees as not a viable alternative. However, the advantages of undertaking mining without having an onsite uranium processing facility are great from economic, technical, financially and environmental perspectives. Some of these advantages include reduced onsite uranium processing infrastructure needs, great environmental benefits, reduced capital investment, less payback period, no need to transport chemicals such as acid across the Khan River, no need for tailing dam, no need for large–scale water and electricity infrastructures to be brought onsite as well as less radiation exposure that could have been associated with the processing plant and other service units.

- **Production Rate** – Between 700 -1000 tons of uranium oxide will be produced annually. This estimate is likely to be increased as new deposits are delineated as a results of the ongoing exploration and the expansion of the project.

- **Mining Method** – The mining technique will utilise open pit utilising drilling and blasting to extract the uranium ore from the country rocks. Due to the nature of the orebody as well as the type of commodity (uranium) to be mined, only open cast mining method will be utilised. Conveyor systems and scoops for short distances and haul trucks of 150 tonnes for longer distances will be used to haul the mined and broken ore to the processing plant as well as the waste rock to spoil sites after processing.

- **Mineral Processing Techniques –** Heap Leaching will be used in the extraction of the uranium oxide from the mined ore. Mined and broken ore will be transported by conveyor system / scoops / 150 tons trucks to the ore pass from which it moves by gravity into the crusher. The uranium containing ore will be crushed and the coarsely crushed ore will be placed on a leaching pad with a liner. The leaching agent (alkaline or sulphuric acid) will be introduced on the top of the pile and will percolate down until it reaches the liner below the pile, where it is expected to be caught and pumped to a processing plant. After completion of the leaching process, the leached ore will either be removed to a disposal site, and new ore will be placed on the leach pad. During leaching, the piles present a hazard because of the potential release of dust, radon gas and leaching liquid. After completion of the leaching process, a long-term problem may result from naturally induced leaching, if the ore contains other minerals such as pyrite (FeS_2). Contact with water and air may cause continuous bacterially induced production of sulphuric acid inside the pile, which may results in the leaching of uranium and other contaminants for centuries and possibly permanent contamination of economic water resources that may be available in the surrounding areas. This may take place through contact with surface runoffs during the rainy season. Having increased the surface area of the rock by several orders of magnitude and having upgraded its uranium content, the release of uranium's decay products into the biosphere is likely to be accelerated and must be monitored and managed accordingly. The fine waste tailings from the processing plant and the coarse waste reject from the sorting will be combined and sent to the tailings dump.

- **Road** – Access to the ML No. 177 and, to the key anomaly No. 18 is currently very challenging. Currently, and only during the dry season, the exploration team are using the Valencia Mine Road off the B2. At the Khan River and just before the bridge to Valencia Mine, the access road follows the Khan River Channel. This access cannot be utilised during the proposed mining stage as it passes along the highly sensitive and potential seasonal flooding Khan River Channel and any accidental chemical / fuel spillage will have a devastating negative effect to the downstream environment and communities. The proposed

access road entails linking either to the Husab or Valencia Mines main access roads. However, this will require early implementation of negotiations with Husab or Valencia Mines Management and an undertaking of an EIA specific for the access not covered in the previous EIA undertaken in 2011.

- **Rail** - The nearest railhead is situated at Rössing Mines across the Khan River.

- **Energy** – The proposed mine will require a power supply of between 20 – 30 Megawatts (MW) mainly to run the processing plant and associated infrastructure. Electricity will be supplied by NamPower via a regional distribution line already available in the area. At least a 5 -10 MW diesel generated power will also be required on-site during the construction stage and as a back-up power supply to keep critical processes such as the leach tanks and one milling circuit operational in case of power failure. Although, electricity infrastructure is available in the area and it will require building a new power line and substation for the proposed uranium mine. Combined alignment of the new power line with other supporting infrastructures such as water pipeline and access road must be undertaken where possible in order to reduce any likely negative environmental impacts. Separate environmental assessments must be undertaken for all such infrastructure developments.

- **Fuel** – Fuel and other related products are available in Usakos, Arandis, Swakopmund and Walvis Bay Towns. An onsite fuel supply services will be required for mining equipment as well as support vehicles.

- **Water** – NamWater will supply the estimated required 2000 000 m^3 of water annually. This supply will be for operational water and will be sourced from a seawater desalination plant and where possible via the already existing or new Swakopmund via Rössing Mine water pipeline. A new pipeline will however be required to bring water to new proposed uranium mine. Where possible, this pipeline must follow the proposed road access in order to minimise any likely negative impacts. The water will be stored onsite in earth reservoirs. This reservoir will be covered and lined with plastic to reduce losses from seepage and evaporation respectively. Should there be an interruption in water supply for any reason, the on-site storage will allow for approximately four days of full operation, after which the plant will have to close.

- **Construction Materials** - Sand and aggregate for concrete work during the construction stage is expected to be sourced from borrow pits areas within the proposed pit and waste rock footprints and should, therefore, not result in any additional surface disturbance. An additional borrow pit may be required for the construction of the access road and other supporting infrastructure. Construction materials for supporting infrastructure may be sourced from the excavations and ground works that will be done in the areas to be used for administration / office, processing plant and heap leaching areas.

- **Services** – Services such as workshop, banking, retail as well as related requirements are available in the Towns of Usakos, Arandis, Swakopmund and Walvis Bay in the Erongo Region. An onsite services workshop will be required to maintain all the vehicle and earth moving equipments. Other mine support services such as housing of mine workers will also be provided in Arandis or Swakopmund, hence there is no need to construct a mine settlement within the Mining License area. However, an office / administration block will be required. The development of the mine in the ML No. 177 will result in increased traffic on the road between Swakopmund to the Valencia Mine or Rössing Mine turn-off. Demand for housing, schools, health services as well as all related urban amenities will also increase in Swakopmund where the operator is likely to establish the main offices.

- **Job Creation** – The project has good potential for job creation however, the total number of people who could be employed during the construction and operational phases may vary considerably compared to the estimated figures. It is estimated that 2500 and 600 indirect and direct job opportunities maybe created during construction and operation phases respectively. These number will need to be revised once the prior to the implementation the project.

- **Other Alternative Land Uses:** The rest of the ML area is being used for agriculture for commercial farm areas in the northeast and wildlife and open landscapes in south. Tourism is very limited due to difficulty access but with good areas of outstanding natural landscape beauty. Overall landscape value and uniqueness to support tourism development can be classified as moderate to low but is not expected to be very outstanding, and.

- **Potential Land Use Conflicts:** Considering the current land use practices as well as potential, other land uses including mining, it is likely that the economic spin-off associated with the development of a new uranium mine in the area will coexist with the current existing land use options. All the mineworkers will be accommodated in Swakopmund.

2.3 Geology and Mineralisation

Uranium deposits in the Erongo Region and indeed in the ML No. 177 are confined to the Central Zone of the Damara Belt and mainly divided into two deposits, the granite type sheeted leucogranite / alaskitehosted primary deposits and the 'calcrete type' superficial secondary deposits. The ML area has predominant primary uranium mineralisation in the leucogranites comprising uraninite (UO_2). These uraniferous leucogranites, known as alaskites, occur preferentially in and around anticlinal and dome structures along the Khan and Swakop River valleys to the east of Swakopmund well into the ML No. 177.

2.4 Current Exploration Results and Possible Mining

2.4.1 Overview

Zhonghe Resource Namibia Development (Pty) Ltd has undertaken extensive exploration activities with the aim of determining the uranium mineral potential of the ML Area. The following is a summary of the exploration activities that have been undertaken:

- Review of old geological data from previous exploration companies.

- Site specific geological mapping.

- Extensive drilling on selected targets.

- Acquired and interpreted satellite data.

- Acquired and interpreted the high resolution aeroradiometric data sets with aim of delineating the uranium mineralisation.

- Extensive trenching on selected targets for sampling purposes.

- Bulk sampling and laboratory assessment of the potential ore / mineral recovery processes.

- Implemented the full feasibility study completed in 2011.

- Contracted Risk-Based Solutions (RBS) CC to undertake the Environmental Assessment starting with preparation of a scoping report followed by the Environmental Impact Assessment (EIA) and development of Environmental Impact Assessment (EMP).

Based on the results of the 2009 – 2010 exploration work undertaken and the data interpretation of the drilling and laboratory data sets, it become clear that the ML No. 177 has good potential for uranium mineralisation.

2.4.2 Economic Assessment of the Project

Although current exploration results feasibility shows that a new uranium mine in the ML No. 177 is viable, it's still likely to be very sensitive to the mining techniques due to the lenses nature and variable depths of the ore body as well as not yet completed processing assessment techniques and possible recoveries. The completion of feasibility study will yield much more reliable results and coupled with a stable high commodity prices will be key to the long-term development of the proposed uranium mine that will no doubt support the much-needed socioeconomic development and job creation in Namibia.

2.4.3 Job Creation

The project has good potential for job creation however, the total number of people who could be employed during the construction and operational phases have not yet been established. It is estimated that 2500 and 600 indirect and direct job opportunities maybe created during construction and operation phases respectively, although these number will need to be confirmed during the feasibility stage.

2.4.4 Preliminary and Indicative Economic Assessments

Table 2.1 summarises of the preliminary and indicative economic variables of the proposed uranium mine in the ML No. 177 based on the initial results. The figures shown in Table 2.1 will be revised during the feasibility study stage. The payback period based on the current commodity prices may be around 5-8 years. There will be no profits in the first five (5) year and if the world economic climate remains favourable for resources and in particular uranium prices the return on investments may be realised much earlier.

Table 2.1: Summary of the technical economic variables of the proposed project.

ITEM	DESCRIPTION	TOTAL	
1.	Estimated production rate	700 – 1000 tons per year over 10 to 15 years	confirmed in the final feasibility study
2.	Average Grade	230 ppm	
3.	Cut off grade	100ppm	
4.	Life of the proposed mine	10 - 15 years (Extended based on the ongoing and future exploration results)	
5.	Monthly income at current price	To be determined in Feasibility Study Ready by June 2011	
6.	Annual income		
7.	Total Project Investment	Projected to USD 600- 700 million	
8.	Annual cost for 2000 and 600 potential direct and indirect permanent employment / contract opportunities	To be determined in Feasibility Study ready	
9.	Initial investments for purchase of specialised equipment prior to the commencement of mining operations		
10.	Operational Costs (Monthly Costs)		
11.	Development and operation time related charges		
12.	Provisions for environmental liabilities for the 1st Year of operation	N$109, 000, 000.00 (To be updated Annually)	

2.5 Preconstruction and Construction Stages

2.5.1 Overview

Once the Ministry of Mines and Energy issues the Mining Licence, Zhonghe Resource Namibia Development (Pty) Ltd will implement the mine development starting with the preconstruction stage. The preconstruction stage will include the following activities:

- ❖ Site preparation for actual pit area, plant area as well as all the associated supporting infrastructure.
- ❖ Building of the construction camp.
- ❖ Material and equipment mobilisation for the development of the pit area, processing facilities and all supporting infrastructures.
- ❖ Undertake all activities aimed at supporting the construction stage including tendering, scheduling and recruitment of workers.

Construction stage will involve the actual building of mine. This will include the actual site excavations for the pit area, processing facilities, office, administration and all related facilities and installation of all the supporting services, roads, electricity and water infrastructures. During the preconstruction and construction stages for the proposed project, a number of negative and positive impacts will be associated with the proposed project activities at local (Mining License Area), regional (Erongo), national (Namibia) and Global / SADC levels (Fig. 2.3).

2.5.2 New Tailing Dump Location and Design

Only three types of waste disposal facility must be developed in the Mining Licence area and these are:

(i) General landfill site to both general wastes such as paper, packaging and plastics and all hazardous waste such as oils and chemicals must be disposed off at an engineered waste disposal site in Walvis Bay or returned to the supplier for recycling.

(ii) Waste rock site – To handle all the waste rock from the excavation as well as crushing, screening and grinding activities. This waste disposal site must be situated close to the tailings site because the material from this site will be used for ongoing and final tailings as well as other excavation covers and restorations.

(iii) Tailings site – will be used to handle all the waste after the mineral recovery process. Waste from the mining and processing activities will be disposed on a new tailings dump to be created within the Mining License. The new site will be first excavated up to hard rock in order to create a landfill compared to the landform type of tailing dumps. Tailings will be filled in the excavated area with final landform having the same height profile as the surrounding terrain. The excavated materials will be stored and used for final site restoration.

No hazardous site shall be developed in the mining license area. All industrial / hazardous waste must be stored in suitable containers / skips onsite and once full must be transported to Walvis Bay waste disposal site. Alternatively, the mining company is highly encouraged to assist the Arandis / Usakos Municipality in developing a suitable waste disposal site, which will not only be utilised by the mining company but also the community of Arandis / Usakos. The support to the development of suitable waste disposal site for the Towns of Arandis or Usakos by the mining company will be within the expected social responsibility of the mining company to the local community in the Erongo Region.

2.6 Mine Operation and Ongoing Rehabilitation

2.6.1 Mining Process

The proposed uranium mine in the ML No. 177 will utilise open pit mining techniques comprising drilling and blasting to extract the uranium ore. Transport of the ore from the central haulage point in the pit area to the processing plant (crusher) will utilise Conveyor systems for short distances and haul trucks of 150 tonnes for longer distances will be used to haul waste rock to spoil sites and ore to the processing

plant. A summary of the likely mining and processing equipment and associated sources of impacts are illustrated in Fig. 2.3.

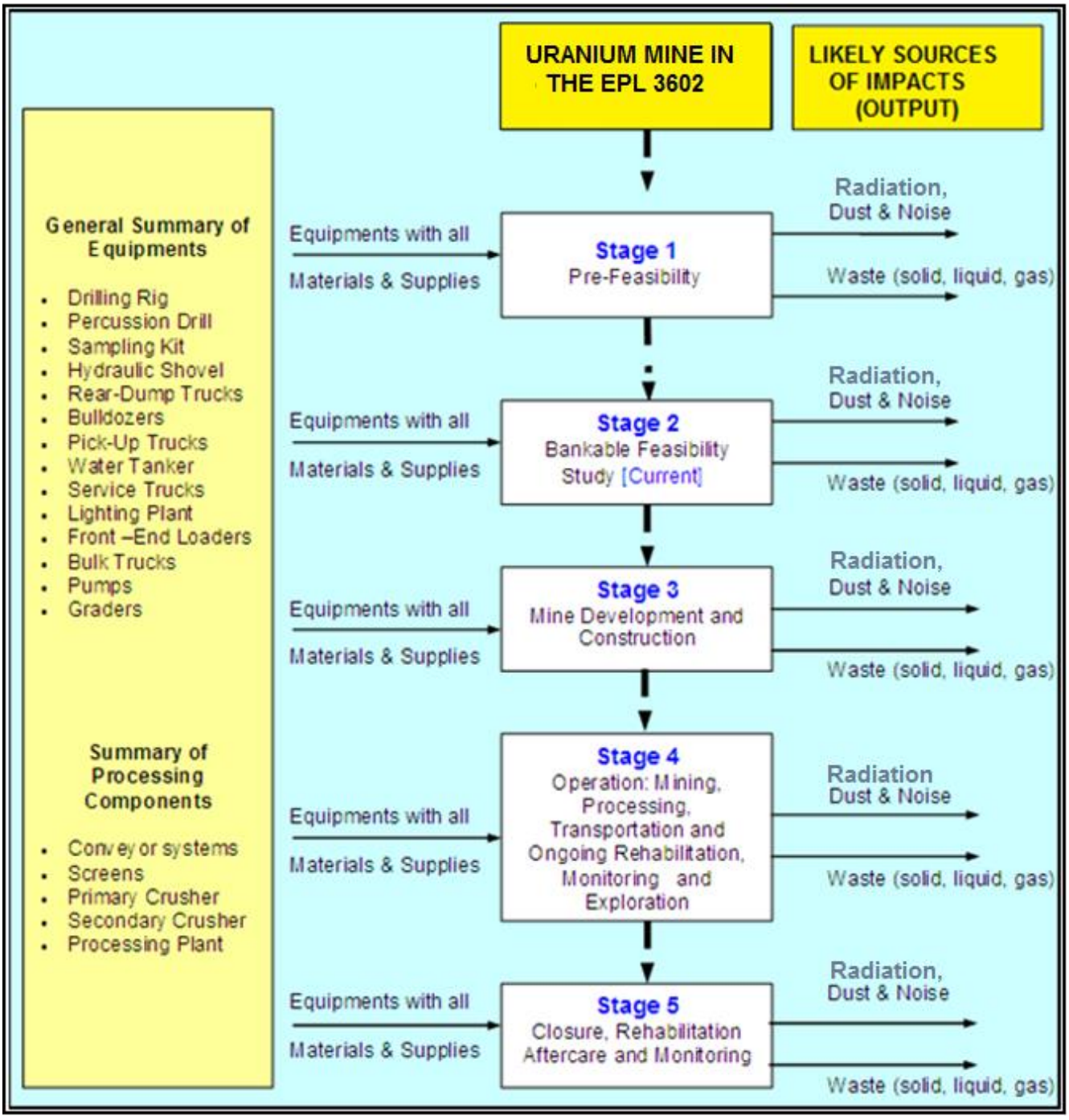


Figure 2.3: General outline of the type of equipment to be used in mining and mineral processing.

2.6.2 Uranium Processing

Heap Leaching will be used in the extraction of the uranium oxide. Mined and broken ore will be transported by conveyor system/ scoops / 150 tons trucks to the ore pass from which it moves by gravity into the crusher (Fig. 2.4). The uranium containing ore will be crushed and the coarsely crushed ore will be placed on a leaching pad with a liner. The leaching agent (alkaline or sulphuric acid) will be introduced on the top of the pile and will percolate down until it reaches the liner below the pile, where it is expected to be caught and pumped to a processing plant.

After completion of the leaching process, the leached ore will either be removed to a disposal site, and new ore will be placed on the leach pad. During leaching, the piles present a hazard because of release of dust, radon gas and leaching liquid. After completion of the leaching process, a long-term problem may result from naturally induced leaching, if the ore contains other minerals such as pyrite (FeS_2). Contact with water and air may cause continuous bacterially induced production of sulphuric acid inside the pile, which may result in the leaching of uranium and other contaminants for centuries and possibly permanent contamination of economic water resources that may be available if any.

Having increased the surface area of the rock by several orders of magnitude and having upgraded its uranium content, the release of uranium's decay products into the biosphere is likely to be accelerated and must be monitored and managed accordingly. From the heap leaching pad, the concentrate will undergo filtration, clarification ion exchange and solvent extraction processes (2.4). The production of yellow cake (precipitation) is followed by washing, calcining and final product packaging. The fine waste tailings from the processing plant and the coarse waste reject from the sorting will be sent to the tailings dump and waste rock dump respectively.

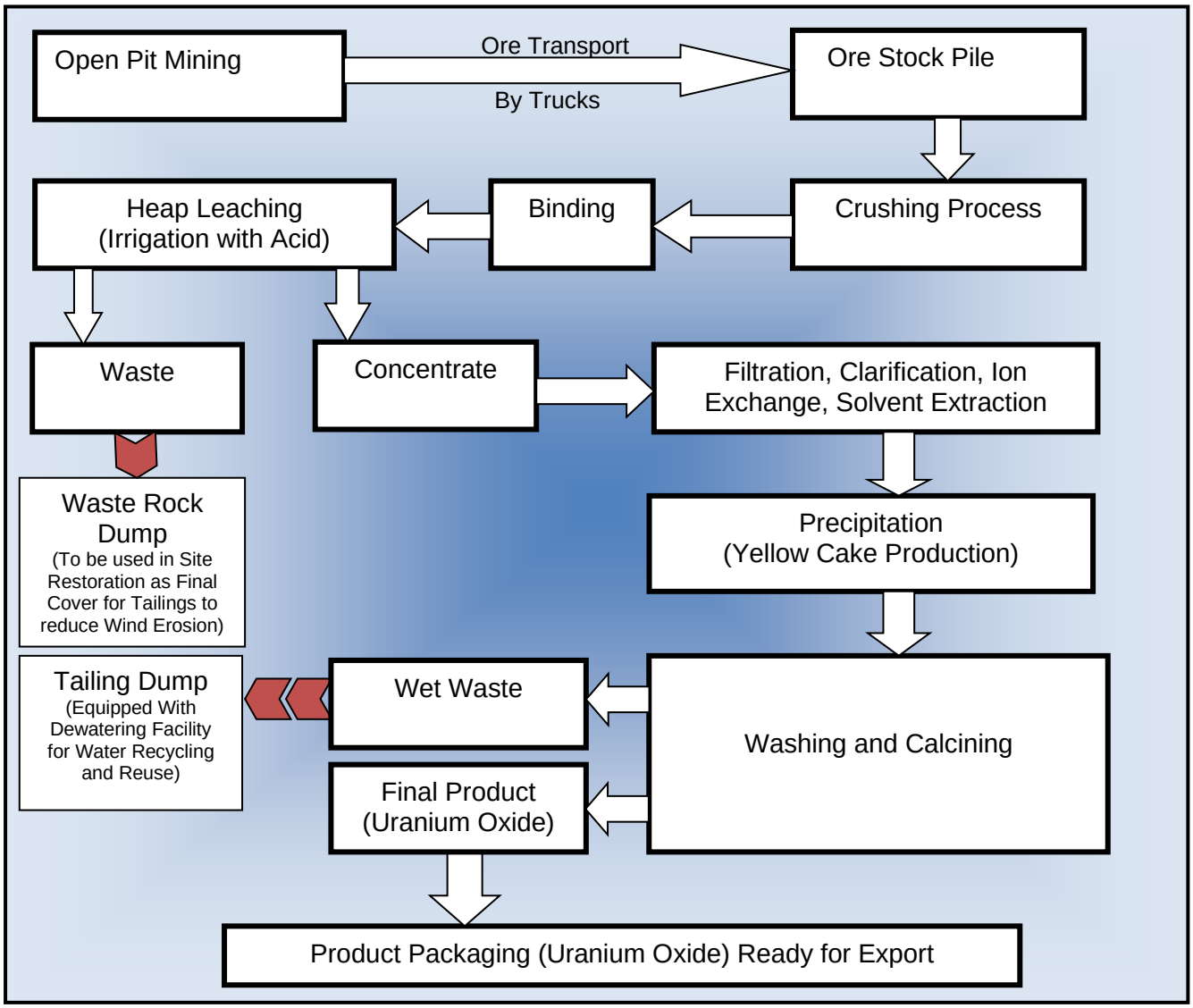


Figure 2.4: Generalised proposed uranium processing flowchart.

2.6.3 Storage and Shipping

The final product will be packed and sealed in steel drums, transported to Walvis Bay via road and exported for further processing and enrichment for use as a fuel in the nuclear fuel cycle.

2.7 Mine Operation and Ongoing Rehabilitation

2.7.1 Likely Effluent Sources

The likely higher levels of water pollution may occur when water is allowed to contact collected dusts or contaminated materials such as oils. Three most significant sources where this contact may occur are:

- The leaching process during mining operation, is important because it removes soluble alkaline and recovers solid insoluble portions for reuse, and discharges overflow (leachate) as waste.
- Disposal of entire wet dust slurry with no recovery or reuse (slurry is fed to a pond, solid settles and overflow is discharged).
- Aqueous effluents associated with the mining and processing equipment.

The other sources of pollution in the associated with overall process of mining are.

- Blow down from cooling mining equipment and processing (high in: TDS and TSS).
- Spent lube oil from mining garage and workshops if mixed with water will give oily wastewater.
- Domestic wastewater from mining and processing areas.
- The likely polluting parameters are TDS, TSS and heavy metals.

2.7.2 Likely Solid Waste Sources

Solid waste from mining and milling of uranium is by far the greatest component of nuclear fuel cycle Low Level Radioactive Waste (LLW). Two types of solid waste stream will be produced and these are:

- Waste rock from the crushing and sorting processes.
- Tailings from washing and calcining process.

The most significant wastes are tailings (finely crushed, solid residues from ore processing), liquid waste from the processing plant, and radon gas (Fig. 2.4). The major task in managing radioactive waste with respect to the proposed new uranium mining and milling is safe disposal of tailings, since they contain most of the radioactivity originally in the ore. Tailings are significant because of their volume, rather than their specific radioactivity, which is generally low. During the operational phase of proposed uranium mine in the ML No. 177, tailings will be minimised in order reduce the potential hazard from release of radioactive radon gas into the atmosphere. This will involve deposition of the tailings under wet conditions on the tailings dams where dewatering will take place (Fig. 2.4).

Waste rock will be used for ongoing rehabilitation as well as final rehabilitation work during the decommissioning stage as well as for maintenance during the aftercare stage. More importantly however, the waste rock will be used as final cover in the restoration of the tailings dam in order to minimise the likely long-term wind erosion and release of radon gas (Fig. 2.5). The Waste rock cover will also encourage vegetation growth by trapping moisture within the voids and minimising excessive evapotranspiration. While significant within the nuclear fuel cycle, the volume of tailings and waste rock is minor in comparison to waste from many other mining and industrial operations that produce materials

with the potential to harm health and the environment. These include waste from heavy metal mining with high acid or alkaline loads, fly ash from coal combustion and toxic industrial waste from urban centres.

Apart from actual mining related solid waste (waste rock and tailings), a variety of solid wastes substances will frequently be generated and will be associated with administration / office blocks as well as mining and processing activities. Sources of solid wastes will include rejected plastic and paper, sacks from packaging process and from the workshops and garage as well as sludge. Unless managed and stored in a shelter, and in a dry country like Namibia, wind can be a major pathway for pollutant migration to targets of concern that may be present in the area such as the Ephemeral Khan River. Furthermore, during the rainy season, rainfall may percolate through these piles, dissolve (or leach) soluble matter and carry them with the surface run-off water. In some instances, polluted water can migrate through permeable sub-surface layers beneath the material storage piles and contaminate water resources if present in the area.

2.7.3 Radiation Exposure and Occupational Health and Safety

All industrial activities, including uranium mining involve risks to human health and safety. The choice of industrial activity such as the proposed uranium mine and or technology or mixture of technologies will inevitably be a matter of balancing different costs and benefits. Operating safely and protecting the health of workers and the public are of high priority for every industry in Namibia and mining is not an exception. The following is summary of the likely occupational health and safety issues associated with the proposed new uranium mine in the ML No. 177:

- Radiation Exposure: The mining and processing of the low-grade uranium deposit will result in the exposure of workers to ionising radiation. A detailed evaluation of the background radiation associated with this project is presented in the EIA Report 2011. The main sources of gamma radiation are likely to result from exposed ore body and truck loads of ore, dust emanating from loads or roads in the pit and all other dust generating activities such as blasting, crushing, disposal of waste rock, dust from tailings, packaging of final product, as well as sealed radiation sources in instruments used for process control.

- Noise: Noise is likely to arise from test mining grinding, crushing, and packaging operations. Noise may reach as high as 100-110 dB, and.

- Heat Stress: Workers will be exposed to summer and equipment heat during mining stages.

2.7.4 Likely Air Emission Sources

The proposed project activities will be associated with localised gas emissions throughout the proposed project life cycle (preconstruction, construction, operation and ongoing rehabilitation, decommissioning and final closure and aftercare stages) and these will include:

- Radiation from mining to actual product packaging and transportation.

- Gas emissions such as radon from mining and processing activities.

- Particulate matter from mining, processing activities.

- Effluent sources from the mining, and processing activities as well as supporting infrastructure on the mine site.

- Solid waste from the various mining activities and field related logistics.

- Carbon dioxide emissions from combustion of fuels and mining processing in which chemical process maybe involved.

- ❖ Particulate matter (or dust) associated with mining activities of physically breaking of the rock mass, ore transportation, dust from ore stockpiles, vehicles and equipment movement, ore crushing and handling.

2.8 Decommissioning and Aftercare Stages

2.8.1 Decommissioning and Final Rehabilitation

The nature of rehabilitation of uranium mines varies with site and regulatory requirements. Under best practice management, tailings impoundments are covered with earth or rock to prevent dispersal and to reduce release of radon gas. Tailings management is site-specific and involves assessment of ground and surface water movement. Choice of disposal site is aimed at maximum tailings isolation. Alternative approaches will consider returning tailings to the mined out pits. The final tailing cover will have a graded layers coarsing upwards (Fig. 2.5). This means that coarse material will be placed on top in order to minimise the generation of radon gas and protect the fines below from wind and water erosion. Furthermore, the coarse grained material below will also help in retaining moisture for good vegetation growth over the tailings. The overall rehabilitation objectives for the proposed new uranium mine in the ML No. 177 include:

- ❖ Ecosystem viability.
- ❖ Radiological safety, and.
- ❖ Landform stability.
- ❖ Estimated rehabilitation and aftercare costs amended annually.

Once all the ore for the proposed new uranium mine has been mined out, Zhonghe Resource Namibia Development (Pty) Ltd will undertake a rehabilitation programme aimed at restoring the physical and ecological setup of the site before mining started. In accordance with current provisions of Section 99 (*Notice of cessation of mining operations*) of the Minerals Act, Act No. 33 of 1992, Zhonghe Resource Namibia Development (Pty) Ltd will inform the Ministry of Mines and Energy (MME) of the intention to cease operation. On acceptance by the MME of the notice to cease mining, Zhonghe Resource Namibia Development (Pty) Ltd will undertake an Environmental Assessment (EA) to review / adapt the existing EMP with respect to rehabilitation. The following is summary of the process that will be undertaken as part of the rehabilitation including Environmental Assessment:

(i) Set closure objectives through consultative process.

(ii) Predict long term impacts using acceptable techniques.

(iii) Develop and implement rehabilitation process in accordance with the provisions of Sections 128 (*Removal of Property*) and 130 (*Environmental liability during the course of the operation*) of the Minerals Act, Act No. 33 of 1992.

(iv) Once the rehabilitation has been completed, Zhonghe Resource Namibia Development (Pty) Ltd will inform MME for inspection and approval of the rehabilitation work that has been undertake.

As a regulatory requirement there is a mandatory need for financial provisions for environmental management during operation, closure, rehabilitation and aftercare stages. Costs for the ongoing environmental management and monitoring from the preconstruction to the operational stage must be provided for in the recurrent annual operational budget.

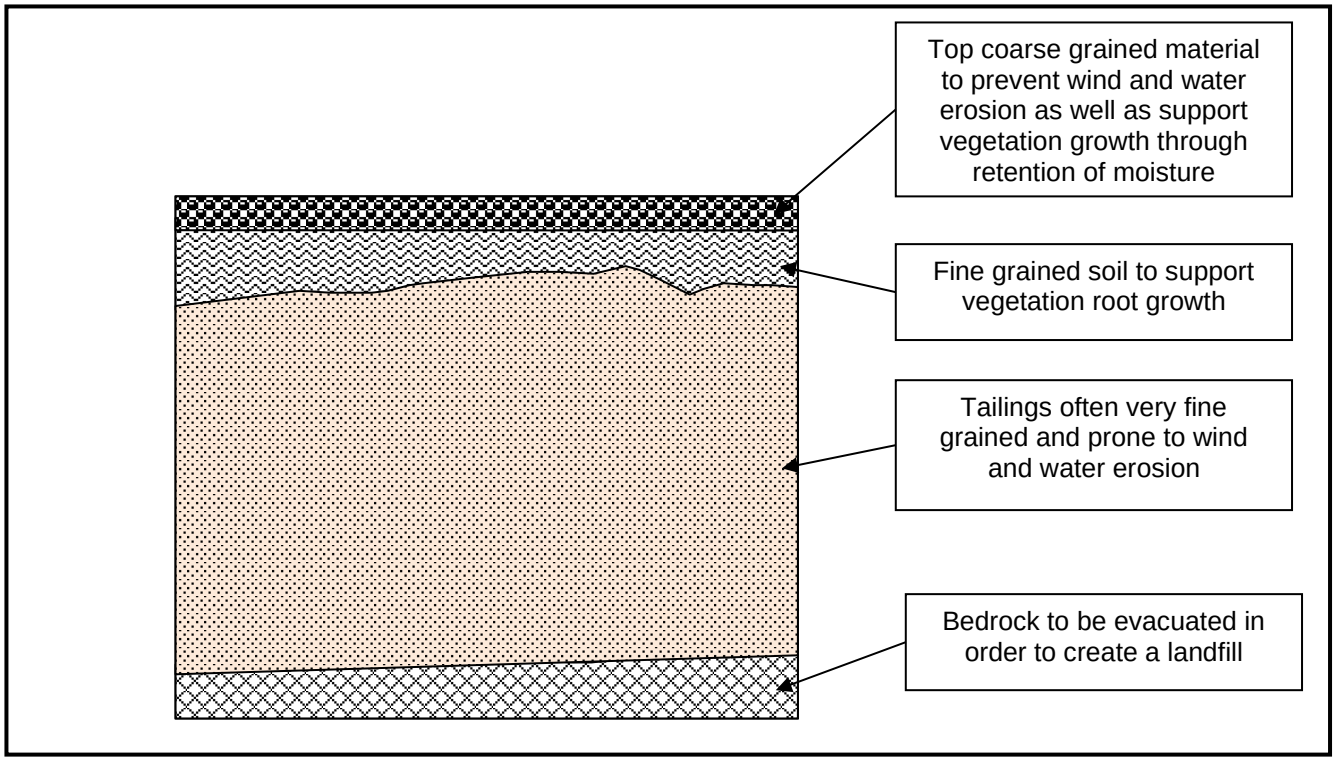


Figure 2.5: Section view through the proposed tailing damp showing the top graded cover layer that will prevent water and wind erosion over time.

2.8.2 Aftercare and Ongoing Rehabilitation / Maintenance

The overall focus of the aftercare stage must be for the management of long-term environmental liabilities of which upon closure of the operating company must be transferrable to a technically sound entity together with the accumulated financial resources for the aftercare stage.

New future regulations associated with the Environmental Management Act, 2007, (Act. No. 7 of 2007) and the current Mining Bill, will require that all mining companies must have a solid independently managed financial instrument for mine closure and aftercare environmental liabilities. Such financial instruments may include bond, insurance or any independently managed vehicle acceptable to the Government.

Although ongoing rehabilitation of the mined areas will be implemented as the mining progresses, there is a need to develop a full rehabilitation and aftercare plan that will take into consideration the project variations and risks. ***Please note that such plan will need to be developed before the implementation of the mining activities and is not part of current Environmental Assessment Process and was not covered in the assessment conducted in 2011***.

3. IMPACT ASSESSMENT

3.1 Overview

A detailed impact assessment was conducted by the Proponent in 2011 and EIA Vol. 2 of 3 Report together with all the specialist reports is available from the client. However, prior to the actual implementation of the project, a detailed review of all the reports will need to be undertaken to align them to the final project design, layout, and operational plan.

3.2 Impact Assessment Results

3.2.1 Project Developmental Activities and Alternatives

Proposed project development activities and alternatives considered for this project and explained in detail under Section 2.2 are:

- Uranium Resources.
- Mining and Processing Infrastructure
- Production Rate.
- Mining Method.
- Mineral Processing Techniques
- Road Access to the ML No. 177
- Rail.
- Energy
- Fuel.
- Water.
- Construction.
- Services, and.
- Job.

3.2.2 Impact Assessment Methodology

The overall impact assessment methodology adapted for this report in line with the ToR. The overall matrix framework used for this project is the Leopold matrix which is one of the internationally best-known matrix methodologies available for predicting the impact of a project on the receiving environment. The Leopold matrix is a two-dimensional matrix cross-referencing the following:

- The activities linked to the project that are supposed to have an impact on man and the environment, and.
- The existing environmental and socioeconomic conditions that could possibly be affected by the project.

The activities linked to the proposed mine development are listed on one axis, while the environmental and socioeconomic conditions are listed on the other axis, and divided in following three (3) major groups:

- Physical conditions: receiving environment, air, etc..
- Biological conditions: fauna, flora, ecosystems etc., and.
- Social and cultural conditions: Socioeconomic setting, historical and cultural issues, populations, economy…

The activities of the proposed mine development have the potential to affect the environment in many ways. The first step in the impact identification has been to identify the various types of activities associated with the proposed mine development, together with their associated emissions and land discharges where appropriate. At a high level, the main sources of impact of the proposed mine development are:

- Physical disturbance to the local environment.
- Emissions, discharges and wastes, and.
- Accidental events.

Accidental events are clearly not a part of the intended activity and their potential occurrence has a low probability of occurrence associated with it. Such impacts have therefor been treated differently.

3.3 Summary of the Key

3.3.1 Climatic Components

Climatic components have a direct linkage to the air quality. The main aim of the air quality assessment of the likely impact of the project activities within and around the project activities area on the air quality is to determine the likely contaminant sources (HAPs), possible pathways and targets as well as to maximise mitigation measures. Within the general area and surround environments and based on the regional climatic data it is likely that a significant proportion of windblown dust will be generated during the operations.

This is likely to occur when the threshold wind speed of 4.5 m/s is exceeded. The threshold wind speed is dependent on the erosion potential of the exposed surface, which is expressed in terms of availability of erodible material per unit area. Any factor that binds the erodible material will significantly reduce the availability of erodible material on the surface, thus reducing the erosion potential of the surface.

- Precipitation variations, wind patterns (direction and speed).
- Evaporation patterns and transpiration influences.
- Runoff and infiltration patterns.
- Other.

Overall, the proposed project activities will have significant impact on the air quality and particularly around the mining and processing plant. However, in terms of production or contribution to the overall negative air quality impacts at local, regional, national, and global levels will be range from high to negligible respectively (Table 3.1).

Table 3.1: Overall assessment of the climatic influences and air quality impacts.

Description	The influence of the proposed development on the air quality at local, regional, national and global levels will be high, low and negligible respectively. Locally, the overall contribution of the vehicles and machinery to overall emission levels around the local area will be high. However, during windy events dust will be a major problem in all areas with fine material exposed such as tailings, gravels roads as well as silty and fine sandy areas without any vegetation cover.
Extent	The extent of impact be localised and will be as follows: • More than 10 km = 1 (v. low) • 10 km – 5 km = 1 (v. low) • 5 km – 1 km = 1 (v. high) • Less than 1 km = 2 (high) (OHS or windy events but Temporal).
Duration	The duration of the likely impacts will be temporal but may be cumulative to other ongoing activities overtime.
Intensity	The level of impacts on the surrounding environment including the associated infrastructure would be affected minimally. This would include very little contribution to dust, noise and other associated disturbances in the area.
Mitigation	Application of Cleaner Production (CP) and Pollution Prevention (P2) and the adoption of Cleaner Technologies right from the beginning including covered containers, and maintenance of structures and equipments as well as the use of filters on all critical material transfer points and the use protective clothing will reduce the impact to medium. Erection of wind barriers in key critical areas as well as the use of vegetation screen and upward coarse graded covers on the fine tailings will important.
Frequency of occurrence	Climatic pattern and in particular wind speed and direction as well as operational and management practices will influence the frequency of occurrence during the construction and operational phases.
Probability	Overall probability of influence is as follows: • More than 10 km = 1 (v. low = 0.3) • 10 km – 5 km = 1 (v. low = 0.3) • 5 km – 1 km = 1 (v. low = 0.3) • Less than 1 km = 4 (high) (Occupational Health and Safety - OHS and windy events = 0.6 but temporal).
Significance	Before or without mitigation: **Medium to High** and After mitigation: **Very Low to Low**
Status of the impact	Negative-Localise and mainly OHS and windy events influences on the air quality that may lead to health impacts but will be temporal and localised.
Legal requirements	Namibia does not have air quality standard but South African standard could be adopted as part of the best practices and air quality monitoring
Degree of confidence in predictions	90% because the planned activities during construction and operational phases are clear and will be undertaken in an environmentally friendly manner.

3.3.2 Habitats, Biodiversity and Archaeological Resources

3.3.2.1 Overview

The Mining License (ML) area comprises varying landscape with the topographic higher areas restricted to the central part of the ML area. Overall, three types of habitats were delineated and these are:

- ❖ Topographically high covering the central mountainous area with very high and steep slopes in some places (>20º), limited loose surficial material cover (<0.2m) comprises bare rock heads, boulders, cobbles, gravels and limited or no sands and silts.

- ❖ Intermediate topographically high areas with slopes angles ranging between 10 – 20 degrees with adulating landscape in some places, loose to cemented surficial deposits in some areas. Marks the transition between very high and low topographically areas, and.

- ❖ Topographically low lying areas with slopes angles generally less than 10 degrees but very sharp scarps in some areas along the major ephemeral river channels such as the Khan River. Comprise, loose to cemented well-rounded and poorly sorted river / surficial deposits in some areas. Surficial materials characterized by cobbles, gravels, calcrete, sands and limited silts in heavily vegetated areas of the zone.

3.3.2.2 Flora

It is estimated that at least 20-45 species of larger trees and shrubs (>1m) (Coats Palgrave 1983, Curtis and Mannheimer 2005, Mannheimer and Curtis 2009 and Van Wyk and Van Wyk 1997) and at least 4-34 (approximately 50 species) grasses (Burke 2003a, Burke 2003b, Müller 1984, Müller 2007 and Van Oudshoorn 1999) occur in the general ML No. 177 area. If herbs and "lower" plants (e.g. algae, lichens, etc.) were to be included, this would undoubtedly increase the floral composition of the area tremendously – e.g. more than 100 lichen species are known from coastal Namibia. Although, the focus for the desktop study was limited to the bigger and thus more obvious species of trees, shrubs and grasses, the importance other species such as lichens is also acknowledged.

According to Mendelsohn *et al.* (2002) the average plant production is extremely low, the overall plant diversity (all species) in the general Swakopmund area is low and estimated at below 50 species while the plant endemism is also viewed as "low to average" with between 2 to 15 endemics expected from the general area. Although the general area is well protected – e.g. Namib-Naukluft National Park – the ML area falls outside the formal protected area, but is protected by its relatively inaccessible location. However, development – mainly mining/prospecting – in the general area is a cause for concern by various stakeholders.

All development have potential negative environmental consequences, but identifying the most important flora species including high risk habitats beforehand, coupled with environmentally acceptable mitigating factors, lessens the overall impact of such development.

3.3.2.3 Fauna

It is estimated that at least 56 reptile, 5 amphibian, 31 mammal and 124 bird species (breeding residents) are known to or expected to occur in the general/immediate area of the ML of which a large proportion are endemics. Endemics include at least 55% of the reptiles, 40% of the amphibians, 19% of the mammals and 50% (7 of the 14 Namibian endemics) of all the breeding and/or resident birds known and/or expected to occur in the general area. Although these endemics are known to occur from the general area, it is currently not clear if any of these are associated with the development area(s) or how exactly they will be affected by the development of the new uranium mine.

The very high percentage of unique and/or endemic species (55%) underscores the importance of the general area for reptiles. Most species – e.g. *Afroedura africana africana* and *Pedioplanis husabensis* – are understudied and their importance to the general ecology not well understood. Species most likely to be adversely affected by the proposed mining development would be the variety of reptiles, small mammals and birds specifically associated with this area.

As all development have potential negative environmental consequences, identifying the most important faunal species including high risk habitats beforehand, coupled with environmentally acceptable mitigating factors, lessens the overall impact of such development.

3.3.2.4 Reptiles

The high percentage of endemic reptile species (55.4%) known and/or expected to occur in the general Swakopmund area underscores the importance of this area for reptiles. Geckos, with 14 of the 16 species expected to occur in the general area being endemic, are the group of reptiles viewed as most important. The reptile species of greatest concern and expected to occur in the general area, are probably the endemic *Afroedura africana africana* (African Flat Gecko), *Pedioplanis husabensis* (Husab Sand Lizard), *Leptotyphlops occidentalis* (Western Thread Snake) and *Lycophidion namibianum* (Namibian Wolf Snake).

3.3.2.5 Amphibians

Of the 5 species of amphibians expected to occur in the general Swakopmund area, 40% (2 species) are of conservation value – i.e. *Poyntonophrynus* (*Bufo*) *hoeschi* and *Phrynomantis annectens*. However, with the exception of the few fountains and temporary pools after rains, the general area is marginal for amphibians. Amphibians are not well represented in the dry western parts of Namibia and their presence in the Khan River and associated tributaries, which potentially could serve as habitat in the general area, is currently unknown.

3.3.2.6 Mammals

Of the 31 species of mammals expected to occur in the general Swakopomund area, 9 species (19%) are endemic and 10 species (32.3%) are classified under international conservation legislation. The most important species expected to occur in the general area of the ML are the Namibian Wing-gland Bat (*Cistugo seabrai*), Namib Long-eared Bat (*Laephotis namibensis*), Littledale's Whistling Rat (*Protomys littledalei namibensis*) and the Brown Hyena *Parahyaena* (*Hyaena*) *brunnea*. Mammals, especially small mammals (rodents and bats) are viewed as the most contentious in the development areas due to the limited knowledge of their actual habitat preferences and uses as well as their actual utilisation of the greater area. The two bats – Namibian Wing-gland Bat and Namib Long-eared Bat – as well as the subspecies of the Littledale's Whistling Rat known and/or expected from the general area are viewed as the most important species, but their actual presence in the development area is currently unknown.

3.3.2.7 Birds

The high proportion of endemics – 7 of the 14 endemics to Namibia (i.e. 50% of all endemics) – expected to occur in the general Swakopmund area underscore the importance of this area. Furthermore 19% are classified as southern African endemics (or 6.5% of all the birds expected) and 81% are classified as southern African near-endemics (or 27.4% of all the birds expected). The most important species expected to occur in the general area are *Ammomanopsis grayi* (Gray's Lark), *Namibornis herero* (Herero Chat) and *Eupodotis rueppellii* (Rüppell's Korhaan). Endemic birds are well represented in the general area (50% of all Namibian endemics) which also includes a high proportion of southern African endemics (6.5%) and near-endemics (27%). The most problematic species are those associated with gravel plains such as the Rüppell's Korhaan and Gray's Lark as well as the Herero Chat which are known to breed in the general area although to what extent they occur in the development area is currently unknown.

3.3.2.8 Archaeology

The most significant archaeological sites are located in the escarpment zone overlooking the Khan River. The zone covers the following habitats:

- Topographically high covering the central mountainous area with very high and steep slopes in some places (>20º), limited loose surficial material cover (<0.2m) comprises bare rock heads, boulders, cobbles, gravels and limited or no sands and silts, and.

- ❖ Intermediate topographically high areas with slopes angles ranging between 10 – 20 degrees with adulating landscape in some places, loose to cemented surficial deposits in some areas. Marks the transition between very high and low topographically areas, and.

Table 3.2: Overall assessment with respect to faunal destruction.

Description	Faunal destruction will vary depending on the scale/intensity of the development operation and associated and inevitable infrastructure. Full scale mining operations will result in intense habitat and associated faunal destruction.
Extent	Localised disruption/destruction of the habitat and thus consequently fauna associated directly with this habitat and the actual development sites. Depending on the various Pits to be mined, this however, would be relatively small areas with localised implications. Further developments and road construction throughout the area would however increase the extent.
Duration	The duration of the impact is expected to be permanent over most of the development sites once established. Most species (e.g. various birds and smaller mammals) are expected to re-colonise the area after completion of the development(s) – i.e. duration viewed as short to medium term – while other species are not expected to return (e.g. various secretive carnivores) – i.e. duration viewed as long term. Depending on the various Pits to be mined, this however, would be relatively small areas with localised implications.
Intensity	The actual development sites would be permanently altered with the intensity of faunal loss depending on the species involved – e.g. slow moving and sedentary species will succumb to development while the more mobile species will vacate the area. This however, would be relatively small areas with localised implications. The areas adjacent the development sites should not be significantly affected. This, however, would depend on control over the contractors during the initial phase(s), but should be limited to localised implications. Areas not directly affected by the development, although within the immediate vicinity, would be affected minimally. This would include dust, noise and other associated disturbances in the area.The effect that the eventual mining activities may have on the fauna is difficult to determine beforehand although increased disturbance associated with increased activities are expected. This would however be limited to the actual mining & processing sites.
Mitigation	**1.** Avoid development and associated infrastructure in sensitive areas – e.g. Khan River riparian vegetation and other ephemeral drainage lines, etc. This would minimise the negative effect on the local environment especially unique features serving as habitat to various species. **2.** Implement and maintain track discipline with maximum speed limits (e.g. 30km/h) as this would result in fewer faunal road mortalities and associated dust pollution problems. Temporary speed humps could also be used to limit the speed at which people travel. **3.** Avoid offroad driving and unnecessary nocturnal driving in the area as this result in the destruction of slow moving fauna – e.g. various reptiles and other nocturnal species. **4.** Prevent and discourage the setting of snares (poaching), illegal collecting of veld foods (e.g. tortoises, etc.), indiscriminate killing of perceived dangerous species (e.g. snakes, etc.) and the collection of wood as this would diminish and negatively affect the local fauna – especially during the initial phase(s).

Table 3.2: *Cont.*

	5. Initiate a suitable and appropriate refuse removal policy as littering could result in certain animals becoming accustomed to humans and associated activity and result in typical problem animal scenarios – e.g. baboon, jackal, etc. **6.** Attempt to avoid the removal of bigger trees (especially protected species – e.g. *Acacia erioloba*, etc. [See Table 6 & Forestry Ordinance No. 37 of 1952) – during the construction phase(s) – including the development of new access routes – as these serve as habitat for a myriad of fauna. **7.** Maintain "green spaces and corridors" – e.g. along the Khan River and associated ephemeral drainage lines – to ensure the natural movement of fauna and to create a "natural" ambiance throughout. **8.** Prevent and discourage fires – especially during the construction phase(s) – as this could easily cause runaway veld fires (especially as the area currently has a good grass biomass due to the exception rainfall recently experienced) affecting the local fauna, and also cause problems (e.g. loss of grazing and domestic stock mortalities, etc.) for the neighbouring farms and Namib-Naukluft Park. **9.** Rehabilitation of the disturbed areas – i.e. initial development access route "scars" and associated tracks, as well as temporary accommodation sites. Preferably workers should be transported in/out to the construction sites on a daily basis to avoid excess damage to the local environment (e.g. fires, wood collection, poaching, etc.). Such rehabilitation would not only confirm the company's environmental integrity, but also show true local commitment to the environment. **10.** Implement erosion control. The area(s) towards and adjacent to the drainage line(s) are easily eroded and further development may exacerbate this problem. Avoid construction within 200m of the Khan River and main drainage line(s) to minimise erosion problems, as well as to preserve the associated riparian fauna. **11.** Prevent (do not allow) domestic pets – e.g. cats and dogs – accompanying the workers during the construction phase as well as future residents (e.g. security personnel, administration area, etc) as pets can cause considerable damage to the local fauna. Cats also interbreed and transmit diseases to the indigenous African Wildcat found in the area. The indiscriminate and wanton killing of the local fauna by such pets should be avoided at all cost. **12.** Initiate a policy of capture and removal of fauna encountered serendipitously within the construction areas. Such fauna should be removed to other areas of similar habitat in the area. **13.** Investigate the idea of employing a qualified ecologist/environmental manager to ensure the appropriate management of the wildlife and ecological processes. This would ensure proper management. **14.** Create an environmental education and awareness culture for all staff as this would sensitise staff and minimise problems over the long term.
Frequency of occurrence	Expected to be "once off" and only affecting the selected site(s).
Probability	Definite (100%) negative impact on fauna is expected in the various development areas as well as the access route construction sites including the future (i.e. planned) developments. Highly Probable (75%) negative impact on fauna is expected in the general areas especially during the construction phase(s) as a result of noise, increased activities, etc. Probable (50%) negative impact on fauna is expected from the infrastructure (roads/tracks). Precautionary principle (e.g. avoid unique habitat features as well as adhering to the proposed mitigating measures would minimise this) would decrease the significance of these potential impacts.

Table 3.3: Overall assessment with respect to flora destruction.

Description	Floral destruction will vary depending on the scale/intensity of the development operation and associated and inevitable infrastructure. Full scale mining operations will result in intense habitat and associated floral destruction.
Extent	Localised disruption/destruction of the habitat and thus consequently fauna associated directly with this habitat and the actual development sites. Depending on the various Pits to be mined, this however, would be relatively small areas with localised implications. Further developments and road construction throughout the area would however increase the extent.
Duration	The duration of the impact is expected to be permanent over most of the development site(s) except the areas designated as “corridors” or “sensitive areas” once established. If the overall onsite landscaping/gardening, especially in the Administration. Processing Plant and Heap Leaching area, is to be indigenous of nature then some species would re-colonise (e.g. seeds of various species remain viable in soil for long periods). This however, would be a relatively small area with localised implications.
Intensity	The actual development sites would be permanently altered with the intensity of floral loss depending on the scale of site clearing for construction purposes. This however, would be relatively small areas with localised implications. The areas adjacent the development sites should not be significantly affected. This, however, would depend on control over the contractors during the initial phase(s) – e.g. fire wood collection, etc., but should be limited to localised implications. Areas not directly affected by the development, although within the immediate vicinity, would be affected minimally.
Mitigation	**1.** Avoid development and associated infrastructure in sensitive areas – e.g. Khan River riparian vegetation and associated ephemeral drainage lines, etc. This would minimise the negative effect on the local environment especially unique features and trees/shrubs serving as habitat to various species. **2.** Identify (e.g. mark – red and white tape) protected and unique species (i.e. *Acacia erioloba*, etc. [See Table 6 & Forestry Ordinance No. 37 of 1952]) before the commencement of construction activities. The areas to be mined would however result in the total destruction of flora, but access routes & other associated infrastructure should avoid important flora hotspots. **3.** Prevent and discourage the collecting of firewood as dead wood has an important ecological role – especially during the development phase(s). Such collecting of firewood, especially for economic reasons, often leads to abuses – e.g. chopping down of live and/or protected tree species such as *Acacia erioloba* which is a good quality wood.

Table 3.3: *Cont.*

	4. Attempt to avoid the removal of bigger trees (especially the protected species – i.e. *Acacia erioloba*, etc. [See Table 6 & Forestry Ordinance No. 37 of 1952] during the development phase(s) – especially with the development of access routes and associated infrastructure – as these serve as habitat for a myriad of fauna. **5.** Attempt to avoid the removal of interesting and unique trees (especially restricted range species – i.e. *Adenia pechuelii*). **6.** Initiate a policy of replacing 2 indigenous tree species (preferably the same species) for each protected species having to be removed. An onsite nursery propagating indigenous species could be established to facilitate this. Indigenous species could also be sourced at Forestry nurseries in Okahandja & Grootfontein or the NBRI (National Botanical Research Institute, Windhoek) and nurseries in Windhoek & Swakopmund. **7.** Prevent and discourage fires – especially during the development phase(s) – as this could easily cause runaway veld fires (especially as the area currently has a good grass biomass due to exception rainfall recently experienced) affecting the local fauna, and also cause problems (e.g. loss of grazing and domestic stock mortalities, etc.) for the neighbouring farms and Namib-Naukluft Park. **8.** Implement erosion control. The area(s) towards and adjacent to the drainage line(s) are easily eroded and further development may exacerbate this problem. Avoid construction within 200m of the Khan River and main drainage line(s) to minimise erosion problems, as well as to preserve the associated riparian flora. **9.** Prevent the planting of potentially alien invasive plant species (e.g. *Opuntia* species, *Prosopis* species, *Tecoma stans*, *Pennisetum setaceum*, etc.) for ornamental purposes, especially at the Administration. Processing Plant and Heap Leaching area as part of the landscaping. Alien species often "escape" and become invasive causing further ecological damage. This is already evident in the Khan River and adding alien species could exacerbate the current problem. **10.** Implement a policy of "no tolerance" towards the existing invasive alien plant species (i.e. *Datura innoxia*, *Nicotiana glauca*, *Prosopis* sp., *Ricinus communis & Sesbania bispinosa*) in the area. This should include the removal and destruction of these species throughout the development areas. Such activity would be beneficial to the overall ecology of the Khan River basin. **11.** Incorporate indigenous vegetation (especially the protected species – i.e. *Acacia erioloba*, etc. – See Table 6) into the overall landscaping of the area. This would create a natural ambiance while indigenous species require less water and overall maintenance. This is especially important where offices and other administration sites are established. **12.** Rehabilitation of the disturbed areas – i.e. initial development access route "scars" and associated tracks, as well as temporary accommodation sites. Preferably workers should be transported in/out to the construction sites on a daily basis to avoid excess damage to the local environment (e.g. fires, wood collection, etc.). Such rehabilitation would not only confirm the company's environmental integrity, but also show true local commitment to the environment.

Table 3.3: *Cont.*

	13. Initiate a policy of removal of unique flora (e.g. *Adenia pechuelii*, *Aloe dichotema* & other Aloe species encountered, etc.) within the proposed construction areas. Such flora should be removed to other areas of similar habitat in the area or stored (cared for in onsite nursery conditions) and replanted as part of the overall natural landscaping. **14.** Investigate the idea of employing a qualified ecologist/environmental manager to ensure the appropriate management of the vegetation and ecological processes. This would ensure proper management.
Frequency of occurrence	Expected to be a "once off" issue affecting the selected site(s).
Probability	Definite (100%) negative impact on flora is expected in the actual development areas as well as the access route construction sites. This however, would be much localised and cover limited areas. Highly Probable (75%) negative impact on flora is expected from the infrastructure (roads/tracks). Precautionary principle (e.g. avoid unique habitat features as well as adhering to the proposed mitigating measures would minimise this) would decrease the significance of these potential impacts.
Significance	Before mitigation: **High** After mitigation: **Medium** to **Low**
Status of the impact	Negative Localised unique habitats (e.g. Khan River riparian vegetation and associated ephemeral drainage lines, etc.) would bear the brunt of this proposed development, but be limited in extent and only permanent at the actual development sites and access routes.
Legal requirements	Flora related: Forestry Ordinance No. 37 of 1952, Forest Act No. 72 of 1968, Nature Conservation Ordinance No. 4 of 1975, CITES
Degree of confidence in predictions	As an ecologist I am sure of the above mentioned predictions made and would suggest that the mitigation measures be implemented to minimise potentially negative aspects regarding the local flora in the area.

3.3.3 Health and Safety

Previous mining activities around has left some environmental health and safety impacts that includes open trenches, pit area, unstable tailings dump as well as scrap metals. The actual mining processes will leave additional permanent scars on the natural environment around the mining areas as well as the processing the central mine support infrastructure area.

All these health and safety challenges will affect the project development process as well as the day to survival of the local communities and fauna. Table 3.4 outlines a summary evaluation of likely impacts.

Table 3.4: Health and safety assessment and considerations guidance.

Description	Health and safety issues cover mainly the impacts of tailings, unfilled exploration trenches as well as unstable slopes in topographically very high mountainous areas (Zone 1). Intermediate adulating landscape (Zone 2) and Topographically low lying areas dominated by ephemeral river channels (Zone 3).
Extent	Would be a relatively limited and localised within the specific zones.
Duration	The duration of the impact is expected to be permanent in the actual areas likely to be affected.
Intensity	The actual site would be permanently altered. This however, would be a relatively limited to the actual zone where specific activities such as mining and mine infrastructure support will take place. The adjacent zones associated with the existing infrastructure would be affected moderately.
Mitigation	**2**. Develop and adapt an Environmental Management System for the entire the mining project taking into considerations health and safety issues during and after the mining and ongoing exploration project. **3.** Avoid placing dumping sites, overburden/storage sites and associated infrastructure in unstable areas of specific zones **4.** Adapt cleaner production principles that reduce the health and safety impacts of the proposed project.
Frequency of occurrence	Expected to be permanent from construction and operational phase and reduce minimal after closure and rehabilitation.
Probability	Probable (100%) negative impacts are expected on the actual mining areas (the open cast area) and about 50% chance for negative impacts within the infrastructure (roads/tracks/ site usage) mining support Zone 3. Less than 20% is likely to occur in Zone 1. Precautionary principle (e.g. adhering to the proposed mitigating measures would minimise and decrease the likely significance of these potential impacts.
Significance	Before mitigation: **High** After mitigation: **Medium to Low**
Status of the impact	Negative
Legal requirements	Minerals Act, Namibia Environmental Policy of 1995, Environmental Management Act 2007, The Labour Act, 2007 (Act No. 11 of 2007) and Atomic Energy and Radiation Protection Act 5 of 2005 (although covered separately in the RMP)
Degree of confidence in predictions	The specialist consultant is sure that the above-mentioned predictions proposed will minimise potentially negative aspects regarding the local habitats.

3.3.4 Socioeconomic

Social impacts of the mine development are likely to occur considering that the local communities in the area are very reserved to their cultural heritage. A clear understanding of these impacts may help communities understand and anticipate the effects of the mining project in the ML No. 177. One of the major possible conflict of the mine project may be unrealistic expectations about the development of a mine.

It is important for regional authorities and local communities to bear in mind that mine development takes sometime before full production and economic benefits can be realised. Table 3.5 summarises the overall assessment of the likely social economic impacts associated with the proposed project.

Table 3.5: Overall assessment of the likely social economic impacts.

Description	The influence of the proposed mine, metals processing plant as well as the infrastructure development required to support the proposed project on the local, regional and national social economic setting includes positive and negative impacts but the positive impacts outweigh the negative ones.	
Extent	• The positive impacts include local, regional and national impacts mainly in financial terms and benefits as well as support to the development potential tourism products for this area. • Negative social economic impacts includes erosion of family and community values, heritages and individual cohesiveness that currently exists.	
Duration	The duration of the likely impacts (positive and negative) will be permanent and will go beyond the duration of the proposed project activities.	
Intensity	The levels of positive social economic impacts are very high both at national and regional levels.	
Mitigation	• Positive – support to local community in areas such as provision of services and employment opportunities are encouraged. • Negative – respect and support to the promotion of local community cultures, family values and heritages	
Frequency of occurrence	Throughout the proposed project life cycle and beyond for both positive and negative impacts.	
Probability	The likelihood of positive and negative impacts accruing is high as long as the proposed project becomes a reality	
Significance	Before for the negative impacts mitigation: **High** After mitigation: **Low**	Before for the positive impacts mitigation: **High** After mitigation: **Very High**
Status of the impact	Positive and Negatives	
Legal requirements	Labour Act, 2007 (Act No. 11 of 2007), Vision 2030 and Regional Development Strategy for the Hardap Region as well as Poverty Alleviation of Strategies	
Degree of confidence in predictions	The specialist consultant is sure that the assessment and the recommended mitigation measures, once implemented will minimise the potentially negative impacts and maximise the positive ones.	

3.3.5 Ground Components

The ground components include the regional and local geology, geomorphology, surface water and groundwater assessments. Of all the ground components covered in this study, the water and scenic beauty are likely to be negatively impacted because of the proposed project. Table 3.6 summarizes the likely negative impacts of the proposed project on the ground components.

Table 3.6: Overall assessment of the impacts associated with the ground components.

Description	The influences and impacts of the proposed project activities on the ground components including geology, water and construction materials.
Extent	The extent of the likely negative impacts as a result of the proposed project activities on the ground components will be localised and in particular will affect the immediate ground components within the mining areas as well as around the central mine support infrastructure area.
Duration	The duration of the likely impacts will be permanent and beyond the duration of the proposed project.
Intensity	The level of impacts is likely to be high to moderate within the immediate environment and low in the surrounding areas.
Mitigation	1. Based on the land zonation provided for the mining area (Constraint and Opportunity DSTs Layers) the Operator must development effective management plan for the protection of sensitive zones. 2. All solid and liquid wastes generated because of the proposed project activities shall be reduced, reused, or recycled to the maximum extent practicable. Burial of waste on anywhere is not allowed and all waste must be disposed on approved waste disposal site to be developed as part of the mine plan. 3. No littering in the site area including access roads must be always clean. 4. Powder boxes, oil cans, and all other forms of litter must be removed. 5. Trash may not be burned or buried, except at approved sites under controlled conditions in accordance with the regulations. 6. Disposal of wastewater into any public stream including is prohibited. 7. All appropriate permits must be obtained before the implementation of the proposed mining project.
Frequency of occurrence	The likely impacts are likely to occur during the construction and operational phases
Probability	(0.5) Likely occur during the construction and operational phases
Significance	Before for the negative impacts mitigation: **High to Medium** and after mitigation **Medium to Low**
Status of the impact	Negative
Legal requirements	Minerals Act, Water Act Resources Management Act, 2004, Environmental Management Act 2007 and all related Energy Regulations
Degree of confidence in predictions	The geological and geotechnical specialist who undertook the study and contribution to the above assessment is sure of the recommendations with a confidence level of 80%.

3.4 Potential Radiation Impacts

3.4.1 Overview

Based on the assessment undertaken in the EIA (Vol. 2 of 3 of 2011) the proposed new uranium mine in the ML No. 177 indicates that the concentration of uranium varies but generally is about 0.03%. Despite the low ore grades deposit found in the area coupled with the low specific activity of uranium, radiation levels in most parts of the Mining License (ML) area are high are expected to be high throughout the proposed project lifecycle covering exploration, preconstruction, construction, operation, decommissioning, closure, final rehabilitation and aftercare stages. In particular, the proposed pit areas have higher background radiation than the world average of 2.4 millisievert (mSv) per year (Vol. 2 of 3 of 2011 Report). The proposed processing plant including the heap leaching, waste rock damp and tailings dam areas, once operational are also likely to be associated with higher radiation levels in addition to the current background radiation. Currently, background radiation of the proposed administration, plant and heap leaching are not that much higher but some areas are still higher than

the background levels in Swakopmund or Arandis, with terrestrial background radiation levels of between 0.2 and 0.8 mSv per year (Vol. 2 of 3 of 2011 Report).

The four main types of ionising radiation are alpha, beta, gamma and neutron radiations. The two main units used are the becquerel (Bq) for the amount of radioactive substance (radioactivity), and the sievert (Sv) for the dose of radiation received by a person. One sievert is a very large dose and doses in this report are generally in millisieverts (mSv): one thousandth of a sievert, and in some cases microsieverts (μSv): one millionth of a sievert. Radiation exposure can arise from sources outside the body (external exposure) or from radioactive material inside the body (internal exposure). Radioactive material can enter the body (exposure pathway) by inhalation or ingestion. Radiation exposure can be reduced in a number of ways. For external exposure, these include:

- ❖ Staying further from the source.
- ❖ Spending less time in the region of the source.
- ❖ Using radiation shields.

For internal exposure, the main method to reduce exposure is to reduce the intake of radioactive material, for instance, the amount of radioactive dust inhaled, or accidentally ingested via food or drink. This can be done by reducing the amount of dust generated, reducing the time spent in dusty areas, or by using respiratory protection, such as dust masks and respirators. To minimise the chance of ingestion washing hands and utensils prior to eating or drinking is effective. The health effects of radiation are well known. Very high doses from external radiation can cause radiation burns, radiation sickness or death within a short time (e.g. within a month). At lower doses, radiation exposure can result in an increased risk of developing cancer.

The proposed new uranium mine in the ML No. 177 will be associated with ionisation radiation. Ionising radiation is defined as radiation that has enough energy to ionise matter through which it passes. Ionisation is the process of adding or removing one or more electrons from a neutral atom. The resultant ion can be positively or negatively charged, and radiation that has enough energy to cause ionisation is called 'ionising radiation'. The health effects that arise from exposure to ionising radiation are understood to derive from ionisation taking place in living cells. Ionising radiation is of two types: subatomic particles and electromagnetic radiation.
The subatomic particles of interest for the proposed project are alpha particles, beta particles and neutrons:

(i) Alpha particles consist of two protons and two neutrons (i.e. the nucleus of a helium atom). Alpha particles are relatively heavy and slow moving, and, because they lose their energy very quickly, they have very short ranges — around 3 cm of air. They cannot penetrate a sheet of paper, and cannot, therefore, penetrate the outer dead layers of the skin.

(ii) Beta particles are high-energy electrons. They can be moderately penetrating, up to 1 m or so of air, or a few millimetres of aluminium, and a short distance into tissue.

(iii) Neutrons are high-energy neutrons can penetrate several centimetres in concrete.

(iv) Neutrons, unlike alpha and beta particles, can make objects that they irradiate radioactive. They, like gamma and X-rays, can pass right through the body.

Types of electromagnetic radiation include X-rays and gamma rays. X-rays and gamma rays arise from different physical phenomena. X-rays come from atomic processes while gamma-rays come from nuclear processes, but both are electromagnetic radiation and are indistinguishable in their effects. High energy X-rays and gamma-rays are strongly penetrating and may penetrate several centimetres of steel or pass right through the human body, hence their use in diagnostic and therapeutic radiology.

3.4.2 Quantities and Units Used for Radiation Measurement

The major quantities used in the measurement of radiation, the measurement of radioactivity and the measurement of radiation dose and its radiation effect are:

(i) The radioactivity is the 'amount' or quantity of a radioactive substance, measured by the rate at which it is undergoing radioactive decay. The unit is the becquerel (Bq). One becquerel is defined as one radioactive disintegration per second. The gray (Gy) is the unit of 'absorbed dose'. the amount of energy deposited in the form of ionisation in matter. It is equal to one joule of energy deposited per kg of matter. The gray is a purely physical measure of radiation. it takes no account of biological effects that the radiation might produce in living matter, and.

(ii) The radiation dose is the amount of radiation being absorbed by an object. The unit mostly used in this document is the sievert (Sv). It is strictly a measure of what is called the effective dose to a person. The sievert is a complex unit that allows for the energy deposited in the organs being irradiated, the radiosensitivity of the exposed organ and the radiological effectiveness of the radiation involved (alpha, beta and gamma).

3.4.3 Types of Radiation Exposure

There are two general ways in which a person can be exposed to radiation externally and internally.

3.4.3.1 External Exposure

External exposure comes from radiation sources outside the body, such as X-ray machines or from standing on ground contaminated by radioactive material. External exposure can only arise from radiation that has sufficient range and energy to penetrate any gap or shielding between the source of radiation and the person, and then pass through clothes and the outer dead layers of the skin. Hence, alpha particles cannot contribute to external dose, nor can low-energy beta particles. External exposure to people ceases as soon as the source is removed or they move away from the source, although where clothes or equipment are contaminated a person may take radioactive material with them.

External radiation is relatively easy to assess. Instruments such as a Geiger-Müller counter can measure the radiation level (dose rate) in an area. The total radiation dose a person has received can then be calculated from the time spent in that area. There are several dosemeters that can measure total external dose directly, the most common being the thermoluminescent dosemeter (TLD) used for personal dosimetry which replaced the traditional film badge.

3.4.3.2 Internal Exposure

Internal radiation exposure is the accumulation of radiation dose from radioactive materials within the body. Most commonly, this arises from such materials that have entered the body by inhalation, ingestion (swallowing), entry through a wound or injection. Other possible internal pathways are absorption of radioactive material through the skin, or via the contamination of wounds. All forms of radiation can produce internal exposure. It is considerably more difficult to assess internal exposure than external exposure.

The intake of radioactive material for example, by inhalation can be estimated from the radioactive content of the air being breathed, the breathing rate and the time spent in the area. However, in order to estimate the radiation dose arising from this intake, it is necessary to have information on such matters as the following:

(i) Particle size of the material (to determine where in the respiratory tract it will deposit).

(ii) The chemical form (to determine the rate at which it will be taken up by lung fluids), and.

(iii) Circulation in the body, retention in organs, radioactive half-life and excretion rate of the relevant radionuclides (biological half-life).

These values can be obtained from tables published by bodies such as the International Commission on Radiological Protection (ICRP), if sufficient is known about the materials inhaled or ingested. Internal exposure will continue until the radioactive material in the body has either decayed away radioactively or been excreted. Thus, exposure can continue for many years after an initial intake. In the method of estimating internal dose outlined above, allowance is made for this extended exposure. The entire radiation dose that will be accumulated in the years following an intake of radioactive materials is calculated, and this dose is recorded as having occurred in the year of the intake.

If doses are received in subsequent years, the same procedure is followed and the doses added. Direct assessment of internal radiation exposure can be made by Whole Body Monitoring where the subject is placed in a specially shielded unit containing sensitive radiation detectors, in order to measure the radiation emitted by the radioactive materials inside the body. This procedure is only suitable for gamma-emitting radionuclides and is very cumbersome and restricted in its availability.

3.5 Summary of the Likely Positive and Negative Impacts

3.5.1 Likely Positive Impacts

The following is the summary of the positive impacts that are likely to be associated with the proposed project new uranium mine throughout the project life cycle comprising the preconstruction, construction, operation and ongoing rehabilitation, decommissioning and final rehabilitation and aftercare stages at local (Mining License Area), regional (Erongo), national (Namibia) and Global / SADC levels:

- ❖ Contribute to efforts to reduce climate change.
- ❖ Improved environment regulatory measures.
- ❖ Support environmental protection and conservation.
- ❖ Awareness raising on environmental issues and uranium Industry in Namibia.
- ❖ Environmental education.
- ❖ Improved environmental management and planning.
- ❖ Promote research and development.
- ❖ Direct financial contributions.
- ❖ Improve Access to energy and energy security.
- ❖ Environmental funding and research.
- ❖ Direct and indirect employment opportunities.
- ❖ Local community funding.
- ❖ Income redistribution.
- ❖ Poverty alleviation.
- ❖ Improved standard of living.
- ❖ Alternative employment opportunities.

- ❖ Improved infrastructure development.
- ❖ Revaluation of culture and traditions.
- ❖ Civic involvement and pride to natural resources management.
- ❖ Strengthening communities, and.
- ❖ Force for promotion of peace and stability.

3.5.2 Likely Negative Impacts

The following is the summary of the positive impacts that are likely to be associated with the proposed project new uranium mine throughout the project life cycle comprising the preconstruction, construction, operation and ongoing rehabilitation, decommissioning and final rehabilitation and aftercare stages at local (Mining License Area), regional (Erongo), national (Namibia) and Global / SADC levels:

- ❖ Loss of biological diversity.
- ❖ Depletion of the ozone layer.
- ❖ Climate Change.
- ❖ Radiation safety.
- ❖ General impacts on fauna.
- ❖ General Impacts on Flora.
- ❖ Water resources.
- ❖ Local resources.
- ❖ Land degradation.
- ❖ Air pollution.
- ❖ Noise pollution.
- ❖ General solid waste and litter management.
- ❖ Hazardous Management.
- ❖ Mine waste rock and tailings.
- ❖ Sewage management.
- ❖ Minerals processing effluent.
- ❖ Aesthetic pollution.
- ❖ Physical impacts.
- ❖ Impacts on existing infrastructures and services.
- ❖ Alteration of ecosystems.

- ❖ Trampling impacts on vegetation.
- ❖ Trampling impacts on soil and landscape.
- ❖ Visual impact.
- ❖ Cultural deterioration.
- ❖ Conflicts with current and future land uses.
- ❖ Resource use conflicts.
- ❖ Crime generation.
- ❖ Poor labour practices.
- ❖ Prostitution.
- ❖ Spread of HIV and Aids.
- ❖ Job level friction.
- ❖ Economic inequality.
- ❖ Other socioeconomic areas.

3.6 Overall Impact Assessment Results

3.6.1 Key Sources of Negative Impacts

The results of the overall impacts and key issues associated with the proposed activities / sources (mining, exploration and supporting infrastructure activities) of potential impacts with respect to the receiving environment that could potentially be affected, resulting in key issues are presented in Table 3.7.

3.6.2 Overall Impact Assessment Results

To determine the likely environmental impacts as well as the overall significant impact of individual sources associated with the proposed mine development (Table 3.7), an impact identification and assessment process was undertaken based on the EIA and EMP conducted by the Proponent in 2012. The results of the overall impacts and key issues associated with the proposed activities / sources of potential impacts with respect to the receiving environment that could potentially be affected, resulting in key issues are presented in Table 3.8.

The EIA significant impact identification and assessment processes focused on the environment interaction approach with respect to the proposed project activities, the pathways and the likely targets or receptor. In this process, components of the project activities that are likely to impact the natural environment (physical, biological and social) were broken down into individual development stages and activities.

3.6.3 Overall Significant Impact Assessment Results

The results of the overall significant impacts assessment associated with the proposed activities / sources of potential impacts with respect to the receiving environment that could potentially be affected, resulting in key issues are presented in Tables 3.9. The summary of key potential environmental concerns expected during site preparation are outlined in Table 3.10 while those associated with the proposed mine operations, closure and aftercare stages are outlined in Table 3.11.

Table 3.7: Outline of proposed project developmental stages and all the associated activities as sources of potential environmental impacts.

PROJECT DEVELOPMENT PHASE	ACTIVITIES	
PRECONSTRUCTION	1. General site clearing of the mining area, administration block, waste rock, tailings, supporting infrastructure (water and electricity etc.)	
	2. Access roads clearing	
	3. Top soil removal and storage	
	4. Development of the temporary construction camp	
	5. Installation of campsites, offices, workshops, storage facilities.	
CONSTRUCTION	MINE SUPPORTING INFRASTRUCTURE	1. Transportation facilities, including access roads to the site and on-site roads
		2. Production plant and ore handling infrastructure including foundation and the entire structures
		3. Tailing disposal facilities
		4. Waste rock stockpiles
		5. Water supply systems
		6. Power infrastructure, including power distribution systems
		7. Administration blocks and warehouses
		8. Fuel supply and storage
		9. Workshop and equipment maintenance facilities
		10. Explosives storage facility / bunker
		11. Wastewater treatment systems
		12. Solid waste disposal
		13. Storm water management around the plant, waste rock and tailings
		14. Testing the ore handling and processing facilities
	OPEN PIT MINE WORKINGS	1. Excavation to create direct access to the ore body
		2. Blasting to create direct access to the ore body
		3. Mine infrastructure such slopes, benches and as pit access
		4. Ore production for test mining operations
		5. Test mining
OPERATION	1. Mining operations (actual mining operations including drilling, blasting etc.)	
	2. Material processing plant (crushers and milling)	
	3. Disposal of waste rock materials	
	4. Disposal of tailings materials	
	5. Expansion of the tailing dump facility	
	6. Expansion of the waste rock facility	
	7. Management of industrial and domestic waste water	
	8. Storage and management of hazardous materials	
	9. Storage and management of recovered uranium concentrate	
	10. Ongoing exploration support delineating additional resources	
CLOSURE AND AFTERCARE	1. Closure and rehabilitation of operations	
	2. Closure of solid waste piles	
	3. Backfill waste dump sites	
	4. Closure of storage sites	
	5. Closure of water and electricity sources	
	6. Overall land reclamation	
	7. Restoration of internal roads	
	8. Revegetation as may be required	

Table 3.8: Matrix impact assessment results of the proposed mining project.

SCALE		DESCRIPTION
0		no observable effect
1		low effect
2		tolerable effect
3		medium high effect
4		high effect
5		very high effect (devastation)

SOURCES OF POTENTIAL IMPACT	PROJECT DEVELOPMENT PHASE		ACTIVITIES	RECEPTORS / TARGETS THAT MAY BE IMPACTED: PHYSICAL AND SOCIOECONOMIC ENVIRONMENT – Natural Environment – Air, Noise, Water, Green Space	PHYSICAL AND SOCIOECONOMIC ENVIRONMENT – Built Environment – Houses, Roads, Transport Systems, Buildings, Infrastructure	PHYSICAL AND SOCIOECONOMIC ENVIRONMENT – Socioeconomic, Archaeological and Cultural Resources	BIOLOGICAL ENVIRONMENT – Flora	BIOLOGICAL ENVIRONMENT – Fauna	BIOLOGICAL ENVIRONMENT – Habitat	BIOLOGICAL ENVIRONMENT – Ecosystem - Services, function, use values and non-use
	PRE-CONSTRUCTION		1. General site clearing of the mining area, administration block, waste rock, tailings, water and electricity other supporting infrastructure	3 (-)	1 (-)	3 (-)	3 (-)	3 (-)	3 (-)	3 (-)
			2. Access roads clearing / upgrading	3 (-)	1 (-)	3 (-)	3 (-)	3 (-)	3 (-)	3 (-)
			3. Top soil removal and storage for all operations	3 (-)	1 (-)	1 (-)	3 (-)	3 (-)	3 (-)	3 (-)
			4. Development of the temporary construction camp	3 (-)	1 (-)	1 (-)	2(-)	2(-)	2(-)	2(-)
			5. Installation of campsites, offices, workshops, storage.	3 (-)	1 (-)	1 (-)	2(-)	2(-)	2(-)	2(-)
	CONSTRUCTION	MINE SUPPORTING INFRASTRUCTURE	1. Transportation facilities, including access roads to the site and on-site roads	3 (-)	1 (-)	1 (-)	3 (-)	3 (-)	3 (-)	3 (-)
			2. Processing plant infrastructure including foundation and the entire structures	3 (-)	1 (-)	1 (-)	2(-)	2(-)	2(-)	2(-)
			3. New tailing disposal facilities	3 (-)	1 (-)	1 (-)	3 (-)	3 (-)	3 (-)	3 (-)
			4. New waste rock stockpiles	3 (-)	1 (-)	1 (-)	3 (-)	3 (-)	3 (-)	3 (-)
			5. Water supply systems	3 (-)	1 (-)	1 (-)	3 (-)	3 (-)	3 (-)	3 (-)
			6. Powerline and local power infrastructure, including power distribution systems	3 (-)	1 (-)	1 (-)	3 (-)	3 (-)	3 (-)	3 (-)
			7. Administration blocks and warehouses	3 (-)	1 (-)	1 (-)	2(-)	2(-)	2(-)	2(-)
			8. Fuel supply and storage facilities	3 (-)	1 (-)	1 (-)	2(-)	2(-)	2(-)	2(-)
			9. Workshop and equipment maintenance	3 (-)	1 (-)	1 (-)	2(-)	2(-)	2(-)	2(-)
			10. Chemicals and explosives storage facility	3 (-)	1 (-)	1 (-)	2(-)	2(-)	2(-)	2(-)
			11. Wastewater treatment systems	3 (-)	1 (-)	1 (-)	2(-)	2(-)	2(-)	2(-)
			12. Solid waste storage / transfer facilities	3 (-)	1 (-)	1 (-)	2(-)	2(-)	2(-)	2(-)
			13. Storm water management around the plant, waste rock and tailings	3 (-)	1 (-)	1 (-)	2(-)	2(-)	2(-)	2(-)
			14. Mining and processing facilities	3 (-)	1 (-)	1 (-)	2(-)	2(-)	2(-)	2(-)
		OPEN PIT MINE WORKINGS	1. Excavation, drilling and blasting to create access to the ore body	3 (-)	1 (-)	1 (-)	3 (-)	3 (-)	3 (-)	3 (-)
			2. Excavation to access the ore body	3 (-)	1 (-)	1 (-)	3 (-)	3 (-)	3 (-)	3 (-)
			3. Ore production for test mining operations	3 (-)	1 (-)	1 (-)	2(-)	2(-)	2(-)	2(-)
			4. Mining process	3 (-)	1 (-)	1 (-)	2(-)	2(-)	2(-)	2(-)

Table 3.8: *Cont.*

SCALE	DESCRIPTION
0	no observable effect
1	low effect
2	tolerable effect
3	medium high effect
4	high effect
5	very high effect (devastation)

SOURCES OF POTENTIAL IMPACT	PROJECT DEVELOPMENT PHASE	ACTIVITIES	RECEPTORS / TARGETS THAT MAY BE IMPACTED: PHYSICAL AND SOCIOECONOMIC ENVIRONMENT: Natural Environment – Air, Noise, Water, Green Space	PHYSICAL AND SOCIOECONOMIC ENVIRONMENT: Built Environment – Houses, Roads, Transport Systems, Buildings, Infrastructure	PHYSICAL AND SOCIOECONOMIC ENVIRONMENT: Socioeconomic, Archaeological and Cultural Resources	BIOLOGICAL ENVIRONMENT: Flora	BIOLOGICAL ENVIRONMENT: Fauna	BIOLOGICAL ENVIRONMENT: Habitat	BIOLOGICAL ENVIRONMENT: Ecosystem - Services, function, use values and non-use
	OPERATION, ONGOING MONITORING AND REHABILITATION	1. Mining operations (actual mining operations including drilling, blasting etc.)	3(-)	0(-)	3(-)	1(-)	2(-)	1(-)	1(-)
		2. Transportation of the mined materials from mining area to the processing plant (crushers and milling)	3(-)	1(-)	1(-)	1(-)	2(-)	1(-)	1(-)
		3. Minerals (Uranium) processing crushing and milling	3(-)	1(-)	3(-)	1(-)	2(-)	1(-)	1(-)
		4. Transportation and disposal of waste rock materials	3(-)	0(-)	0(-)	1(-)	2(-)	1(-)	1(-)
		5. Transportation and disposal of tailings materials	3(-)	0(-)	0(-)	1(-)	2(-)	1(-)	1(-)
		6. Expansion of the tailing	2(-)	0(-)	0(-)	1(-)	2(-)	1(-)	1(-)
		7. Expansion of the waste rock	2(-)	0(-)	0(-)	1(-)	2(-)	1(-)	1(-)
		8. Management of industrial and domestic waste water	1(-)	0(-)	0(-)	1(-)	2(-)	1(-)	1(-)
		9. Storage and management of hazardous materials	1(-)	0(-)	0(-)	1(-)	2(-)	1(-)	1(-)
		10. Storage and management of recovered minerals concentrates (Uranium) at the production plant	1(-)	0(-)	0(-)	1(-)	2(-)	1(-)	1(-)
		11. Ongoing exploration support	1(-)	0(-)	0(-)	1(-)	2(-)	1(-)	1(-)
	DECOMMISSIONING CLOSURE AND AFTERCARE	1. Implementation of sustainable socioeconomic plan	0(-)	0(-)	4 (+)	2(-)	2(-)	2(-)	2(-)
		2. Closure of mining area	3(-)	0(-)	3 (+)	2(-)	2(-)	2(-)	2(-)
		3. Closure of solid waste piles	3(-)	0(-)	3 (+)	2(-)	2(-)	2(-)	2(-)
		4. Backfill waste dump sites	3(-)	0(-)	3 (+)	2(-)	2(-)	2(-)	2(-)
		5. Closure of storage sites	2(-)	0(-)	3 (+)	2(-)	2(-)	2(-)	2(-)
		6. Decommissioning of water and electricity infrastructure	2(-)	0(-)	3 (+)	2(-)	2(-)	2(-)	2(-)
		7. Overall land reclamation	2(+)	0(-)	3 (+)	2(-)	2(-)	2(-)	2(-)
		8. Restoration of internal roads	2(-)	0(-)	3 (+)	2(-)	2(-)	2(-)	2(-)
		9. Revegetation and aftercare as may be required	1(+)	0(-)	3 (+)	2(-)	2(-)	2(-)	2(-)

Table 3.9: Significant matrix impact assessment results of the proposed mining project.

IMPACT SEVERITY	IMPACT LIKELIHOOD: Extremely Unlikely [0]	Unlikely [1]	Low Likelihood [2]	Medium Likelihood [3]	High Likelihood [4]
Slight [A]	[A0]	[A1]	[A2]	[A3]	[A4]
Low [B]	[B0]	[B1]	[B2]	[B3]	[B4]
Medium [C]	[C0]	[C1]	[C2]	[C3]	[C4]
High [D]	[D0]	[D1]	[D2]	[D3]	[D4]

SOURCES OF POTENTIAL IMPACT	PROJECT DEVELOPMENT PHASE		ACTIVITIES	RECEPTORS / TARGETS THAT MAY BE IMPACTED: PHYSICAL AND SOCIOECONOMIC ENVIRONMENT: Natural Environment – Air, Noise, Water, Green Space	Built Environment – Houses, Roads, Transport Systems, Buildings, Infrastructure	Socioeconomic, Archaeological and Cultural Resources	BIOLOGICAL ENVIRONMENT: Flora	Fauna	Habitat	Ecosystem - Services, function, use values and non-use
	PRE-CONSTRUCTION		1. General site clearing of the mining area, administration block, waste rock, tailings, water, and electricity other supporting infrastructure	B4 (-)	A1(-)	D4 (+)	B3(-)	B3(-)	B3(-)	B3(-)
			2. Access roads clearing / upgrading	B4 (-)	A1(-)	D4 (+)	B3(-)	B3(-)	B3(-)	B3(-)
			3. Top soil removal and storage for all operations	B4 (-)	A1(-)	A1(-)	B3(-)	B3(-)	B3(-)	B3(-)
			4. Development of the temporary construction camp	B4 (-)	A1(-)	A1(-)	B2 (-)	B2 (-)	B2 (-)	B2 (-)
			5. Installation of campsites, offices, workshops, storage.	B4 (-)	A1(-)	A1(-)	B2 (-)	B2 (-)	B2 (-)	B2 (-)
	CONSTRUCTION	MINE SUPPORTING INFRASTRUCTURE	1. Transportation facilities, including access roads to the site and on-site roads	B4 (-)	A1(-)	A1(-)	B3(-)	B3(-)	B3(-)	B3(-)
			2. Processing plant infrastructure including foundation and the entire structures	B4 (-)	A1(-)	A1(-)	B3(-)	B3(-)	B3(-)	B3(-)
			3. New tailing disposal facilities	B4 (-)	A1(-)	A1(-)	B3(-)	B3(-)	B3(-)	B3(-)
			4. New waste rock stockpiles	B4 (-)	A1(-)	A1(-)	B3(-)	B3(-)	B3(-)	B3(-)
			5. Water supply systems	B4 (-)	A1(-)	A1(-)	B3(-)	B3(-)	B3(-)	B3(-)
			6. Powerline and local power infrastructure, including power distribution systems	B4 (-)	A1(-)	A1(-)	B4 (-)	B4 (-)	B4 (-)	B4 (-)
			7. Administration blocks and warehouses	B4 (-)	A1(-)	A1(-)	B2 (-)	B2 (-)	B2 (-)	B2 (-)
			8. Fuel supply and storage facilities	B4 (-)	A1(-)	A1(-)	B2 (-)	B2 (-)	B2 (-)	B2 (-)
			9. Workshop and equipment maintenance	B4 (-)	A1(-)	A1(-)	B2 (-)	B2 (-)	B2 (-)	B2 (-)
			10. Chemicals and explosives storage facility	B4 (-)	A1(-)	A1(-)	B2 (-)	B2 (-)	B2 (-)	B2 (-)
			11. Wastewater treatment systems	B4 (-)	A1(-)	A1(-)	B2 (-)	B2 (-)	B2 (-)	B2 (-)
			12. Solid waste storage / transfer facilities	B4 (-)	A1(-)	A1(-)	B2 (-)	B2 (-)	B2 (-)	B2 (-)
			13. Storm water management around the plant, waste rock and tailings	B4 (-)	A1(-)	A1(-)	B2 (-)	B2 (-)	B2 (-)	B2 (-)
			14. Test the mining and processing facilities	B4 (-)	A1	A1(-)	B2 (-)	B2 (-)	B2 (-)	B2 (-)
		OPEN PIT MINE WORKINGS	1. Excavation, drilling and blasting to create access to the ore body	B4 (-)	A1(-)	A1(-)	B3(-)	B3(-)	B3(-)	B3(-)
			2. Excavation to access the ore body	B4 (-)	A1(-)	A1(-)	B3(-)	B3(-)	B3(-)	B3(-)
			3. Ore production for test mining operations	B4 (-)	A1(-)	A1(-)	B3(-)	B3(-)	B3(-)	B3(-)
			4. Test mining process	B4 (-)	A1(-)	A1(-)	B3(-)	B3(-)	B3(-)	B3(-)
			5. Excavation, drilling and blasting to create access to the ore body	B4 (-)	A1(-)	A1(-)	B3(-)	B3(-)	B3(-)	B3(-)

Table 3.9: *Cont.*

IMPACT SEVERITY	IMPACT LIKELIHOOD				
	Extremely Unlikely [0]	Unlikely [1]	Low Likelihood [2]	Medium Likelihood [3]	High Likelihood [4]
Slight [A]	[A0]	[A1]	[A2]	[A3]	[A4]
Low [B]	[B0]	[B1]	[B2]	[B3]	[B4]
Medium [C]	[C0]	[C1]	[C2]	[C3]	[C4]
High [D]	[D0]	[D1]	[D2]	[D3]	[D4]

SOURCES OF POTENTIAL IMPACT	PROJECT DEVELOPMENT PHASE	ACTIVITIES	RECEPTORS / TARGETS THAT MAY BE IMPACTED						
			PHYSICAL AND SOCIOECONOMIC ENVIRONMENT			BIOLOGICAL ENVIRONMENT			
			Natural Environment – Air, Noise, Water, Green Space	Built Environment – Houses, Roads, Transport Systems, Buildings, Infrastructure	Socioeconomic, Archaeological and Cultural Resources	Flora	Fauna	Habitat	Ecosystem - Services, function, use values and non-use
	OPERATION, ONGOING MONITORING AND REHABILITATION	1. Mining operations (actual mining operations including drilling, blasting etc.)	C3(-)	A1(-)	D4 (+)	A1(-)	B4 (-)	A1(-)	A1(-)
		2. Transportation of the mined materials from mining area to the processing plant (crushers and milling)	C3(-)	A1(-)	A1(-)	A1(-)	B4 (-)	A1(-)	A1(-)
		3. Minerals (Uranium) processing crushing and milling	C3(-)	A1(-)	D4 (+)	A1(-)	B4 (-)	A1(-)	A1(-)
		4. Transportation and disposal of waste rock materials	C3(-)	A1(-)	A1(-)	A1(-)	B4 (-)	A1(-)	A1(-)
		5. Transportation and disposal of tailings materials	C3(-)	A1(-)	A1(-)	A1(-)	B4 (-)	A1(-)	A1(-)
		6. Expansion of the tailing	B2 (-)	A1(-)	A1(-)	A1(-)	B4 (-)	A1(-)	A1(-)
		7. Expansion of the waste rock	B2 (-)	A1(-)	A1(-)	A1(-)	B2 (-)	A1(-)	A1(-)
		8. Management of industrial and domestic waste water	A1(-)	A1(-)	A1(-)	A1(-)	B2 (-)	A1(-)	A1(-)
		9. Storage and management of hazardous materials	A1(-)	A1(-)	A1(-)	A1(-)	B2 (-)	A1(-)	A1(-)
		10. Storage and management of recovered minerals concentrates (Uranium) at the production plant	A1(-)	A1(-)	A1(-)	A1(-)	B2 (-)	A1(-)	A1(-)
		11. Ongoing exploration support	A1(-)	A1(-)	A1(-)	A1(-)	B2 (-)	A1(-)	A1(-)
	CLOSURE AND AFTERCARE	1. Implementation of sustainable socioeconomic plan	A1(-)	A1(-)	D4 (+)	B2 (-)	B2 (-)	B2 (-)	B2 (-)
		2. Closure of open mining areas and other excavated areas of the operations	C3(-)	A1(-)	B4 (-)	B2 (-)	B2 (-)	B2 (-)	B2 (-)
		3. Closure of solid waste piles	C3(-)	A1(-)	B4 (-)	B2 (-)	B2 (-)	B2 (-)	B2 (-)
		4. Backfill waste dump sites	C3(-)	A1(-)	B4 (-)	B2 (-)	B2 (-)	B2 (-)	B2 (-)
		5. Closure of storage sites	B4 (-)	A1(-)	B4 (-)	B2 (-)	B2 (-)	B2 (-)	B2 (-)
		6. Decommissioning of water and electricity infrastructure	B4 (-)	A1(-)	B4 (-)	B2 (-)	B2 (-)	B2 (-)	B2 (-)
		7. Overall land reclamation	B4 (-)	A1(-)	B4 (-)	B2 (-)	B2 (-)	B2 (-)	B2 (-)
		8. Restoration of internal roads	B4 (-)	A1(-)	B4 (-)	B2 (-)	B2 (-)	B2 (-)	B2 (-)
		9. Revegetation and aftercare as may be required	A1(-)	A1(-)	B4 (-)	B2 (-)	B2 (-)	B2 (-)	B2 (-)

Table 310: Summary of key potential environmental concerns during site preparation and the construction of mine infrastructures including test mining operations.

POTENTIAL SOURCES OF CONCERN	NATURE OF POTENTIAL CONCERN	ASSESSMENT	SIGNIFICANCE
Air Quality			
1. Operation and maintenance of vehicles and any on-site power generation facilities	(i) Potential releases of particulate matter, carbon monoxide, oxides of nitrogen, sulphur dioxide, and volatile organic compound	Negative Impacts	Localised
2. Fuel and chemical transportation, handling and storage	(ii) Potential releases of volatile organic compounds and other harmful substances		
3. Site preparation and construction activities	(iii) Potential releases of particulate matter		
Surface and Ground Water Vulnerability			
1. Operation and maintenance of vehicles and any on-site power generation facilities	• Potential releases of substances such as suspended solids, trace metals, oil, degreasers, and detergents and other harmful substances that could affect water quality and aquatic ecosystems	Negative Impacts	Localised
2. Fuel and chemical transportation, handling and storage	• In the event of spills, potential releases of petroleum products or chemicals that could affect surface waters or groundwater as well as aquatic ecosystems		
3. Site preparation and construction activities	• Potential release of sediments, increasing concentrations of total suspended solids in receiving waters		
4. Sewage and wastewater disposal	• Potential releases of nutrients and other contaminants		
5. Construction of site access roads and power lines	• Potential release of sediments along the routes, increasing total suspended solids in receiving waters • Potential for acidic drainage if sulphide-bearing minerals are exposed during construction • Stream crossings for access roads may affect ephemeral habitats and related ecosystems. • Increased road access in the area may lead to increased illegal hunting and poaching of wildlife, harvesting of firewood and grass as well as plant species.		

Table 3.10: *Cont.*

POTENTIAL SOURCES OF CONCERN	NATURE OF POTENTIAL CONCERN	ASSESSMENT	SIGNIFICANCE
Soil Quality and Terrestrial Ecosystems			
1. Fuel and chemical transportation, handling and storage	• In the event of spills, potential releases of petroleum products or chemicals that could affect soils, vegetation and wildlife	Negative Impacts	Localised
2. Operation of vehicles	• Vehicle operations may result in collisions with wildlife • Low altitude aircraft operations could disrupt wildlife		
3. Site preparation and construction activities	• Clearing of vegetation on site may have impacts on biodiversity, particularly if any rare, threatened or keystone species are present • Activities on site may disrupt and dislocate local wildlife and any migratory wildlife in the area • Some animals may be drawn to the site as a result of improper waste disposal or kitchen odours, which could lead to potential hazards for both workers and the animals		
4. Construction of site access roads and power lines	• Construction activities may disrupt and dislocate wildlife and any migratory wildlife in the area • Increased road access in remote areas may lead to increased hunting, stressing wildlife populations • Vehicle operations may result in collisions with wildlife		
Noise			
1. Noise from construction activities, including vehicle operations, drilling, and blasting	• Noise may affect local wildlife populations, and well as people living in communities near the exploration activity	Negative Impacts	Localised

Table 3.11: Summary of key potential environmental concerns during mine operations, closure, rehabilitation and aftercare stages.

POTENTIAL SOURCES OF CONCERN	NATURE OF POTENTIAL CONCERN	ASSESSMENT	SIGNIFICANCE
All others Impacts			
Land disturbance	Relatively large area	Negative Impacts	Localised
Waste rock disposal	Can require large area. involves trucking, runoff and leachate management, dusting and aesthetic considerations		
Tailings	Tailings volumes generally larger due to large volume of ore processed		
Radiation	May be associated with both mine, processing, tailings and waste rock areas		
Reclamation	Both mine and waste rock area can represent major concerns due to the extent of the waste rock and mining area		
Slope Instability / Rock falls	Open pit, tailings and rock waste slope stability and potential failures are major challenges		
Traffic and processing plant Noise	Traffic and mill can be a serious noise problem		
Vent Fan Noise	Not a concern		
Drilling and blasting effects	Noise and vibration can be a concern requiring careful management		
Dust	Can be a concern due to minerals processing operations, haulage roads and waste rock piles		
Mine water	Mine water volume influenced by precipitation, surface and groundwater ingress. Elevated ammonium levels from blasting can be a concern. High sediment loadings are common. Mine water may contain metals and may have a low pH. Or high levels of radioactivity		

4. THE EMP FRAMEWORK

4.1 Implementation of the EMP

An Environmental Management Plan (EMP) is one of the most important outputs of the environmental assessment process and is the synthesis of all the proposed mitigation and monitoring actions, set to a timeline and with specific assigned responsibilities. The aim of the EMP is to assist Zhonghe Resource (Namibia) Development (Pty) Ltd and their Contractors to ensure that the day-to-day operations are carried out in an environmentally responsible manner, thereby preventing or minimizing the negative effects and maximizing the positive effects of the project-related activities. The summary of the required organisational structure to fully implement the EMP is shown in Fig. 4.1. Provision has also been made, on an ongoing basis, for sufficient management sponsorship and human and financial resources.

The EMPs are presented as comprehensive matrices: for each **Activity/Process** and related **Aspects** (defined by the International Organization for Standardization ISO 14001:2004 as *element of an organization's activities or products or services that can interact with the environment*. environment is defined as *surroundings in which an organization operates, including air, water, land, natural resources, flora, fauna, humans, and their interrelation*) and **Impacts** (*any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's environmental aspects*), **Management Actions** required to address the impacts arising directly and indirectly from the various aspects of the proposed mine project, with **Responsible Persons** and **Timing** for each, are listed.

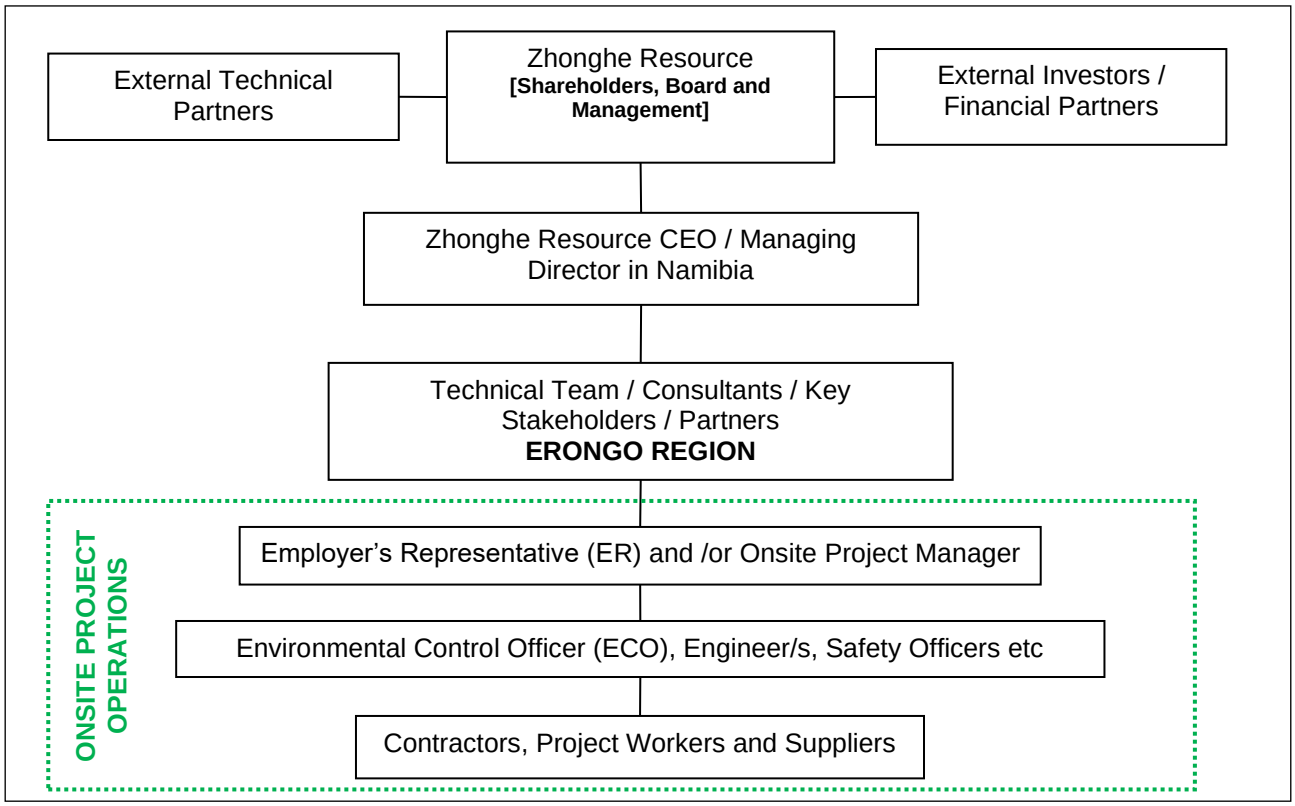


Figure 4.1: Zhonghe Resource (Namibia) Development (Pty) Ltd organisational structure for the proposed new uranium mine in the ML No. 177.

Management of the environmental elements that may be affected by the different activities of the proposed mine development and ongoing exploration are grouped together into climatic, environmental and ground components. The EMP also identifies the activity groups / environmental elements, the aspects / targets, the indicators, the schedule for implementation and who should be responsible for the management to prevent major impacts that the different mining and exploration activities and processes may have on the environment. Separate EMPs have been prepared for the project: an EMP for the preconstruction, including rehabilitation, of access road(s) to and from the proposed mine

development. and EMPs for the Construction, Operations and Decommissioning/Closure Phases of the proposed new uranium mine near Arandis, Erongo Region Namibia.

4.2 EMP Actions and Responsibilities

4.2.1 Overview

All the responsibilities to ensure that the recommendations are executed accordingly, rest with the **Zhonghe Resource (Namibia) Development (Pty) Ltd**. The company must provide all appropriate resource requirements for the implementation of the EMP. It is the responsibility of **Zhonghe Resource (Namibia) Development (Pty) Ltd** to make sure that all members of the workforce including contractors and subcontractors are aware of the EMP and its objectives. The following abbreviations are used to indicate who should be responsible for the implementation:

1. Project Developer (PD) / Project Operator (PO),
2. Project Manager (PM).
3. Project Engineer (PE).
4. Site Engineer (SE)
5. Project Geologist (PG).
6. Geological Technician (GT).
7. Team Leader (TL).
8. Contractor (CONT)
9. Subcontractor (SCONT).
10. Environmental Control Officer (ECO).
11. Environmental Coordinator (EC).
12. Environmental Social Government (ESG).
13. Erongo Regional Council (ERC).
14. Ministry of Environment, Forestry and Tourism (MET).
15. Ministry of Mines and Energy (MME).
16. Interested and Affected Parties (I&APs).

4.2.2 Proponent's Representative (PR) / Project Manager (PM)

The Proponent is to appoint a **Proponent's Representative (PR) / Project Manager (PM)** with overall project management responsibilities and EMP implementation, monitoring and reporting not limited to the following as may be applicable:

- Act as the site project manager and implementing agent.
- Ensure that the Proponent's responsibilities are executed in compliance with the relevant legislation.

- ❖ Ensure that all the necessary environmental authorisations and permits have been obtained.
- ❖ Assist the project team and contractor/s in finding environmentally responsible solutions to challenges that may arise.
- ❖ Should the PR believe a serious threat to, or impact on the environment may be caused by the ongoing activities, he/she may stop work. The Proponent shall be informed of the reasons for the stoppage as soon as possible.
- ❖ The ER or as may be contractually delegated, has the authority to institute disciplinary proceedings in accordance with the provisions of the national laws for transgressions of basic conduct rules and/or contravention of the EMP.
- ❖ Should the Contractor or his/her employees fail to show adequate consideration for the environmental aspects related to the EMP, the ER can have person(s) and/or equipment removed from the site or work suspended until the matter is remedied.
- ❖ Report to the Employer on the implementation of the EMP on site (with input from the HSE and Environmental Social Governance (ESG) / EMP Coordinators and/or independent environmental auditor).
- ❖ Maintain open and direct lines of communication between the Employer, ESG/ EMP Coordinators, Contractor, and stakeholders with regards to environmental matters, and.
- ❖ Attend regular site meetings and inspections.

4.2.3 Project Health, Safety and Environment (Project HSE)

The Proponent is to appoint a Project Health, Safety and Environment (Project HSE) with responsibilities not limited to the following as may be applicable and with respect to the EMP implementation, monitoring and reporting:

- ❖ Manage the site HSE day to day issues.
- ❖ Assist the PR and Contractor in finding environmentally responsible solutions to challenges that may arise.
- ❖ Conduct HSE site reviews.
- ❖ Carry out regular site inspections (on average once per week) of all exploration areas with regards to compliance with the EMP and document any non-compliance(s) and report to the PR as soon as possible.
- ❖ Support external HSE regulatory inspections / audits as may be required.
- ❖ Continuously review the site HSE requirements and recommend additions and/or changes to the EMP and other documents.
- ❖ Monitor the Contractor's HSE awareness training for all new personnel coming onto site.
- ❖ Keep records of all activities related to HSE control and monitoring. the latter to include a photographic record of the site preparation, construction, drilling operations / activities, rehabilitation process, and a register of all major incidents, and.
- ❖ Attend regular site meetings / debriefing and training.

4.2.4 Environmental Social Governance (ESG) / EMP Coordinator/s

The **Environmental Social Governance (ESG) / EMP Coordinator/s** shall have responsibilities not limited to the following as may be applicable and with respect to the EMP implementation, monitoring and reporting:

- ❖ Provide guidance on the implementation of the EMP and Environmental Social Governance (ESG) requirements.
- ❖ Coordinates, implement and monitor all the Corporate Social Responsibilities (CSRs) projects.
- ❖ Assist the project team in ensuring that the necessary environmental authorisations and permits are in place and valid.
- ❖ Assist the project team in finding environmentally responsible solutions to challenges that may arise.
- ❖ Conduct internal environmental review / monitoring as per EMP requirements.
- ❖ Oversee basic EMP conduct rules/ protocols and/or contraventions.
- ❖ Advise the PM / Proponent on the removal of person(s) and/or equipment not complying with the specifications of the EMP.
- ❖ Carry out regular site inspections / reviews (on average once per week) of all operations project areas with regards to compliance with the EMP provisions and report any non-compliance(s) to the PM as soon as possible.
- ❖ Support regulatory / inspections on the implementation of and compliance to the EMP.
- ❖ Organise and support regular independent environmental monitoring as may be required.
- ❖ Continuously review the EMP and recommend additions and/or changes to the EMP document as may be applicable.
- ❖ Monitor the Contractor's environmental awareness training for all new personnel coming onto site.
- ❖ Keep records of all activities related to environmental control and monitoring. the latter to include a photographic record of the construction and environmental control and rehabilitation process, and a register of all major incidents, and.
- ❖ Attend site and community/ stakeholders engagements or consultations meetings as may be required.

4.2.5 Contractors and Subcontractors

The responsibilities of the **Contractors and Subcontractors** that may be appointed by the Proponent to undertake certain field-based activities related to the project:

- ❖ Comply with the relevant legislation and the EMP provision.
- ❖ Preparation and submission to the Proponent through the Project HSE of the following Management Plans:
  - o Environmental awareness training and inductions.
  - o Emergency preparedness and response.

- Waste management, and.
- HSE.

- Ensure adequate environmental awareness training for senior site personnel.
- Environmental awareness presentations (inductions) to be given to all site personnel prior to work commencement. the Project HSE is to provide the course content and the following topics, at least but not limited to, should be covered:
  - The importance of complying with the EMP provisions.
  - Roles and responsibilities, including emergency preparedness.
  - Basic rules of conduct (Do's and Don'ts).
  - EMP: aspects, impacts and mitigation.
  - Disciplinary actions to be taken for failure to adhere to the EMP, and.
  - Health and safety requirements.
- Record keeping of all environmental awareness training and induction presentations, and.
- Attend regular site meetings and environmental inspections.

4.2.6 Construction Supporting Teams

The construction of mine, processing plant and supporting infrastructure will require an array of specialist teams working very closely with their suppliers and core Zhonghe Resource (Namibia) Development (Pty) Ltd Namibia onsite operations team. The following is a summary of some of the specialists that will be required during the construction phase as part of the team of contractors:

- Civil/Structural Contractors, Metallurgist, Mechanical and Crane Contractors, Electrical Contractors and each with their respective Sub-contractors and Suppliers, would report directly to the Employer's Representative (ER), acting as the onsite Project Manager.

4.3 Mitigation Measures

4.3.1 Preconstruction Mitigation Measures

This section contains the mitigation measures for the preconstruction stage of the proposed mining and ongoing exploration activities in the ML No. 177 including clearing of bush. The main activities potential sources of negative impacts of the preconstruction stage will be the site clearing, upgrading and/or construction, including rehabilitation, of access road(s) to and from the proposed mine development areas ML area. Tables 4.12-4.15 outline the key mitigation measures for the preconstruction stage of the proposed development to be implemented by the Proponent.

Table 4.12: Preconstruction mitigation measures with respect to mining and supporting infrastructure and development process.

Development Stage/ Activity	Source of impact	Impact	Mitigation	Responsible person (s)	Time-line
<u>Pre-construction of main mining infrastructure</u> • **Site preparation for open cast**	• Vehicles, Trucks, Earthmoving equipment	• Disturbance of flora and fauna • Habitat alteration	• Pre-construction and construction in the ML No. 177 area is limited to the demarcated zone for mining development, other areas will be regarded as “no go” zones in order to minimize impact on surrounding land. • Minimize the removal of native plant species. no vegetation may be removed/damaged without direct instruction. • No off-road driving will be allowed. already existing routes should be upgraded and used. • No animal may be injured, fed, trapped, hunted or harmed in any way.	Developer / Operator (Project Manager (PM), Project Engineers (PE), Site Engineers (SE) Environmental Control Officer (ECO), Environmental Coordinator (EC), Environmental Social Government (ESG), Team Leaders (TL), Contractors (CONT) and Subcontractors (SCONT)	All pre-construction phases
		• Pollution (fugitive dust) and waste	• Protective gear including masks must be worn during site preparation • Adequate rubbish disposal bins should be provided at construction site. • Proper disposal site should be developed in line with the environmental regulations		
		• Noise	• Nearby community should be alerted of pre-construction, construction and operational phases of the mine • Proper hearing gear should be used at all mining and ongoing processes.		

Table 4.13: Preconstruction mitigation measures with respect to the plant for process of uranium and tailing dam and disposal site.

Development Stage/ Activity	Source of impact	Impact	Mitigation	Responsible person	Time-line
Site preparation for construction of the plant, tailing dam and waste disposal site	• Vehicles, Trucks, Earthmoving equipment	• Disturbance of flora and fauna • Alteration of habitant	• Site preparation for construction of plant, tailing dam, and waste disposal site should be limited to the demarcated zone. • Minimize the removal of native plant species. no vegetation may be removed/damaged without direct instruction. • No off-road driving will be allowed. already existing routes should be used and upgraded. • No animal may be injured, fed, trapped, hunted or harmed in any way.	Developer / Operator (Project Manager (PM), Project Engineers (PE), Site Engineers (SE) Environmental Control Officer (ECO), Environmental Coordinator (EC), Environmental Social Government (ESG), Team Leaders (TL), Contractors (CONT) and Subcontractors (SCONT)	Pre-construction phase
		• Pollution (fugitive dust) and waste	• Protective gear including masks must be worn during site preparation • Adequate rubbish disposal bins should be provided at construction site. • Proper disposal site should be developed in line with the environmental regulations		
		• Noise	• Nearby community should be alerted of pre-construction, construction and operational phases of the mine • Proper hearing gear should be used at all mining and ongoing processes.		

Table 4.14: Preconstruction mitigation measures with respect to the infrastructure for the support services.

Development Stage/ Activity	Source of impact	Impact	Mitigation	Responsible person	Time-line
Support services and infrastructure (workshops and garage)	• Vehicles, Trucks, Earthmoving equipment	• Disturbance of flora and fauna • Alteration of habitant	• Site preparation for construction of workshop and garage should be limited to the demarcated zone. • Minimize the removal of native plant species. no vegetation may be removed/damaged without direct instruction. • No off-road driving will be allowed. already existing routes should be used and upgraded. • • No animal may be injured, fed, trapped, hunted or harmed in any way.	Developer / Operator (Project Manager (PM), Project Engineers (PE), Site Engineers (SE) Environmental Control Officer (ECO), Environmental Coordinator (EC), Environmental Social Government (ESG), Team Leaders (TL), Contractors (CONT) and Subcontractors (SCONT)	Pre-construction phase
		• Pollution (fugitive dust) and waste	• Protective gear including masks must be worn during site preparation • Adequate rubbish disposal bins should be provided at construction site. • Proper disposal site should be developed in line with the environmental regulations		
		• Noise	• Nearby community should be alerted of pre-construction, construction and operational phases of the mine • Proper hearing gear should be used at all mining and ongoing processes.		

Table 4.15: Preconstruction mitigation measures for ongoing exploration activities.

Development Stage/ Activity	Source of impact	Impact	Mitigation	Responsible person	Time-line
Site preparation for ongoing exploration (sampling and drilling)	• Vehicles, Trucks, Earthmoving Equipment	• Disturbance of flora and fauna • Alteration of habitant	• Site preparation for ongoing exploration/ sampling is limited to selected areas/ zones • Minimize the removal of native plant species. no vegetation may be removed/damaged without direct instruction. • No off-road driving will be allowed. already existing routes should be used and upgraded. Where necessary development of new routes should impose minimum impact to the environment • No animal may be injured, fed, trapped, hunted or harmed in any way.	Developer / Operator (Project Manager (PM), Project Engineers (PE), Site Engineers (SE) Environmental Control Officer (ECO), Environmental Coordinator (EC), Environmental Social Government (ESG), Team Leaders (TL), Contractors (CONT) and Subcontractors (SCONT))	Pre-construction phase
		• Pollution (fugitive dust) and waste	• Protective gear including masks must be worn during site preparation • Adequate rubbish disposal bins should be provided at construction site. • Proper disposal site should be developed in line with the environmental regulations		
		• Noise	• Nearby community should be alerted of exploration drilling that maybe of impact to the community. • Proper hearing gear should be used at all mining and ongoing processes.		

4.3.2 Construction Stage Mitigation Measures

The construction stage of the proposed new uranium mine will cover all the activities that must support major structures such as the crushers, mills, transformers, tailings, rock waste and the actual open pit development process to access the orebody.

The installation of such structures will first require the manufacture / building of the required structures such as the crushers, mill, foundation excavation, steel works and concrete casting. The mitigation measures detailed in this section makes provisions for management of a wider array of activities that will be associated with construction of various infrastructures associated with the mine, processing plant, and supporting infrastructure.

Tables 4.16- 4.18 outlines the mitigation measures for the construction stage of the proposed development.

Table 4.16: Construction mitigation measures with respect to the main and supporting mining infrastructures.

Development Stage	Source of Impact	Impact	Mitigation	Responsible person	Time-line
Construction of main and supporting mining infrastructures.	• Vehicles, Trucks, Earthmoving equipment	• Disturbance of fauna and flora and habitat alteration	• The Planning and design of the mining infrastructure should insure minimum impact to the environment	Developer / Operator (Project Manager (PM), Project Engineers (PE), Site Engineers (SE) Environmental Control Officer (ECO), Environmental Coordinator (EC), Environmental Social Government (ESG), Team Leaders (TL), Contractors (CONT) and Subcontractors (SCONT)	Construction of mine.
		• Noise	• Proper hearing protection gear should be worn, where required,		
		• Air quality (fugitive Dust), gas emissions	• Dust masks should be worn at all times • Use dust control/suppression methods, such as application of water or non-toxic chemicals to minimize dust (oil and oil by-products is not a recommended measure to control road dust). • Fuels such as Liquefied Petroleum Gas (LPG) should be used. LPG is non-toxic, non-corrosive, and free of tetra-ethyl lead or additives, it burns cleanly than petrol.		
		• Waste	• Proper waste management practices for both Hazardous and non hazardous waste should be enforced. No littering in the site area including access roads should be permitted. • Disposable bins or approved disposable site should be used. Trash may not be burned or buried unless approved in accordance with the regulations		

Table 4.16: *Cont*.

Development Stage	Source of Impact	Impact	Mitigation	Responsible person	Time-line
Construction of main and supporting mining infrastructures.		• Socioeconomic (Positive impacts with long lasting positive effects).	• No mitigation proposed	Developer / Operator (Project Manager (PM), Project Engineers (PE), Site Engineers (SE) Environmental Control Officer (ECO), Environmental Coordinator (EC), Environmental Social Government (ESG), Team Leaders (TL), Contractors (CONT) and Subcontractors (SCONT)	Construction of mine.
		• Increased traffic and movement of machinery	• To insure safety of traffic movement. trip schedule should be advised for all scheduled heavy duty vehicles, all drivers should be in possession of valid driver's licence, speed limits should be adhered to. • The use of traffic and safety warning signs and flag persons to warn and control traffic should be advised where required.		
		• Occupational Health and Safety	• An Emergency Preparedness and Response Plan is required. • All Namibian Health and Safety Regulations should be adhered to. • Occupational Health and Safety Training should be implemented • First Aid Kit should be available on site at all times		

Table 4.17: Construction mitigation measures with respect to the processing plant for uranium recovery, pit area, tailing dam, rock waste and waste disposal site.

Development Stage	Source of Impact	Impact	Mitigation	Responsible person	Time-line
Construction of processing plant / pit area, heap leaching areas and other supporting infrastructure	• Vehicles, Trucks, Earthmoving equipment	• Disturbance of fauna and flora and habitat alteration	• The Planning and design of the mining infrastructure should insure minimum impact to the environment	Developer / Operator (Project Manager (PM), Project Engineers (PE), Site Engineers (SE) Environmental Control Officer (ECO), Environmental Coordinator (EC), Environmental Social Government (ESG), Team Leaders (TL), Contractors (CONT) and Subcontractors (SCONT)	Construction of processing plant
		• Noise	• Proper hearing protection gear should be worn, where required,		Construction of processing plant
		• Air quality (fugitive Dust), gas emissions	• Dust masks should be worn at all times • Use dust control/suppression methods, such as application of water or non-toxic chemicals to minimize dust (oil and oil by-products is not a recommended measure to control road dust). • Fuels such as Liquefied Petroleum Gas (LPG) should be used. LPG is non-toxic, non-corrosive, and free of tetra-ethyl lead or additives, it burns cleanly than petrol.		Construction of processing plant
		• Waste	• Proper waste management practices for both Hazardous and non hazardous waste should be enforced. No littering in the site area including access roads should be permitted. • Disposable bins or approved disposable site should be used. Trash may not be burned or buried unless approved in accordance with the regulations		Construction of processing plant
		• Socioeconomic (Positive impacts with long lasting positive effects).	• No mitigation proposed		Construction of processing plant

Table 4.17: *Cont.*

Development Stage	Source of Impact	Impact	Mitigation	Responsible person	Time-line
Construction of processing plant / heap leaching area		• Increased traffic and movement of machinery	• To insure safety of traffic movement. trip schedule should be advised for all scheduled heavy duty vehicles, all drivers should be in possession of valid driver's licence, speed limits should be adhered to. • The use of traffic and safety warning signs and flag persons to warn and control traffic should be advised where required.	Developer / Operator (Project Manager (PM), Project Engineers (PE), Site Engineers (SE) Environmental Control Officer (ECO), Environmental Coordinator (EC), Environmental Social Government (ESG), Team Leaders (TL), Contractors (CONT) and Subcontractors (SCONT)	Construction of processing plant
		• Occupational Health and Safety	• An Emergency Preparedness and Response Plan is required. • All Namibian Health and Safety Regulations should be adhered to. • Occupational Health and Safety Training should be implemented • First Aid Kit should be available on site at all times		
Construction of tailing dam, rock waste and waste disposal site	• Vehicles, Trucks, Earthmoving equipment	**Note:** All the above stated impacts apply in to this development stage. • Tailing dam safety	• The design and construction of the tailing dam should insure minimum impact to the environment. • The design and planning of the tailing dam should include. - Site assessment - Hazard Assessment (rain, flood, soil erosion) - quality assurance for construction material used -Regular monitoring of the tailing dam stability		

Table 4.18: Construction mitigation measures with respect to the infrastructure development process.

Development Stage	Source of Impact	Impact	Mitigation	Responsible person	Timeline
Construction of support service and infrastructure	• Vehicles, Trucks, Earthmoving equipment	• Disturbance of fauna and flora and habitat alteration	• The Planning and design of the infrastructure should insure minimum impact to the environment • Construction is only limited to the demarcated zone	Developer / Operator (Project Manager (PM), Project Engineers (PE), Site Engineers (SE) Environmental Control Officer (ECO), Environmental Coordinator (EC), Environmental Social Government (ESG), Team Leaders (TL), Contractors (CONT) and Subcontractors (SCONT)	Construction of support services and infrastructure
		• Noise	• Proper hearing protection gear should be worn, where required,		
		• Air quality (fugitive Dust), gas emissions	• Dust masks should be worn at all times • Use dust control/suppression methods, such as application of water or non-toxic chemicals to minimize dust (oil and oil by-products is not a recommended measure to control road dust). • Fuels such as Liquefied Petroleum Gas (LPG) should be used. LPG is non-toxic, non-corrosive, and free of tetra-ethyl lead or additives, it burns cleanly than petrol.		
	• Vehicles, Trucks, Earthmoving equipment	• Waste	• Proper waste management practices for both Hazardous and non hazardous waste should be enforced. No littering in the site area including access roads should be permitted. • Disposable bins or approved disposable site should be used. Trash may not be burned or buried unless approved in accordance with the regulations		

Table 4.18: *Cont.*

Development Stage	Source of Impact	Impact	Mitigation	Responsible person	Timeline
<u>Construction of support service and infrastructure</u>	• Vehicles, Trucks, Earthmoving equipment	• Socioeconomic (Positive impacts with long lasting positive effects).	• No mitigation proposed	Developer / Operator (Project Manager (PM), Project Engineers (PE), Site Engineers (SE) Environmental Control Officer (ECO), Environmental Coordinator (EC), Environmental Social Government (ESG), Team Leaders (TL), Contractors (CONT) and Subcontractors (SCONT)	Construction of support services and infrastructure
	• Vehicles, Trucks, Earthmoving equipment	• Increased traffic and movement of machinery	• To insure safety of traffic movement. trip schedule should be advised for all scheduled heavy duty vehicles, all drivers should be in possession of valid driver's licence, speed limits should be adhered to. • The use of traffic and safety warning signs and flag persons to warn and control traffic should be advised where required.		
	• Vehicles, Trucks, Earthmoving equipment	• Occupational Health and Safety	• An Emergency Preparedness and Response Plan is required. • All Namibian Health and Safety Regulations should be adhered to. • Occupational Health and Safety Training should be implemented • First Aid Kit should be available on site at all times		

4.3.3 Operational Stage Mitigation Measures

Once the construction of the mine, processing plant and supporting infrastructure has been completed, only specialised and maintenance workforce will be required to run and maintain the mine, processing plant and supporting infrastructure as well as the ongoing exploration programme.

Zhonghe Resource (Namibia) Development (Pty) Ltd will be responsible for fulfilling the requirements in the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) for the operational stage of the proposed new uranium mine.

A Project / Site / Health Safety and Environmental (HSE) Manager / Engineer/ EMP Coordinator/ ESG Coordinator, Environmental Control Officer could be appointed by Zhonghe Resource (Namibia) Development (Pty) Ltd to oversee all the site operation as well as management of other site workforce.

Tables 4.19 – 4.22 outlines the mitigation measures for the operational stage of the proposed mine, processing plant and supporting infrastructure.

Table 4.19: Operational mitigation measures for mine operations (mining, loading, and transporting the mined ore to the plants).

Development Stage/ Activity	Source of impact	Impact	Mitigation	Responsible person	Time-line
Removal of soil, gravels, and loose rock overlaying the deposit	• Trucks, Earthmoving equipment	• Vegetation removal • Dust • Increased soil erosion	• The upper layer of soil contains dormant seeds for vegetation and is valuable for rehabilitation process. this layer must be stripped and stockpiled. • The stockpile must be surrounded by block to prevent possibility of wind erosion and dust. Devise monitoring for wind erosion on monthly basis. • Revegetate where necessary.	Developer / Operator (Project Manager (PM), Project Engineers (PE), Site Engineers (SE) Environmental Control Officer (ECO), Environmental Coordinator (EC), Environmental Social Government (ESG), Team Leaders (TL), Contractors (CONT) and Subcontractors (SCONT)	Lifecycle of mine
Trenching	• Earthmoving equipment • New Pits	• Land Scar • Danger to inhabitant fauna, livestock • Waste Rock	• Design for closure principles “Rehabilitation” • Ensure stabilisation of pit walls • Block access to the area • Waste rock and stockpiled soil should be separated for easy rehabilitation. • Refill pits with waste rock, and cover with the saved “stockpiled” top soil during ongoing rehabilitation process		

Table 4.19: *Cont*.

Development Stage/ Activity	**Source of impact**	**Impact**	**Mitigation**	**Responsible person**	**Time-line**
Drilling, excavation and pit opening	• Drilling machinery	• Noise and vibration (impact is dependent on proximity to settlements) • Land clearing for drill sites • Possible soil and water contamination by oil spills	• Drilling is to be scheduled only during day time operational hours of mining site and is limited to the demarcated zone for drilling only • Revegetate where necessary • Ensure good maintenance of machinery and regular checkups for oil spills.	Developer / Operator (Project Manager (PM), Project Engineers (PE), Site Engineers (SE) Environmental Control Officer (ECO), Environmental Coordinator (EC), Environmental Social Government (ESG), Team Leaders (TL), Contractors (CONT) and Subcontractors (SCONT)	• During drilling only. • Life cycle of the mine
Blasting of local country rocks	Blasting	• Noise • Blasting vibrations • Fugitive Dust	• Nearby settlement should be notified of scheduled blasting. • Careful examination of the area before blasting should be undertaken • Health and Safety procedure with regard to blasting and handling of explosives should be adopted		During blasting

Table 4.19: *Cont*.

Development Stage/ Activity	**Source of impact**	**Impact**	**Mitigation**	**Responsible person**	**Time-line**
Loading and transporting the blasted materials to primary and secondary crushing plant	Earthmoving equipment, Trucks	• Noise • Fugitive Dust • Road safety • Visual impact	• Proper hearing gear must be worn where needed • Dust masks should also be worn • Use dust control/suppression methods, such as application of water to suppress dust • Diving is only limited to the designated fixed routes, off road driving must be avoided • Headlights must be switched on at all times • All vehicles/ trucks moving in the mining zone should not exceed the speed of 40km/h • The use of fixed routes will reduce the visual impact and minimize the need for post-mining rehabilitation of the tracks	Developer / Operator (Project Manager (PM), Project Engineers (PE), Site Engineers (SE) Environmental Control Officer (ECO), Environmental Coordinator (EC), Environmental Social Government (ESG), Team Leaders (TL), Contractors (CONT) and Subcontractors (SCONT)	Life cycle of the mine
Crushing plant process (Primary and Secondary crushing systems)	• Crushing, mixing grinding, and final grinding	• Dust • Noise	• Induce dust suppression mechanisms (Control of dust guidance) and dust musk should be worn at all times. • Air assessment quality should be carried out throughout the lifespan of the mine, this is done to assess the likely influence of pollutants (e.g. dust, Sulphur dioxide and nitrogen oxides)from the proposed project activities • Proper hearing gear should be worn at all times.		Life cycle of mine

Table 4.20: Operational mitigation measures with respect to the plant for processing of uranium ore operations including leaching areas.

Development Stage/ Activity	Source of impact	Impact	Mitigation	Responsible person	Time-line
Ore (Uranium) processing plant operations including leaching areas as may be applicable	• Leaching area • Cooling down of equipment and processing (high in TDS and TSS) • Tailing Dam	• Contamination (Water Pollution) • Waste • Occupational Health and safety	• Measures should be developed to recycle leached solution and treatment of waste solution • Safety measures should insure proper handling and treatment of effluents. • Ensure treatment of processed water prior to damming or disposing • Treated processed water should be recycled where needed. • Design of tailing dam should insure possibility of revegetation or rehabilitation of land used. • Access to tailing dam must be restricted.	Developer / Operator (Project Manager (PM), Project Engineers (PE), Site Engineers (SE) Environmental Control Officer (ECO), Environmental Coordinator (EC), Environmental Social Government (ESG), Team Leaders (TL), Contractors (CONT) and Subcontractors (SCONT)	Life cycle of mine

Table 4.21: Operational mitigation measures for supporting infrastructure.

Development Stage/ Activity	Source of impact	Impact	Mitigation	Responsible person	Time-line
Support Service and infrastructure (Workshops and garage)	• Garage and workshop • Storage facilities. Fuel storage, chemical for treatment storage, scrap metal storage. • Generators	• Noise	• Proper hearing protection gear must be worn.	Developer / Operator (Project Manager (PM), Project Engineers (PE), Site Engineers (SE) Environmental Control Officer (ECO), Environmental Coordinator (EC), Environmental Social Government (ESG), Team Leaders (TL), Contractors (CONT) and Subcontractors (SCONT)	Lifecycle of mine
		• Pollution: Water pollution from rinse water contaminated with lube oil, wastewater (TDS and TSS).	• Any form of spillage of any toxic chemical should be reported and corrective measures undertaken • Measures should be undertaken to avoid potential spillage during transfer/ handling of fuels, oils and chemicals. This should be in compliance with environmental regulations • During occurrence of spillage, all spills should be cleaned up immediately together with the polluted soil and dispose off at recognized dumping site • Leak and spill control plans should be implemented to ensure the above is adhered to. • Diesel generators should be placed on concrete slab, the entire workshop should be lined by concrete • Fuel should be stored in underground or aboveground tanks • Weekly monitoring of workshop and garage is advisable		
		• Chemical leak and accidental oil and fuel spillages			
		• Waste scrap metal	• Specifications for storage of scrap metals should be developed. • Scrap metal should be removed from mine site on a regular basis and disposed off to approved disposal site, this should be done to avoid accumulation of large quantities on site • Devise measures to reuse scrap metals where possible		

Table 4.22: Operational mitigation measures for going exploration, mining, and environmental monitoring.

Development Stage/ Activity	Source of impact	Impact	Mitigation	Responsible person	Time-line
• On-going Exploration,	• Vehicle, Truck and earthmoving equipment • Sampling and Drilling	• Disturbance of flora and fauna, alteration of habitat	• The Planning and design of the ongoing exploration, mining infrastructure should insure minimum impact to the environment. • Exploration is limited to demarcated zone for such activity • Already established routes should be used and adhered to minimise impact	Developer / Operator (Project Manager (PM), Project Engineers (PE), Site Engineers (SE) Environmental Control Officer (ECO), Environmental Coordinator (EC), Environmental Social Government (ESG), Team Leaders (TL), Contractors (CONT) and Subcontractors (SCONT)	All ongoing exploration activities (lifecycle of the mine)
		• Surface and groundwater	• The design and planning of exploration and mining activities should ensure that, Ephemeral River channels and discontinuities are avoided with respect to highly polluting activities. These systems are good for groundwater water recharge		
		• Pollution (fugitive dust), gas emissions and waste	• Adoption of cleaner production, pollution prevention and cleaner technology will relatively reduce impacts. • Use dust control/suppression methods, such as application of water or non-toxic chemicals to minimize dust (oil and oil by-products is not a recommended measure to control road dust). • Fuels such as Liquefied Petroleum Gas (LPG) should be used. LPG is non-toxic, non-corrosive, and free of tetra-ethyl lead or additives, it burns cleanly than petrol.		

Table 4.22: *Cont.*

Development Stage/ Activity	Source of impact	Impact	Mitigation	Responsible person	Time-line
On-going Exploration		• Waste	• During ongoing exploration, proper waste management practices for both Hazardous and non hazardous waste should be enforced. No littering in the site area including access roads should be permitted. • A proper waste disposal site must be developed in line with the environmental regulations	Developer / Operator (Project Manager (PM), Project Engineers (PE), Site Engineers (SE) Environmental Control Officer (ECO), Environmental Coordinator (EC), Environmental Social Government (ESG), Team Leaders (TL), Contractors (CONT) and Subcontractors (SCONT)	All ongoing exploration activities (lifecycle of the mine)
		• Social economic	• No mitigation proposed, the likely impacts are more positive than negative, creating job possibility thorough exploration phases of the mine		
		• Occupational health and safety	• All required operational equipment must be secured for on-going exploration and mining. • An Emergency Preparedness and Response Plan is required. • Sensitive or dangerous areas should be clearly marked, avoided and with restricted entry • All Namibian Health and Safety Regulations should be adhered to during all mining and ongoing exploration phases. • Occupational Health and Safety Training should be implemented. • First Aid Kit should be available on site at all times. • Use of headlights when driving through gravel roads is advised		

4.3.4 Closure, Rehabilitation, Aftercare and Ongoing Monitoring Stage

4.3.4.1 Progressive and Final Mine Closure Plan

Large areas of land may be disturbed through ore extraction and other mining activities within the proposed Mining License (ML) area. Disturbed areas that are not stabilised can be susceptible to erosion caused by both wind and water. erosion can lead to problems with dust as well as water quality problems related to sedimentation. During the mine operations phase, it is important for the operator to start with ongoing landscape rehabilitation which may include the reshaping and restructuring of the landscape and erosion control measures to be provided for in the Mine Closure Plan. In addition to reshaping or recontouring, landscape restructuring activities can include the use of stockpiled soils to reconstruct soil structure in preparation for revegetation.

4.3.4.2 Final Mine Closure Plan Migratory Activities

The objectives of final mine closure to be provided for in the Closure Plan are to:

- Ensure public and wildlife safety and preventing inadvertent access to mine openings and other infrastructure.
- Provide for the stable, long-term storage of waste rock and tailings.
- Ensure that the site is self-sustaining and to prevent or minimise environmental impacts, and.
- Rehabilitate disturbed areas for a specified land use (e.g., return of disturbed areas to a natural state or other acceptable land use).

The final cover of the tailings dump must have a graded layers coarsing upwards (Fig. 4.2). This means that coarse material must be placed on top to protect the fines below from wind and water erosion. Furthermore, the coarse-grained material below will also help in retaining moisture for good vegetation growth over the tailings.

No municipal or hazardous site shall be developed in the mining license area. All municipal / industrial / hazardous waste must be stored in suitable containers / skips onsite and once full must be transported to the Arandis municipal waste disposal site.

The Arandis Municipal Waste Disposal Site is not well engineered and organised to handle hazardous waste. The mining company is highly encouraged to assist the Arandis Municipality in developing a suitable waste disposal site, which will not only be utilised by the mining company but also the community of Arandis. The support to the development of suitable waste disposal site for the Town of Arandis by the mining company will be within the expected Corporate Social Responsibility (CSR) to be overseen by the Environmental, Social Governance (ESG) Coordinator of the mining company to the local community.

Table 4.23 provided a summary of components to be addressed in the ongoing and final mine closure phase. Table 4.24 summarises the initial estimated cost provisions for final rehabilitation, closure and aftercare environmental liabilities for the proposed mine for the first year of operation. During the entire project life cycle, the environmental liability for final rehabilitation, closure and aftercare must be validated, revised annually and capitalized accordingly in order to avoid major final shortfall during mine closure.

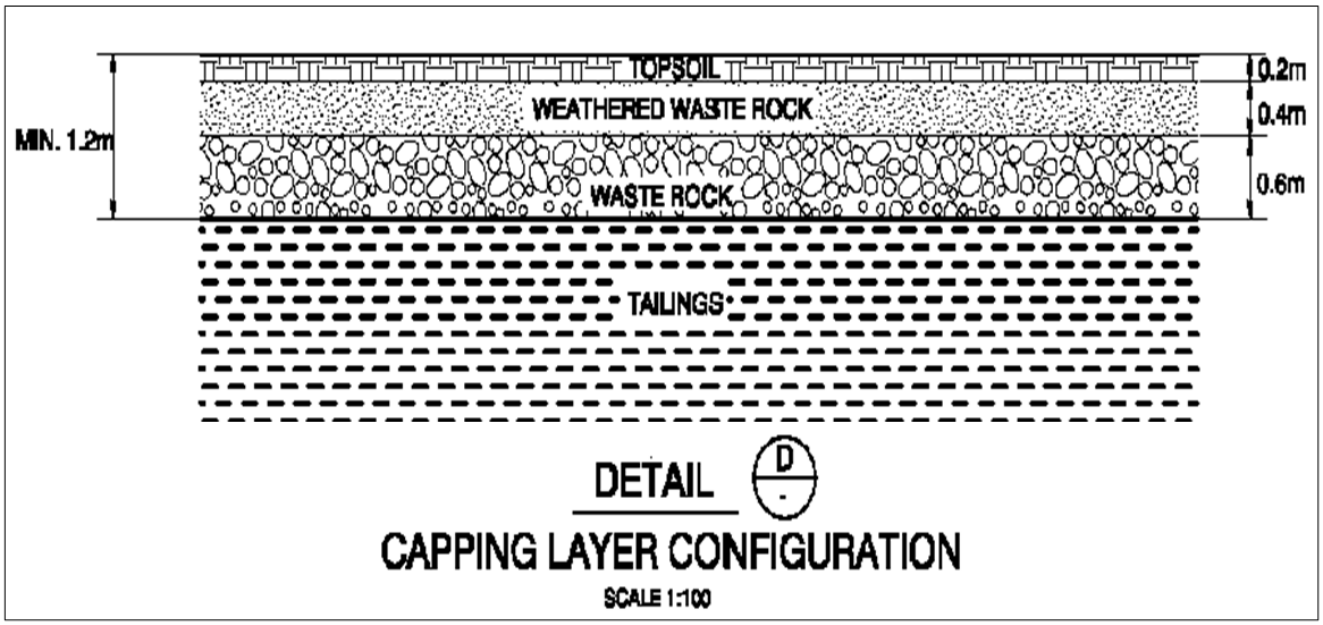


Figure 4.2: Section view through the proposed tailing damp showing the final top graded cover layer to be capped during the mine closure stage to prevent water and wind erosion over time.

Table 4.23: Mitigatory measures that will address ongoing and final mine Closure Plan.

Components	Aspects to be Addressed
Open Pit Workings	○ Pit workings stability ○ Groundwater and rainwater management ○ Security and unauthorised access ○ Public and wildlife entrapment ○ Effects of drainage into and from the pit working areas
Ore Processing Facilities	○ Removal of buildings and foundations ○ Clean-up of workshops, fuel, and reagent ○ Disposal of scrap and waste materials ○ Re-profiling and revegetation of site
Waste Rock Piles	○ Slope stability ○ Effects of leaching and seepage on surface and groundwater ○ Dust generation ○ Visual impact ○ Special radiation considerations that maybe be associated with the waste rock
Tailings Management Facilities	○ Dam stability ○ Changes in tailings geochemistry ○ Effects of seepage past the dam and from the base of the facility ○ Surface water management and discharge ○ Dust generation ○ Access and security ○ Wildlife entrapment ○ Special radiation considerations that maybe be associated with tailing dump
Water Management Facilities	○ Restoration or removal of dams, reservoirs, settling ponds, culverts, pipelines, spillways or culverts which are no longer needed ○ Surface drainage of the site and discharge of drainage waters ○ Maintenance of water management facilities
Landfill / Waste Disposal Facilities	○ Disposal or removal from site of hazardous wastes ○ Disposal and stability of treatment sludge ○ Removal of sewage treatment plant ○ Prevention of groundwater contamination ○ Security and unauthorised access to prevent illegal dumping
Infrastructure	○ Removal of unwanted power and water supply, haul, and access roads ○ Reuse of transportation and supply depots

4.3.4.3 Estimate of the Final Rehabilitation, Closure and Aftercare Costs

The Mine closure plan shall calculate the final mine rehabilitation, closure and aftercare costs to be based on a number of technical reports for the development of the proposed mine prepared by various consultants. No feasibility or preferability report was provided by Proponent with respect to the assessment of the mine closure plan estimate shown in Table 4.24 covering the following components as detailed in Table 4.24:

(i) Stakeholder engagement.

(ii) Employees costs and social development.

(iii) Demolition, removal and rehabilitation, and.

(iv) Aftercare maintenance and environmental monitoring.

Without taking into consideration the cost of ongoing rehabilitation that will be undertaken in the first twelve (12) months of the mine operations, it is hereby estimated that the total cost for final rehabilitation, closure and aftercare costs covering the first twelve (12) month of the proposed mine operations is Seven Million Four Hundred Thousand Namibia Dollar (N$7, 400, 000.00) (Table 4.24). The Proponent shall review the mine closure plan and indicated costs and make annual contributions to the fund to provide for a complete final mine rehabilitation, closure and aftercare costs.

Table 4.24: 1st Year indicative final rehabilitation, closure, and aftercare liabilities.

	Activity	Costs to Be Validated Annually (Namibian$)
FINAL REHABILITATION AND MINE CLOSURE ACTIVITIES	**A. STAKEHOLDER ENGAGEMENT**	
	1. Consultants support	200,000.00
	2. Stakeholder engagement (land owners, employees, authorities, unions and special interest group forum) and advertisements	300, 000.00
	SUBTOTAL	**500, 000.00**
	B. EMPLOYEES COSTS AND SOCIAL DEVELOPMENT	
	1. Retrenchment and long service	2, 000,000.00
	2. Training for re-skilling	1, 000,000.00
	3. Health Continuation programme	1, 000,000.00
	SUBTOTAL	**4, 000,000.00**
	C. DEMOLITION, REMOVAL AND REHABILITATION	
	1. Removal of the processing plant and related infrastructure	100,000.00
	2. Cleaning equipment to enable sale	50,000.00
	3. Tailings dump closure	200,000.00
	4. Waste rock dump	50,000.00
	5. Final rehabilitation of pit and other surface excavations	300,000.00
	6. Removal of offices, administration facilities, support areas	20,000.00
	7. Water infrastructure	10,000.00
	8. Exploration mining area and other excavations	200,000.00
	9. Running costs for the mine site during closure activities	500,000.00
	10. Access roads	20,000.00
	11. Clean-up of the areas contaminated and preparation for other land use options	50,000.00
	12. General clean-up of area including removal of all scrap metal etc	100,000.00
SUBTOTAL		**1, 600, 000.00**
AFTERCARE ACTIVITIES	**D. ENVIRONMENTAL MANAGEMENT**	
	1. Professional consulting support	300,000.00
	2. Maintenance of site including any failures of the pit, Tailings Storage Facility (TSF), Waste Rock Facility (WRF), and general site erosion	500,000.00
	SUBTOTAL	**800, 000.00**
	E. ENVIRONMENTAL MONITORING	
	3. Air quality (Dust)	100,000.00
	4. Surface water monitoring	100 000.00
	5. Groundwater monitoring	200, 000.00
	6. Erosion control and management	100,000.00
	SUBTOTAL	**700, 000.00**
GRAND TOTAL ENVIRONMENTAL LIABILITY (FINAL REHABILITATION, CLOSURE AND AFTER CARE STAGES)		**7, 400, 000.00**

4.3.4.4 Funding Mechanisms for Final Rehabilitation, Closure and Aftercare Costs

The Proponent shall establish a Mine Environmental Rehabilitation Fund, which will provide for expenditures associated with mine final rehabilitation, closure and aftercare costs.

The establishment of the Mine Environmental Rehabilitation Fund shall comply with statutory obligations and stipulated requirements of both the Ministry of Mines and Energy and the Ministry of Environment, Forestry and Tourism (MEFT). In addition to the fixed terms cash deposits and to diversity this fund, portions of the Mine Environmental Rehabilitation Fund funds shall be invested in some of the following mechanisms or instruments:

(i) Bond.

(ii) Insurance, or

(iii) Other short and long-term investments instruments.

The Mine Environmental Rehabilitation Fund and associated investments instruments of the fund shall be administered by the Proponent, the Government of the Republic of Namibia (MME and MEFT), representatives of the land owners and employees / union representatives to make sure that the fund is fully capitalised and covers all the aspects of the envisaged environmental liabilities at mine closure.

It is expected that no post mine closure residual liability once all rehabilitation has been completed. However, if any residual liability is identified then the transfer of such liability is to be negotiated between Proponent and the landowner or third-party service provider. Residual liability would include ongoing maintenance or monitoring. In the event that the Proponent becomes insolvent, any residual liability would be negotiated between the administrator and the landowner or third-party service provider, notwithstanding the fact that the Namibian Government and other stakeholders will also hold the rights to the Mine Environmental Rehabilitation Fund that should cover the complete costs for final rehabilitation, closure and aftercare activities including monitoring.

4.3.4.5 Mitigation Measures for Closure, Rehabilitation, Aftercare, and Monitoring

The closure, rehabilitation, aftercare and ongoing monitoring stage of the proposed new uranium mine will cover all the activities that aim at restoring site and the surrounding areas to the state before the mine was created. The closure, rehabilitation, aftercare and ongoing monitoring stage will only be implemented once the mine has reached its useful life span. Although the current license period is up to 15 years, the license is renewable deepening on the availability of additional resources that extend the life of the mine.

The closure, rehabilitation, aftercare, and ongoing monitoring stage will cover the removal of all structures such as the processing plant, foundation, steel works and concrete casted to hold all structures onsite. The EMP makes provisions for management of a wider array of activities that will be associated with closure, rehabilitation, aftercare, and ongoing monitoring of the proposed new uranium mine.

Table 4.25 outlines the mitigation measures for the decommissioning and closure stage of the proposed development.

Table 4.25: Mitigation measures for closure, rehabilitation, aftercare, and ongoing monitoring for all mining and ongoing exploration activities.

Development Stage/ Activity	Source of impact	Impact	Mitigation	Responsible person	Time-line
Closure and Rehabilitation	• Excavated trenches, pits	Land scar	• Pits must be refilled with saved stockpiled waste rock and top soil for easy rehabilitation, no vegetation should be cleared during this operation • Revegetate where necessary. • All rehabilitated areas should be monitored over a 4 year period from the onset of the rehabilitation procedures.	Developer / Operator (Project Manager (PM), Project Engineers (PE), Site Engineers (SE) Environmental Control Officer (ECO), Environmental Coordinator (EC), Environmental Social Government (ESG)Team Leaders (TL), Contractors (CONT) and Subcontractors (SCONT) (Ministry of Environment, Forestry and Tourism – MEFT, Ministry of Mines and Energy and National Radiation Authority (NEA)	Ongoing to final Rehabilitation
	• Domestic and Industrial waste from mining and processing areas	All waste and unwanted material	• All remaining domestic waste and unwanted material must be collected and transported to an MET approved disposal site. • All weedy species must be removed from site • All scrap metal and debris must be removed and disposed off to a designated area • A site contamination assessment should be conducted and any contaminated material must be disposed of at an appropriate disposal facility.		

Table 4.25: *Cont.*

Development Stage/ Activity	Source of impact	Impact	Mitigation	Responsible person	Time-line
Closure and Rehabilitation	• Support service structures – Workshop and garage, • Base camp • Processing plant	Abandoned structures	• All surrounding fences, workshop structures, generators and any scrap metals must be removed. • All Petrol, diesel, oil and grease containers must be removed from site to a recognized storage facility. • All concrete slabs must be broken loose and dumped filling some of the open pits. These can also be transported and dumped at an approved dumping site. • Pending the approval by relevant authorities, the company may donate the remaining buildings, such as the workers quarters, office complex and the manager's house, to organizations aimed at uplifting the standards of the local communities. • All access roads, tracks are to be rehabilitated	Developer / Operator (Project Manager (PM), Project Engineers (PE), Site Engineers (SE), Environmental Control Officer (ECO), Environmental Coordinator (EC), Environmental Social Government (ESG), Team Leaders (TL), Contractors (CONT) and Subcontractors (SCONT)	Ongoing to final Rehabilitation
Aftercare and Ongoing monitoring	• Rehabilitation process.	Environmental performance	• Rehabilitation process should have fulfilled goals and targets raised in the EMP in fulfilment of the provisions stated in the Environmental Management Act no. 7 of 2007.		During aftercare and ongoing monitoring.

4.4 Other Specific Mitigation Measures and EMP Provisions

4.4.1 Habitant, Fauna and Flora Mitigation Measures

The mine development and ongoing exploration programme will be undertaken over time and destructive methods such as excavation and removal of the overburden, development of infrastructure as well as drilling and sampling will likely to cause some local damages to flora and fauna in the area. The main reasons for integrating both fauna and flora in the conceptual model of this study are to evaluate:

- The ecological significance and conservation status with respect to the international and local conservation requirements in order to avoid conflicts between the purposed mine development and conservation.

- The nature and scale of any likely negative impacts on the ecological setting, which include likely temporal or permanent damage to specific species within the vicinity of the targeted areas.

- To identify those species that maybe useful for monitoring of the environmental performances during mining.

All development has potential negative environmental consequences, but identifying the most important flora species including high risk habitats beforehand, coupled with environmentally acceptable mitigating factors, lessens the overall impact of such development.

4.4.2 Archaeology Mitigation Measures

A simplified zonation of ML No. 177 including the ML area identified the escarpment as high sensitivity zone, the steppe as a medium sensitivity zone and the Khan River course as a medium to low sensitivity zone. These are the sites with the most concentrated, diverse and well preserved evidence of human settlement, and without them it would be difficult to interpret the archaeological record. In contrast, the gravel plains and steppe sites (topographically lower areas), while interesting, represent a narrower range of activities and are generally not well preserved. The evidence from these sites is also well represented in other parts of the Namib and the examples found within the ML areas and indeed the entire ML No. 177 area are therefore not unique.

While this zonation is based on a relatively large body of field survey data it must be subject to the caveat that because the entire area has not been surveyed, and because the archaeology of the central Namib is not known in every detail. The ML area falls in an area of known archaeological significance. The available data also serve to alert potential developers to high probability of negative archaeological impacts in some parts of the property, especially within the escarpment zone where the actual main pit area covering the deposits defined by the anomaly No. 18.

Before the implementation of the new uranium mine pit and all associated infrastructure preconstruction and construction planning should include detailed archaeological assessment of each area of the final mine plan.

4.4.3 Radiation Management and Mitigation Measures

4.4.3.1 Radiation Management Plan

Management of radiation must be undertaken within the provisions of the Radiation Management Plan (RMP) to be prepared and integrated into the EMP. The RMP must be a comprehensive document that must outline the responsibilities, programmes and actions at the proposed new uranium mine in the ML No. 177. The overall aim will be to minimise, monitor and manage any likely radiation exposure to employees and the public exposure.

4.4.3.2 External Exposure Pathway

There are three general methods for the control of external exposures:

(i) Time: External exposures can be reduced by decreasing the time spent near radiation sources or in contaminated areas.

(ii) Distance: External exposures can be reduced by increasing the distance from the source of radiation. The reduction generally follows the inverse square law which states that the dose is reduced by the square of the increase in distance. Thus, doubling the distance will reduce the dose to a quarter of what it would be at the original distance, increasing the distance three times reduces the dose to one ninth, and increasing distance by a factor of ten reduces the dose to one hundredth. Strictly, this law only applies to point sources, but it can be applied to large sources when the distance from a source is much greater than its lineal size. It is not applicable when close to large area sources, such as areas of contaminated soil.

(iii) Shielding: Placing some radiation absorbing material (shielding) between the source and the potentially exposed person can reduce the resulting external radiation dose. The amount and nature of the shielding required depends on the type of radiation involved. Heavy elements, such as lead, are very effective for shielding X and gamma radiations. At high radiation energies, all materials are approximately equivalent, and the shielding depends on the density of the shield. Personal shielding, such as a lead-rubber apron, is only practical against low energy X and gamma radiation, and rapidly becomes totally impracticable at higher energies. Millimetre thin layers of metal, or a centimetre or so of plastic, are effective for shielding beta radiation. Neutrons are quite penetrating in heavy elements. They are more effectively shielded by materials containing hydrogen such as water, wax, or polythene.

4.4.3.3 Internal Exposure Pathway

The procedures for protection against internal exposure are not as simple as those for external exposure, given that there are numerous possible exposure pathways. Protection focuses on limiting intakes, and some general principles including the following may be considered:

(i) Isolation from sources by keeping people away from potential sources of exposure, such as contaminated areas, means that the intake of radioactive materials will be reduced.

(ii) Ventilation, which removes contaminated air and provides fresh air for breathing, is another way of reducing exposure.

(iii) Reduction of the activities of the sources that produce potential exposure pathways should be minimised. for example, dust generation should be reduced where practicable by wetting down dusty materials.

(iv) Personal protection is the common forms of personal protection include protective clothing, footwear, gloves, and respiratory protection, which removes contaminants from inhaled air. This can range from a relatively simple respirator to a complete ‘air suit’ with its own air supply. Personal protective equipment which impedes normal working arrangements is not routinely used because other means of providing a save working environment for all (for instance by ensuring buildings provide adequate shielding and have appropriate air filters) are given a higher priority in the hierarchy of occupational health and safety measures.

(v) Personal hygiene is very important for reducing ingestion, particularly via hand-to mouth transfer. Removal of contaminated clothing and showering after leaving a contaminated area can reduce the spread of radioactive material to uncontaminated work or living areas. It should be noted that ‘radiation protective clothing’ does not protect against external radiation exposure, except for low-energy beta radiation, but it is an aid to decontamination after working in contaminated areas.

4.4.3.4 Monitoring of External and Internal Radiations Exposure

In accordance with the recommendations of the 2011 EIA (Vol. 2 of 3) Report on Radiation Safety for the proposed new uranium mine, Zhonghe Resource (Namibia) Development (Pty) Ltd the developer of the proposed new uranium mine in the ML No. 177 is required to develop and implement a Radiation Management Plan (RMP) approved by the National Radiation Protection Authority (NRPA) within the provisions of the Atomic Energy and Radiation Protection, 2005, (Act No. 5 of 2005). To develop an occupational health and safety guidelines or thresholds for management of ionisation radiation for the proposed new uranium mine in the ML No. 177, a separate specialist study must be undertaken as soon as possible incorporating the proposed final mine design and layout. This specialist study will then feed into the preparation of a Radiation Management Plan (RMP) as required by the NRPA. The RMP must be a comprehensive document that must outline the responsibilities, programmes and actions at the proposed new uranium mine in the ML No. 177. The overall aim will be to minimise, monitor and manage any likely radiation exposure to employees and the public exposure. Within the framework of the RMP the following must be elaborated in detail covering the entire proposed project lifecycle:

- The operational details of the proposed new uranium mine.
- Processing plant (technology).
- The occupational radiation monitoring programme
- The workplace and public radiation exposure control programme
- The radiation training and awareness programmes,
- The environmental impact assessments and dose assessments carried.
- The waste management, and.
- Transport and disaster management plans.

The radiation monitoring programme to be developed within the framework of the RAM must comprise the monitoring of three exposure pathways namely:

- Internal exposure (exposure within the body, mostly to lungs and airways) to alpha radiation, mainly from the inhalation of the short-lived decay products of radon (radon is a gas and is a radioactive decay product arising from the natural radioactive decay of uranium).
- Internal exposure to alpha radiation from the inhalation of the long-lived radionuclides occurring in uranium ore dust, and.
- External exposure to gamma radiation, mostly from ore outcrops, ore stockpiles and from extracted uranium oxide stored onsite.

The monitoring data will enable radiation safety staff to ensure that radiation exposure levels in all areas of the proposed new uranium mine in the ML No. 177 are kept as low as is reasonably achievable to ensure that such exposure levels comply with national and international radiation protection standards of 20 mSv per year stipulated in the new Namibian regulations of the Atomic Energy and Radiation Protection, 2005, (Act No. 5 of 2005).

4.4.3.5 Radiation Management Action Plan

Within the framework of the EMP and to be provided for in the Radiation Management Plan (RMP), the summary of the radiation management actions and expectations from the Management of Zhonghe Resource (Namibia) Development (Pty) Ltd, various mine Departmental Radiation Officers, Radiation Safety Officer, Administrative Officer (Radiation) are outlined in Tables 4.26-4.35. These provisions may need to be revised and incorporated in the RMP to be prepared for the proposed new uranium mine in the ML No. 177.

Table 4.26: Appraisals and reviews.

Description: Regular assessment of the effectiveness, suitability, and acceptance of the management of ionising radiation safety on an informal basis			
ACTION	**RESPONSIBILITY**	**TIMING**	**PROGRESS/COMMENT**
1. Review the operation of the ionizing radiation management plan with respect to the RMP in consultation with the management on at least an annual basis	• Radiation Safety Officer • Administrative Officer (Radiation)	At least annually	
2. Review the recording system, the company's legal obligations, and accountability at least annually		At least annually	
3. Review the audits, corrective actions, objectives and targets, legislative compliance, and incident data, and report the results to the management		At least annually	

Table 4.27: Inspections schedule.

Description: The Department Radiation Safety Officers will carry out regular inspections of the locations of ionising radiation work in their areas of responsibility			
ACTION	**RESPONSIBILITY**	**TIMING**	**PROGRESS/COMMENT**
1. Perform regular inspections of the locations of ionizing radiation work	• Radiation Safety Officer • Administrative Officer (Radiation)	Every 3 months	
2. Ensure that the local rules as those relating to appropriate PPE, waste disposal practices and regular monitoring are obeyed		Every 3 months	
3. Inspect records for the monitoring of X-Ray apparatus and the purchase of unsealed radioactive material		Every 3 months	

Table 4.28: Internal audits**.**

Description: To ensure continuing adherence to the company's policy and the RMP and EMP will be conducted in accordance with agreed protocols approved by the management.			
ACTION	**RESPONSIBILITY**	**TIMING**	**PROGRESS/COMMENT**
Audit ionizing radiation work carried out by the Radiation Safety Officer	• Radiation Safety Officer • Administrative Officer (Radiation)	Annually	
Audits of the records maintained by the Administrative Officer (Radiation)		Annually	
Provide reports of the internal audits on ionising radiation work carried out by other mine operational areas		Annually	
Provide reports of the internal audits on ionizing radiation work carried out by other mine operational areas		Annually	
Internal auditors to carry out follow-up inspections where corrective action is needed to ensure compliance		Annually	

Table 4.29: External audits.

Description: To ensure that those directly responsible for ionizing radiation safety around the proposed mine continue to maintain a high standard of management of the hazard of radiation and enable the mine to demonstrate that it meets the appropriate standards in radiation safety			
ACTION	**RESPONSIBILITY**	**TIMING**	**PROGRESS/COMMENT**
A biennial external audit of ionising radiation safety covering the entire mine operation		Annually	
An audit to be conducted when new equipment are installed, a change in the uranium recovery process or heap leaching modifications		As required	
An audit of radioactive waste (waste rock, tailings and contaminated equipments) is to be conducted		Annually	
Appoint external auditors to operate under an agreed protocol and with clearly identified objectives with reports directed to the management		Annually	

Table 4.30: Radiation training.

Description: Mine employees must receive training appropriate to their use of ionizing radiation.			
ACTION	**RESPONSIBILITY**	**TIMING**	**PROGRESS/COMMENT**
All radiation mine employees must receive training in the elementary principles of radiation safety and ALARA (As Low As Reasonably Achievable)	• Radiation Safety Officer • Administrative Officer (Radiation)	As part of induction and there after every six months	
All mine employees must receive training relating to the Company Policy relating to ionizing radiation			
All mine employees must receive training relating to the Radiation Management Plan (RMP)			
All mine employees must receive training relating to the Radiation Safety Manual			
All mine employees must receive training relating to the National Radiation Protection and Control Regulations			
Radiation mine employees to be provided with detailed instruction in procedures and operations relevant to the work being carried.			
The company should develop web-based radiation safety training material to be used in addition to formal training Sessions.			

Table 4.31: Storage of Sources of radiation.

Description: The potential use of radioactive materials in acts of terrorism requires the mine to pay particular attention to the security of radioactive material			
ACTION	**RESPONSIBILITY**	**TIMING**	**PROGRESS/COMMENT**
The mine must develop a security policy for sealed sources that addresses the potential threat. The policy must take into account the storage of long-lived radioactive waste for which currently no disposal pathway exists in Namibia.	• Radiation Safety Officer • Administrative Officer (Radiation)		

Table 4.32: Radioactive spills.

Any loss of control of radioactive material is an abnormal situation and spills will produce contamination of natural environment, equipment, and in more serious cases, the floor and people.			
ACTION	**RESPONSIBILITY**	**TIMING**	**PROGRESS/COMMENT**
Ensure that radiation workers are trained in how to deal with radioactive spills and in relevant remedial actions	Department Radiation Safety Officers	Mine Life Cycle	
Ensure that spill kits are available key specific areas.	Radiation Safety Officer Department Radiation Safety Officers		

Table 4.33: Radiation accidents.

A loss of control of a source of ionising radiation where control is not regained, or a significant dispersal of radioactive material takes place, or a person is likely to receive a dose or intake that is at least twice that normally received in the work with that source			
ACTION	**RESPONSIBILITY**	**TIMING**	**PROGRESS/COMMENT**
Ensure that radiation workers are trained in how to deal with radiation accidents and in relevant emergency actions	Radiation Safety Officer Department Radiation Safety Officers	Mine Life Cycle	

Table 4.34: Radiation emergencies.

Description: Radiation Emergency means a situation in which a source of ionising radiation is out of control to such an extent that the continued exposure of a person to excessive amount of ionising radiation while the source of ionising radiation remains out of control is unavoidable unless the normal functions or operations of the facility or place in which the source of ionising radiation is being used are grossly disrupted			
ACTION	**RESPONSIBILITY**	**TIMING**	**PROGRESS/COMMENT**
Ensure that radiation workers are trained in how to deal with radiation emergencies as described in the Company Radiation Safety Manual and in relevant emergency actions	Radiation Safety Officer Department Radiation Safety Officers	Mine Life Cycle	

Table 4.35: Sealed radiation source emergencies category 1.

Description: The source is temporarily "loose" from its proper housing or shielding but the dose to the operator is less than 500 µSv per hour (about 10 µSv per minute).			
ACTION	**RESPONSIBILITY**	**TIMING**	**PROGRESS/COMMENT**
Ensure that radiation workers are trained in how to deal with radiation emergencies and in relevant emergency actions	Radiation Safety Officer Department Radiation Safety Officers	Mine Life Cycle	

Table 4.36: Sealed radiation source emergencies category 2.

Description: The source cannot be returned to its proper storage configuration due to failure of mechanical or electrical actuators. This is a serious emergency			
ACTION	**RESPONSIBILITY**	**TIMING**	**PROGRESS/COMMENT**
Ensure that radiation workers are trained in how to deal with radiation emergencies and in relevant emergency actions	Radiation Safety Officer Department Radiation Safety Officers		

4.5 EMP Guidance and Awareness Materials

4.5.1 Environmental Awareness Guidance

(i) The Environmental Rules apply to EVERYBODY. This includes all permanent, contract, or temporary workers as well as any other person who visits the mine settlement, mining and exploration area. Any person who visits the license areas will be required to adhere to the company Environmental Code of Conduct.

(ii) The Exploration Geologist or Site Manager will issue warnings and will discipline ANY PERSON who breaks anyone of the Environmental Rules and Procedures. Repeated and continued breaking of the Rules and Procedures will result in a disciplinary hearing and which may result in that person being asked to leave the site permanently.

(iii) The ENVIRONMENT means the whole surroundings around us. The environment is made-up of the soil, water, air, plants, and animals. and those characteristics of the soil, water, air, plant, and animal life that influence human health and wellbeing.

(iv) If any member of the WORK FORCE does not understand, or does not know how to keep any of Environmental Rule or Procedure, that PERSON must seek advice from the ENVIRONMENTAL COORDINATOR, PROJECT GEOLOGIST or SITE MANAGER or CONTRACTOR. The PERSON that does not understand must keep asking until s/he is able to keep to the all the Environmental Rules and Procedures.

4.5.2 Environmental Awareness Training Guidance Materials

4.5.2.1 Control of Fires

- Never start any open fire and do not burn any vegetation.
- Do not smoke near refuelling depots or any other area where fuel, oil, solvents, or paints are used or stored. Make sure that cigarette butts are put-off before throwing them into the refuse bin.
- Do NOT throw cigarette butts anyhow in the field.
- Immediately notify your Contractor or the Environmental Coordinator, Exploration Geologist / Site Manager if you see a fire on site.

4.5.2.2 Natural Environmental Management

- Never feed, tease or play with, hunt, kill, destroy or set devices to trap any wild animal (including birds, reptiles and mammals), livestock or pets. Do not bring any wild animal or pet to the exploration site.
- Do not pick any plant or take any animal out of the exploration area EVER. You will be prosecuted and asked to leave the project area.
- Never leave rubbish and food scraps or bones where it will attract animals, birds or insects. Rubbish must be thrown into the correct rubbish bins or bags provided.
- Protect the surface material by not driving over it unnecessarily.
- Do not drive over, build upon, or camp on any sensitive habitats for plants and animals.
- Do not cut down any part of living trees / bushes for firewood.

- ❖ Do not destroy bird nest, dens, burrow pits, termite hills etc or any other natural objects in the area.

4.5.2.3 Vehicle Use and Access

- ❖ Never drive any vehicle without a valid licence for that particular vehicle and do not drive any vehicle that appears not to be road-worthy.
- ❖ Never drive any vehicle when under the influence of alcohol or drugs.
- ❖ DO NOT make any new roads without permission. Stay within demarcated areas.
- ❖ Avoid U-Turns and large turning circles. 3-point turns are encouraged. Do not ever drive on rocky slopes.
- ❖ Stay on the road, do not make a second set of tracks and do not cut corners.
- ❖ DO NOT SPEED - keep to less than 60 km per hour on the tracks and site roads.
- ❖ No off-road driving is allowed.
- ❖ Vehicles may only drive on demarcated roads.
- ❖ Adhere to speed limits and drive with headlights switched on along any gravel road.

4.5.2.4 Control of Dust

- ❖ Do not make new roads or clear any vegetation unless instructed to do so by your Contractor or the Environmental Coordinator / Project Geologist / Site Manager.
- ❖ Try to disturb the surface of the natural landscape as little as possible.

4.5.2.5 Health and Safety

- ❖ Drink lots of water every day, but only from the fresh water supplies.
- ❖ Take the necessary precautions to avoid contracting the HIV/AIDS virus.
- ❖ Only enter or exit the exploration area at the demarcated gates.
- ❖ Always keep the gates as you found them.
- ❖ Any damage to the fence or gate must be report to the Environmental Coordinator / Exploration Geologist / Project Manager who will then inform the land owner of any damage with all the repairs done to the satisfaction of the land owner or Environmental Coordinator for communal land on behalf of the local community.
- ❖ Never enter any area that is out of bounds, or demarcated as dangerous or wander off without informing or permission of team leader.
- ❖ Never climb over any fence or trespass on private property without permission of the landowner or consultation with the Environmental Coordinator, Project Geologist / Site Manager.

- ❖ Report to your Contractor or the Project Geologist / Site Manager if you see a stranger or unauthorised person in the exploration area.

- ❖ Do not remove any vehicle, machinery, equipment or any other object from the exploration camp site or along the profile or at a seismic testing station without permission of your Contractor or the Project Geologist / Site Manager.

- ❖ Wear protective clothing and equipment required and according to instructions from your Contractor or the Exploration Geologist or Site Manager.

- ❖ Never enter or work in the mine or exploration area when under the influence of alcohol or drugs.

4.5.2.6 Preventing Pollution and Dangerous Working Conditions

- ❖ Never throw any hazardous substance such as fuel, oil, solvents, etc. into streams or onto the ground.

- ❖ Never allow any hazardous substance to soak into the soil.

- ❖ Immediately tell your Contractor or Environmental Coordinator/ Project Geologist / Site Manager when you spill, or notice any hazardous substance being spilled anywhere in the field or camp.

- ❖ Report to your Contractor or Environmental Coordinator / the Project Geologist / Site Manager when you notice any container, which may hold a hazardous substance, overflow, leak, or drip.

- ❖ Immediately report to your Contractor or Environmental Coordinator / the Project Manager when you notice overflowing problems or unhygienic conditions at the ablution facilities.

- ❖ Vehicles, equipment and machinery, containers and other surfaces shall be washed at areas designated by the Contractor or Environmental Coordinator / the Project Geologist / Site Manager.

- ❖ If you are not sure how to transport, use, store or dispose any hazardous substance - ASK your Contractor or Environmental Coordinator / the Project Geologist / Site Manager for advice.

4.5.2.7 Saving Water

- ❖ Always use as little water as possible. Reduce, reuse and re-cycle water where possible.

- ❖ Report any dripping or leaking taps and pipes to your Contractor or Environmental Coordinator/ the Project Geologist or Site Manager.

- ❖ Never leave taps running. Close taps after you have finished using them.

4.5.2.8 Disposal of Waste

- ❖ Learn to know the difference between the two main types of waste, namely:
    - ✓ General Waste. and
    - ✓ Hazardous Waste.
- ❖ Learn how to identify the containers, bins, drums, or bags for the different types of wastes.

Never dispose of hazardous waste in the bins or skips intended for general waste or exploration rubble.

- ❖ Never burn or bury any waste on the camp or in the field.
- ❖ Never overfill any waste container, drum, bin, or bag. Inform your Contractor or the Environmental Coordinator/ the Project Geologist / Site Manager if the containers, drums, bins or skips are nearly full.
- ❖ Never litter or throwaway any waste on the site, in the field or along any road. No illegal dumping.
- ❖ Littering is prohibited.

4.5.2.9 Religious, Cultural, Historical and Archaeological Objects

- ❖ If you find any suspected religious, cultural, historical or archeologically object or site around the campsite or in the field, you must immediately notify your Contractor or Environmental Coordinator / the Project Geologist **/** Site Manager.
- ❖ Never remove, destroy, interfere with or disturb any religious, cultural, historical or archaeological object or site around the campsite or in the field.

4.5.2.10 Dealing with Environmental Complaints

If you have any complaint about dangerous working conditions or potential pollution to the environment, immediately report this to your Contractor or the Environmental Coordinator / the Project Geologist **/** Site Manager.

If any person complains to you about noise, lights, littering, pollution, or any other harmful or dangerous condition, immediately report this to your Contractor or the Environmental Coordinator / the Site Manager.

5. MONITORING AND ENVIRONMENTAL PERFORMANCE

5.1 Overview

The monitoring process of the EMP performances for the proposed mining and exploration project is divided into following two parts:

(a) General EMP Monitoring covering:

(i) Monitoring activities and effects to be undertaken and supported by the Environmental Control Officer (ECO), Environmental Coordinator (EC), Environmental Social Government (ESG), and.

(ii) Preparation of an Environmental Monitoring Report covering all activities related to the Environmental Management Plan throughout the life cycle of the proposed mining project to be undertaken and supported by the Environmental Control Officer (ECO) Environmental Coordinator (EC), Environmental Social Government (ESG).

(b) Specific Radiation Monitoring as provided for in the RMP covering:

(i) Monitoring activities and effects to be undertaken by various mine Departmental Radiation Officers, Radiation Safety Officer, Administrative Officer (Radiation).

(ii) Preparation of a Radiation Environmental Monitoring (RMP) Report covering all activities related to the RMP throughout the life cycle of the proposed mining project to be undertaken by the Radiation Safety Officer in consultation with the Environmental Control Officer (ECO).

5.2 Environmental Performance Reporting

Zhonghe Resource (Namibia) Development (Pty) Ltd will be required to report to the Ministry of Mines and Energy (MME) and Ministry of Environment, Forestry and Tourism (MEFT), the environmental performances for every six (6) months or as per the conditions of the ECC that may be granted by the Environmental Commissioner in the MEFT.

In addition, Zhonghe Resource (Namibia) Development (Pty) Ltd will be required to also report to the National Radiation Authority (NRA) in the Ministry of Health and Social Services within the framework of the RMP to be approved by the NRA.

The environmental performance monitoring of the EMP and RMP are both part of the ongoing environmental monitoring programme to be undertaken through the proposed new uranium mine lifecycle. The process of undertaking appropriate monitoring of the EMP as per specific topic (Tables 5.1 - 5.8) and tracking performances against the objectives and documenting all environmental activities is part of internal and external auditing to be coordinated by the Environmental Control Officer/ EMP Coordinator, ESG Coordinator / Consultant / Suitable qualified in-house resource person.

Tables 5.1 – 5.9 outline the type of information that shall need to be recorded on a regular by the Environmental Control Officer as part of the monitoring process of the activities and the effects.

5.3 Environmental Performance Monitoring

The second part of the monitoring of the EMP performance will require a report outlining all the activities related to effectiveness of the EMP at the end of the following stages:

(i) Preconstruction.

(ii) Construction.

(iii) Operation and ongoing monitoring.

(iv) Decommissioning.

(v) Closure and Final Rehabilitation, and.

(vi) Aftercare (On Annual intervals throughout the specified aftercare period).

The types of the data sets to be used in the preparation of such a report are outlined in Tables 5.1 - 5.9. The objective will be to ensure that corrective actions are reviewed and steps are taken to ensure compliance for future EIA and EMP implementation.

The report shall outline the status of the environment and any likely environmental liability after every key developmental stage. The report shall be submitted to the Ministry of Environment, Forestry and Tourism via the Ministry of Mines and Energy and will represent the final closure and fulfilment of the Environmental obligations for this project.

Table 5.1: Monitoring of environmental performance implementation / environmental awareness training.

Mitigation	Compliance	Follow-up Action Required	By Whom	By When	Completed
Is there an Environmental awareness training programme?	Environmental Management Act No. 7 of 2007	Ensure that all personnel before participating in the proposed project activities attend and understand the content of the EMP.	Environmental Control Officer (ECO), Environmental Coordinator (EC), Environmental Social Government (ESG), Team Leaders (TL), Contractors (CONT) and Subcontractors (SCONT)	At the start and during the duration of the project activities.	
How many people have been given environmental awareness training?		Ensure that, all personnel on site attend the environmental awareness training programme		At the start and during the duration of the project activities.	
Is a copy of the EMP on site?		Regularly follow up to ensure availability of the EMP copy on site.		At the start and during the duration of the project activities.	
How effective is the awareness training? Do people understand the contents of the EMP? Where are the weaknesses? Ask 3 people at random various questions about the EMP.		All personnel must indicate that they understand the contents of the EMP.		During the training programme	

Table 5.2: Monitoring of environmental performance for the settlement.

Mitigation	Compliance	Follow-up Action Required	By Whom	By When	Completed
Is the mine settlement positioned to avoid sensitive zones, river channels and potential archaeological sites?	Environmental Management Act No. 7 of 2007, (MET)	Adhere to site layout plan for the designated project zones.	Environmental Control Officer (ECO), Environmental Coordinator (EC), Environmental Social Government (ESG), Team Leaders (TL), Contractors (CONT) and Subcontractors (SCONT)	At the start and during the duration of the project activities.	
Has new infrastructure been created? If so, what, and how well planned / built with respect to environment?		Adhere to site layout plan for the designated project zones.		At the start and during the duration of the project activities.	
Have pit latrines been provided? Where are they situated?		Adhere to site layout plan for the designated project zones.		During pre construction, and construction phases of project	
Do receptacles for waste have scavenging animal proof lids?		Adhere to guidelines as mentioned in the Disposal Waste Guidance		At the start and during the duration of the project activities.	
What litter is there – who is littering?		Adhere to guidelines as mentioned in the Disposal Waste Guidance		At the start and during the duration of the project activities.	

Table 5.2: *Cont.*

Mitigation	Compliance	Follow-up Action Required	By Whom	By When	Completed
Are there facilities for the disposal of oils / etc and how often is it removed to an approved disposal site?	Environmental Management Act no. 7 of 2007	Adhere to guidelines as mentioned in the Disposal Waste Guidance	Environmental Control Officer (ECO), Environmental Coordinator (EC), Environmental Social Government (ESG), Team Leaders (TL), Contractors (CONT) and Subcontractors (SCONT)	At the start and during the duration of the project activities.	
Is there evidence of oil / diesel spills? Bunding or not?	• Environmental Management Act no. 7 of 2007 • Disposal of Waste Guidance • Petroleum (Exploration and Production) Act 1991 (Act 2 of 1991)	Regular monitory and compliance with effective measure to handle oil spills and contamination with soil.		At the start and during the duration of the project activities.	
What fuel source is being provided for cooking?	Environmental Management Act no. 7 of 2007	Adhere to Energy saving measures		At the start and during the duration of the project activities.	
Housekeeping				At the start and during the duration of the project activities.	

Table 5.3: Environmental data collection.

Mitigation	Compliance	Follow-up Action Required	By Whom	By When	Completed
Are records being kept?	Environmental Monitoring Report requirements	Regular monitoring of project site.	Environmental Control Officer (ECO), Environmental Coordinator (EC), Environmental Social Government (ESG), Team Leaders (TL), Contractors (CONT) and Subcontractors (SCONT)	At the start and during the duration of the project activities.	
Have archaeological sites been found / disturbed / described?		Regular monitoring of project site.		At the start and during the duration of the project activities.	

Table 5.4: Health and safety.

Mitigation	Compliance	Follow-up Action Required	By Whom	By When	Completed
Is there First Aid Kit containing anti-histamines etc?	Health and Safety Guidance	Regular checking of First Aid Kits	Environmental Control Officer (ECO), Environmental Coordinator (EC), Environmental Social Government (ESG), Team Leaders (TL), Contractors (CONT) and Subcontractors (SCONT)	At the start and during the duration of the project activities	
Are dangerous areas clearly marked off?	Health and Safety Guidance	Regular monitoring of sites.		At the start and during the duration of the project activities	
Do vehicles appear to maintain the recommended speed limits?	• Vehicle Use and Access Guidance • Health and Safety Guidance	Regular monitoring of traffic on site.		At the start and during the duration of the project activities	
Do vehicles drive with headlights on along the gravel roads at all times?	• Vehicle Use and Access Guidance • Health and Safety Guidance	Regular monitoring of traffic on site.		At the start and during the duration of the project activities	

Table 5.5: Recruitment of labour.

Mitigation	Compliance	Follow-up Action Required	By Whom	By When	Completed
What labour source is used?	Labour Act, 2007 (Act No. 7 of 2007)	Adhere to the regulations stipulated in the labour Act.	Environmental Control Officer (ECO), Environmental Coordinator (EC), Environmental Social Government (ESG), Team Leaders (TL), Contractors (CONT) and Subcontractors (SCONT)	During recruitment process (at the start and during project activities).	
How has the recruitment practice been done?		Adhere to the regulations stipulated in the labour Act.		During recruitment process (at the start and during project activities).	

Table 5.6: Management of the natural habitat and surficial materials management.

Mitigation	Compliance	Follow-up Action Required	By Whom	By When	Completed
Has there been camp development on or very close sensitive areas?	• Environmental Management Act No. 7 of 2007	Adhere to site layout plan for designated project zones.	Environmental Control Officer (ECO), Environmental Coordinator (EC), Environmental Social Government (ESG), Team Leaders (TL), Contractors (CONT) and Subcontractors (SCONT)	During pre-construction and construction camp.	
Has anyone been caught with plants or animals in their possession?	• Environmental Management Act No. 7 of 2007	Regular monitoring of project site		At the start and during the duration of the project activities	
Has there been wilful or malicious damage to the environment?	• Nature Conservation Ordinance 4, 1975	Regular monitoring of project site		At the start and during the duration of the project activities.	
Has topsoil / seed bank layer been removed from demarcated camp, mining and exploration areas and appropriately stored?	• Environmental Management Guidance	Regular monitoring of project activities	ENV, PG, GT, CONT.	At the start and during the duration of the project activities	

Table 5.7: Tracks and off-road driving.

Mitigation	Compliance	Follow-up Action Required	By Whom	By When	Completed
Are existing tracks used and maintained?	• Environmental Management Act No. 7 of 2007	Regular monitoring	Environmental Control Officer (ECO), Environmental Coordinator (EC), Environmental Social Government (ESG), Team Leaders (TL), Contractors (CONT) and Subcontractors (SCONT)	At the start and during the duration of the project activities	
What new tracks have been developed and are they planned?		• Adhere to proposed existing access roads and tracks • Regular Monitoring		At the start and during the duration of the project activities	
What evidence is there of off-road driving? Who appears to be responsible?		Regular monitoring		At the start and during the duration of the project activities	
Are corners being cut, what type of turning circle are there? Three point turns vs. U turns?		Regular monitoring		At the start and during the duration of the project activities	
Have unnecessary tracks been rehabilitated and how well?		Regular monitoring		During Rehabilitation process	

Table 5.8: Management of surface and groundwater.

Mitigation	Compliance	Follow-up Action Required	By Whom	By When	Completed
How is potable water supplied and how often? Position of tanks?	• Water Resources Management Act, 2004 (Act No. 24 of 2004) • Saving Water Guidance	Regular monitoring	Environmental Control Officer (ECO), Environmental Coordinator (EC), Environmental Social Government (ESG), Team Leaders (TL), Contractors (CONT) and Subcontractors (SCONT)	At the start and during the duration of the project activities	
Is water being wasted?		Regular monitoring		At the start and during the duration of the project activities	
Is there any leakage from pipes or taps?		Regular monitoring of pipes and taps for leakages		At the start and during the duration of the project activities	
Has casing been left when boreholes hit water and have any records of water strikes been kept? Were water samples taken and RWL measured?		Regular monitoring and record keeping.		At the start and during the duration of the project activities	

Table 5.9: Public relations.

Mitigation	Compliance	Follow-up Action Required	By Whom	By When	Completed
Have any complaints been made about the mining and exploration activities by the different I&APs? If so, what, and how was the issue resolved?	Environmental Management Act No. 7 of 2007	Create platform for I&APs to present their concerns. These should be collected and addressed accordingly.	Environmental Control Officer (ECO), Environmental Coordinator (EC), Environmental Social Government (ESG), Team Leaders (TL), Contractors (CONT) and Subcontractors (SCONT)	At the start and during the duration of the project activities	

5.4 Mine Closure Plan Monitoring and Reporting

5.4.1 Mine Closure Environmental Monitoring

Environmental monitoring with respect to the implementation of the Mine Closure Plan will be undertaken to measure the achievement of outcomes for both the ongoing rehabilitation and final mine closure and aftercare activities. Both the ongoing rehabilitation and final mine closure and aftercare monitoring activities will cover the following components:

(i) Air quality and dust emissions.

(ii) Stability of the following engineered structures:

  (a) Tailings Storage Facility (TSF).

  (b) Waste Rock Facility (WRF).

  (c) Waste disposal site.

  (d) Surface and subsurface excavated areas.

  (e) Drainage systems, and.

  (f) Pollution Control Dam (PCD).

(iii) Surface and groundwater quality, and.

(iv) Fauna and flora recovery in ongoing and final rehabilitated areas.

The Proponent shall report on the technical and financial monitoring performances of the Mine Closure Plan and this will be provided to all the key stakeholders. The monitoring report will also be made available to the public on the website of the Proponent. The following performance indicators will be measured against the Mine Closure Plan implementation and monitoring of the ongoing rehabilitation and final mine closure and aftercare activities:

(i) Compliance to the national regulations.

(ii) Compliance to the conditions of the ML, ECC, freshwater abstraction and wastewater discharge permits as well as all other granted statutory permits \ authorisations\ consents.

(iii) Compliance to the key Agreements \ contracts with key stakeholders such as the land owners \ unions \ employees, and.

(iv) Compliance with the Mine Closure Plan, as indicated by internal and statutory reporting.

The Proponent shall strive to continually improve on the mine's environmental performance by applying the precautionary principles as enshrined in the Environmental Management Act, 2007, Act No. 7 of 2007 and the principles of best practice to mining operations, including where cost-effective and practicable, the adoption of new best practice technologies and improved ongoing rehabilitation and final mine closure and aftercare control measures.

5.4.2 Annual Reviews of the Mine Closure Plan

The Mine Closure Plan to be prepared shall be reviewed, and if necessary revised, to the satisfaction of all the stakeholders and in consultation with stakeholders, in accordance with the requirements of the Environmental Management Act, 2007, Act No. 7 of 2007 with respect to the review, update and

approval of environmental reporting. Technical reviews will be undertaken annually and or because of the following:

- Following changes to project approval or licence conditions relating to mine closure management or monitoring.
- Following any significant mine closure related incident.
- When a relevant/significant improvement has been identified.
- For necessary or any unforeseen changes to mine closure domains.
- Where a risk assessment identifies the requirement to alter the Plan, and.
- Annually.

Closure cost estimates should be reviewed regularly to reflect changing circumstances that may be linked to the technical review. The Proponent shall on the annual basis review the cost estimates contained in Mine Closure Plan and must account for the following:

(i) Inflation and escalation.

(ii) Changes in legislation.

(iii) Changes in available technology to better address ongoing rehabilitation and final closure and aftercare risks.

(iv) Changes in the 'Life of Mine' plan (for instance, expansions, changes in process or new activities), and.

(v) Changes in stakeholder and \ or public expectations.

6. CONCLUSION AND RECOMMENDATION

6.1 Conclusions

Based on the assessment of both negative and positive impacts detailed in the EIA (Vol. 2 of 3) Report undertaken in 2011 and reviewed and updated in this report for the proposed new uranium mine development in the ML No. 177, Erongo Region Namibia, several positive and negative impacts have been identified. Overall, positive impacts of the proposed new uranium mine development outweigh the negative ones at local, regional, national and SADC levels.

The 2011 EIA (Vol. 2 of 3) also recommended that, a specialist studies on management and monitoring of occupational radiation and the preparation of a Radiation Management Plan (RMP) in accordance with the provisions of the Atomic Energy and Radiation Protection Act, 2005, (Act No. 5 of 2005), must be undertaken and approved by the National Radiation Authority (NRA) in the Ministry of Health and Social Services.

Furthermore, the 2011 EIA also recommended that separate Environmental Assessments covering scoping, EIA and EMP for all leaner infrastructures such as water pipeline, power line and main mine access road must be undertaken because they are not covered 2011 EIA nor in this updated report prepared specifically for the renewal of the ECC.

Finally, the mitigation measures to be outlined in detail in the EMP for the linear structures and RMP Reports shall cover the entire project lifecycle including exploration, preconstruction, construction, operation, and ongoing rehabilitation, decommissioning and final rehabilitation as well as the aftercare stages of the proposed new uranium mine. The implementation and monitoring of both the EMP and RMP is the full responsibility of the developer / operator Zhonghe Resources (Namibia) Development (Pty) Ltd).

6.2 Recommendations

It is hereby recommended that the proposed mine development shall go ahead and be issued with a renewed Environmental Clearance Certificate (ECC). The Proponent shall:

(i) Negotiate an Access Agreements with the land owner/s.

(ii) Pay a fair and negotiate compensation to the affected land owners where the proposed mining operations will be situated. The proposed mine will negatively affect the wellbeing and socioeconomic asserts of the land owners.

(iii) The Proponent shall adhere to all the provisions of the EMP and conditions of the Access Agreement to be entered between the Proponent and the land owner/s in line with all applicable national regulations, and.

(iv) Before entering any private property such as a private farm, the Proponent must give advance notices and obtain permission to access private properties at all times.

The following are the recommended actions to be executed by the Zhonghe Resource (Namibia) Development (Pty) Ltd as a part of the management of the impacts through implementations of the EMP are:

(i) Undertake separate EIAs for all linear infrastructures such as water pipeline, main mine access roads and power line as well as a Specialist Study on Occupational Radiation and the development of a Radiation Management Plan (RMP) to be linked to this EMP.

(ii) Radiation Management Plan (RMP) in accordance with the provisions of the Atomic Energy and Radiation Protection Act, 2005, (Act No. 5 of 2005.

(iii) Contract an Environmental Social Governance (ESG), Environmental Coordinator / Consultant / suitable in-house resources person to lead and further develop, implement and promote environmental culture through awareness raising of the workforce, contractors and sub-contractors in the field during the whole duration of the proposed project.

(iv) Provide with other support, human and financial resources, for the implementation of the proposed mitigations and effective environmental management during the planned mine project life cycle.

(v) Develop a simplified environmental induction and awareness programme for all the workforce, contractors and sub-contractors.

(vi) Where contracted service providers are likely to cause environmental impacts, these will need to identified and contract agreements need to be developed with costing provisions for environmental liabilities.

(vii) Implement internal and external monitoring of the actions and management strategies developed during the project duration and the final Environmental Monitoring report be prepared by the Environmental Coordinator / Consultant / Suitable in-house resource person and to be submitted to the regulators and to end the proposed uranium mine project, and.

(viii) Develop and implement a monitoring programme that will fit into the overall company's Environmental Management Systems (EMS) as well as for any future EIA for drilling and production phases.

All the responsibilities to ensure that the recommendations are executed accordingly, rest with the **Zhonghe Resource (Namibia) Development (Pty) Ltd**. The company must provide all appropriate resource requirements for the implementation of the EMP.

It is the responsibility of **Zhonghe Resource (Namibia) Development (Pty) Ltd** to make sure that all members of the workforce including contractors and subcontractors are aware of the EMP and its objectives.

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