Rio Tinto

Rössing Uranium Limited

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Rössing Uranium Limited

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Namibia

SOCIAL AND ENVIRONMENTAL IMPACT ASSESSMENT: PROPOSED MINING OF THE Z20 URANIUM DEPOSIT

FINAL DRAFT SCOPING REPORT

- Mining of the Z20 ore body including disposal of waste rock;
- An infrastructure corridor across the Khan River;
- Production of sulfuric acid at Rössing;
- Processing plant modifications;
- Changes to the present Tailings Storage Facility; and
- Establishment of a new High Density Tailings Storage Facility on the Rössing Dome

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FINAL DRAFT

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ABBREVIATIONS

AD	Anno Domini
ALARA	As Low As Reasonably Achievable
ATC	Arandis Town Council
BID	Background Information Document
BC	Before Christ
CBS	Central Bureau of Statistics
CSI	Corporate Social Investment
CTAN	Coastal Tourism Association of Namibia
CITES	Convention on International Trade in Endangered Species
CIX	Continuous Ion Exchange
cm	Centimetre
cm^2	Centimetre square
CO	Carbon monoxide
CO_2	Carbon dioxide
CV	Curriculum Vitae
dB	Decibel
DEM	Digital Elevation Model
DRFN	Desert Research Foundation of Namibia
EC	European Community
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment
EMP	Environmental Management Programme
EQOs	Environmental Quality Objectives
FFI	Fauna & Flora International
GDP	Gross Domestic Product
GHG	Green House Gases
GLC	Ground Level Concentration
H_2S	Hydrogen Sulphide
H_2SO_4	Sulfuric acid
Ha	Hectares
HAN	Hospitality Association of Namibia
HD	High Density
HDT	High Density Tailings
HIV/AIDS	Human Immunodeficiency Virus / Acquired Immune Deficiency Syndrome
HSEQ	Health, Safety, Environment and Quality
Hz	Hertz
IAPs	Interested and Affected Parties
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiation Protection
IFC	International Finance Corporation
ISO	International Organisation for Standardisation
ISO 14001 EMS	International Organisation for Standardisation 14001 Environmental Management System
km	Kilometre
km/h	Kilometre per Hour
KOPs	Key Observation Points
LAeq	Equivalent continuous A-weighted sound pressure level
LHU	Langer Heinrich Uranium
m	Metre
m/s	Metre per second

m^3	Cubic Metre
m^3/day	Cubic Metres per Day
m^3/h	Cubic Metres per Hour
m^3/tonne	Cubic Metres per Tonne
mamsl	Metres Above Mean Sea Level
MJ/t	Mega joules per tonne
MAWF	Ministry of Agriculture, Water and Forestry
MET	Ministry of Environment & Tourism
MET:DEA	Ministry of Environment and Tourism's Directorate of Environmental Affairs
mg	Milligram
mg/ℓ	Milligram per litre
mg/m^3	Milligram per cubic meter
MHSS	Ministry of Health & Social Services
MLA	Mine Licence Area
mm	Millimetre
mm/s	Millimetres per Second
Mm^3	Million Cubic Metres
Mm^3/a	Million Cubic Metres per Annum
MME	Ministry of Mines & Energy
MS	Management System
mSv/a	Millisieverts per Annum
Mt	Megatonne (one million metric tonnes)
MW	Megawatt
N$	Namibian Dollar
NACOMA	Namibian Coast Conservation and Management project
Namport	Namibian Ports Authority
NamPower	Namibian Power Corporation (Pty) Ltd
NamWater	Namibian Water Corporation (Pty) Ltd
NANGOF	Non-Governmental Organisation`s Forum
NBC	Namibian Broadcasting Corporation
NIMT	Namibian Industry for Mining Technology
NOx	Nitrogen oxides
NO_2	Nitrogen dioxide
NSA	Namibian Statistics Agency
O_2	Oxygen
pH	Potential Hydrogen
ppm	Parts per Million
PPP	Public Participation Process
Ripios	Spent, crushed "reject" ore, after being subjected to uranium leaching on heap leach facility
Rössing Uranium	Rio Tinto Rössing Uranium Limited
SACLAP	South African Council for the Landscape Architectural Profession
SANS	South African National Standards
SEA	Strategic Environmental Assessment
SAIEA	Southern African Institute for Environmental Assessment
SEIA	Social and Environmental Impact Assessment
SEMP	Social and Environmental Management Plan
SLR	SLR Environmental Consulting Namibia (Pty) Ltd
SO_2	Sulphur Dioxide
SX	Solvent Extraction
t	Tonne

TDS	Total Dissolved Solids
ToR	Terms of Reference
Tpd	Tonnes per day
TSF	Tailings Storage Facility
TSP	Total Suspended Particulates
U	Uranium
U_3O_8	Uranium Oxide
US$	United States Dollar
US.EPA	United States Environmental Protection Agency
UNDP	United Nations Development Programme
UV	Ultra Violet
V	Volt
VAC	Visual Absorption Capacity
VIA	Visual Impact Assessment
VOCs	Visual Object Classes
WB	World Bank Group
WHO	World Health Organisation
µSv/a	MicroSievert per Annum
ZVI	Zone of Visual Influence

EXECUTIVE SUMMARY

Introduction

Rio Tinto Rössing Uranium Limited (Rössing Uranium) appointed Aurecon Namibia (Pty) Ltd (Aurecon) and SLR Environmental Consulting (Namibia) (Pty) Ltd (SLR) to undertake a Social and Environmental Impact Assessment (SEIA) for the proposed mining of the Z20 uranium deposit.

Project location and context

The Rössing Uranium Mine is located in the Erongo Region of Namibia. The Z20 uranium deposit is situated south of the existing Rössing Uranium Mine and the Khan River, where the Mining License Area 28 overlaps with the Namib-Naukluft National Park (NNNP). The existing socio-economic and biophysical characteristics are described in the Draft Scoping Report (DSR).

Proposed project

It is envisaged that the Z20 uranium deposit would be mined as a satellite open pit as it contains uranium bearing alaskite rocks, utilising conventional blast, load and haul methodology. The Z20 deposit contains roughly 720Mt of ore and waste, of which 160Mt of ore could potentially be mined.

The proposed mining project would therefore entail the following:

- Mining of the Z20 ore body and disposal of Z20 waste rock;
- Expansion of the approved Acid Plant;
- Processing plant modifications;
- Changes to the present Tailings Storage Facility (TSF); and
- Establishment of a new High Density TSF on the Rössing Dome.

An infrastructure corridor would need to be established to link the Z20 site to the existing Rössing Uranium Mine across the Khan River, which would include:

- RopeCon/ RailCon aerial conveyor;
- Asphalt access road; and
- Other services including a water supply pipeline, power supply and fuel supply pipeline.

Please see Figure 1 for the proposed layout of these project components.

The motivation for the proposed mining project is driven by economic informants as the Z20 ore deposit is a substantial discovery in Mining License Area 28 (MLA) which will constitute a significant addition to the economic value of Rössing Uranium’s ore inventory.

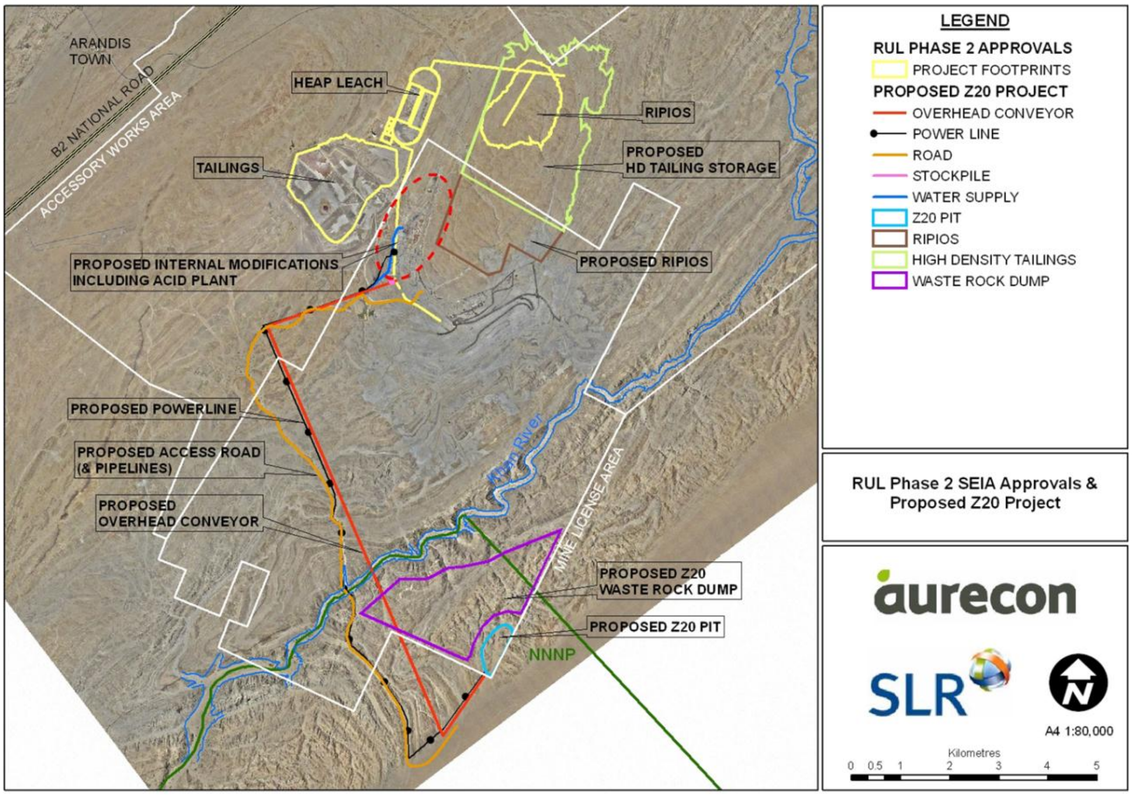

Figure 1: Proposed layout of project components

Alternatives assessed

Various alternatives were investigated during project conceptualisation phases, as per Table 1 below.

Table 1: Alternatives investigated and assessed for project components

Infrastructure corridor component	Alternatives investigated	Alternative assessed by SEIA specialists
Product transport	• Conventional troughed aerial conveyor; • Tube or pipe conveyor; • Aerial ropeway system.	Aerial ropeway system.
Access roads	• B2 to the Z20 uranium deposit; • C21 to Z20 uranium deposit; • Access from B2 via Valencia; • Access via Zhonghe Resources; and • New access.	New road from Rössing Uranium Mine to the Z20 uranium deposit (14.4km in length).
Water supply pipeline	• Attach water pipeline to conveyor system; • Below ground; • Above ground.	Combination of below ground and above ground.
Diesel supply pipeline	• Attach diesel pipeline to the conveyor; • Construct diesel pipeline above ground along the access road route;	Attaching the diesel supply line to the RopeCon/ RailCon.

	• Construct diesel pipeline below ground along the access road route; and • Transport by road tanker.	
Power supply infrastructures	Aboveground transmission lines	Above ground transmission lines
No-Go Alternative	The assessment of the no-go option requires a comparison between the options of proceeding with the project with that of not proceeding with the project. The assessment of this option requires input from the various investigations so that the full extent of social, economic and environmental considerations can be taken into account.	

Social and Environmental Impact Assessment (SEIA) Process

The activities to be undertaken as part of this SEIA are summarised in Table 5 below.

Table 2: Summary of the SEIA process

Phase 1 – Project initiation/screening (August to October 2012)
• Internal screening and appointment of independent environmental consultants (SLR and Aurecon) • Meet with MET and Ministry of Mines and Energy (MME) • Submit two applications for environmental clearance certificates to MET and copies to MME
Phase 2 – Scoping/assessment (October to December 2012)
• Notify IAPs and regulatory authorities of the proposed project (via newspaper advertisements, this document, letters, e-mails) • Public scoping meetings and open day • Key stakeholder meetings • Assess the impacts of the proposed RopeCon/ RailCon aerial conveyor • Define outstanding issues and terms of reference for further investigations relating to all other project components • Compile Scoping Report (including assessment findings and social and environmental management plan (SEMP) for the infrastructure corridor) • Make reports available for comment by regulatory authorities and other IAPs. • Submit a final Scoping Report, SEMP (for RopeCon/ RailCon aerial conveyor) and Issues and Response Report to MET
Phase 3 – SEIA/SEMP (all other project components) (January to May 2013)
• Commission outstanding specialist investigations • Assess impacts of proposed project and compile SEIA/SEMP report • Make the report available to regulatory authorities and other IAPs for review • Submit final SEIA/SEMP report and Issues and Response Report to MET • Circulate notification of record of decision to IAPs

Public Participation Process

The scoping phase public participation process is summarised in Table 2 below:

Table 2: Summary of the SEIA Scoping public participate process

TASK	DETAILS	DATE

<table>
<tr><th colspan="3">Stakeholders notification (relevant authorities and IAPs)</th></tr>
<tr><td>Notification to MET (DEA) and submit Applications for Authorisation</td><td>SLR met with MET:DEA to provide information on the proposed project; to discuss the proposed SEIA process to be followed; to provide information on the public participation process; and to obtain initial comments on the project and the proposed SEIA process. A follow up meeting was held with the MET Environmental Commissioner on the 7th of November 2012.

The two applications for authorisation were submitted to MET and copies submitted to MME:
1. The Infrastructure corridor associated with the proposed mining of the Z20 resource by Rössing Uranium Ltd
2. The proposed mining of the Z20 resource by Rössing Uranium Ltd.

Refer to Annexure B for the minutes of the meeting with MET (DEA) and a follow up meeting with the MET Environmental Commissioner, as well as proof of submission of the two applications.</td><td>18 October 2012</td></tr>
<tr><td>Stakeholder identification</td><td>A stakeholder database was developed for the project by referring to various other projects' databases in the Erongo Region. This database will be updated during the SEIA as required. A copy of the IAP database is attached in Annexure B.</td><td>September/ October 2012</td></tr>
<tr><td>Distribution of background information document (BID)</td><td>BIDs with covering letters were distributed via email to the authorities and IAPs on Rössing Uranium's stakeholder database and hard copies were placed at the following places:
• Swakopmund Public library,
• Arandis Public library, and
• The Uranium Institute in Swakopmund.

Hard copies of the BID were also distributed during the Scoping focus group meetings, public meetings and public open day.
The purpose of the BID was to provide stakeholders with the opportunity to register as IAPs in the SEIA process and to obtain their initial comments on the proposed mining project and SEIA process of the Z20 uranium deposit. A copy of the BID is attached in Annexure B.</td><td>12 October 2012</td></tr>
<tr><td>Site notices</td><td>Site notices were erected to inform the general public of the proposed project and the public participation process. One was placed at Rössing Uranium's Swakopmund office and another at the entrance to the mine site. A further nine copies of these notices (A3 size) were placed at the following places in Swakopmund:
• Stadtmitte;
• Woermann & Brock in Mondesa;
• Woermann & Brock in Vineta;
• Spar in Ocean View;
• Two inside the Woermann & Brock complex in the Sam Nujoma Drive;
• Pick & Pay;
• Rossmund Conference Centre; and
• Brauhaus Restaurant.
Photos of the site notices and notices around Swakopmund are</td><td>12 October 2012</td></tr>
</table>

	attached in Annexure B.	
Newspaper Advertisements	Block advertisements were placed as follows: • The *Republikein*; and • The *Namib Times*. Copies of the advertisements are attached in Annexure B.	**12 & 19 October 2012**
Focus Group Meetings, public meetings, open day and submission of comments		
Focus group meetings	Focus group meetings were held with key stakeholders and affected parties as follows: • Representatives of the media in Swakopmund; • The ATC in Arandis; • The Labour Unions at Rössing Uranium; • Members of the Erongo Regional Council, NACOMA and the local Ministry of Environmental and Tourism (Directorate Parks and Wildlife) at the Rossmund Conference Centre in Swakopmund. The Swakopmund Town Council was invited to the same meeting but an apology was send that no one could attend. The Director and Chief Park Warden from the MET – Directorate of Parks and Wildlife in Windhoek. • Two separate meetings with representatives from MAWF (Hydrology and Geohydrology). • The Mining Commissioner (Ministry of Mines and Energy) in Windhoek. The same project information was presented at all the meetings. (Refer to Annexure B for a copy of the information that was presented at the meetings). A focus group meeting was arranged for the River Farmers and the Tourism Industry in Swakopmund but no one attended. A number of apologies were, however, received.	**23-26 October 2012**
Open day and Public meetings	A public meeting was held on the 23rd of October in Arandis. This meeting was very well attended. A public open day was held between 13:00 and 18:00 on 24 October 2012 at the Rossmund Conference Centre in Swakopmund where relevant project and social and environmental related information was presented by means of a poster display. A public meeting followed in the same venue at 18:00 on the same day where the project and SEIA process were presented and comments/concerns recovered and discussed. The same project information was presented at all the meetings.	**23-26 October 2012**
Comments and Responses	Minutes of the meetings and all comments received during the meetings and open day, by email, fax and SMS as well as the Summary Issues and Response Report are attached in Annexure B.	**12 - 31 October 2012**
Review of Draft Scoping Report		
IAPs and authorities (excluding MET) review of scoping report and SEMP	Copies of the Scoping Report (and SEMP) are available for review at the following places: • Swakopmund Public Library, • Arandis Public Library; • The Uranium Institute in Swakopmund; and	**16 November to 14 December 2012**

	• Rössing Uranium corporate office in Swakopmund. Electronic copies of the report will be made available on request (on a CD). Summaries of the scoping report were distributed to all authorities and IAPs that are registered on the IAP database via e-mail. Authorities and IAPs will be given 21 days to review the scoping report and submit comments in writing to SLR. The closing date for comments is 14 December 2012.	
MET review of scoping report and SEMP	A copy of the final scoping report, including authority and IAP review comments, will be delivered to MET on completion of the public review process.	**December 2012**

Potential socio-economic and biophysical impacts

Potential impacts on the social and biophysical environment associated with all the phases of the proposed project were identified during the screening and scoping process and are summarised in
Table 3 below.

Table 3: Potential impacts associated with project components

Aspects	Potential impacts
Potential social and environmental impacts associated with the infrastructure corridor	
Socio-economic	• Creation of jobs and other economic opportunities • Overarching social impact on public health and safety • Additional electricity requirements impacting on the national power grid • Construction and operational related health, safety and aesthetic impacts • Negative impacts related to a construction camp
Air quality	• Particle emissions during road construction • Release of gases and particles from vehicles/construction equipment tailpipe emissions • Wind-blown dust from conveyor • Dust generation from tipping • Gases and Particulates released as a result of rehabilitation activities
Visual	• Visual impact caused by landscape changes
Noise	• Noise pollution resulting from blasting activities, land clearing and bulk earthworks • Noise pollution as a result of helicopter operations • Nuisance factor caused to local residents and tourists due to increased noise
Radiation	• Fugitive radioactive dust emissions from the ore transport • Spillage of ore from aerial conveyor
Biodiversity	• Physical destruction and/or general disturbance of biodiversity
Archaeology	• Altering of sensitive archaeological and/or heritage sites
Surface water	• Spillage of ore and leakage of diesel from aerial conveyor and diesel supply line
Potential social and environmental impacts associated with other project components	
Socio-economic	• Impact on the economic sustainability of Arandis • Positive impact resulting from temporary and permanent employment creation • The potential impacts on occupational and public health and safety • Impact on housing and accommodation

	• Impact on local economies • Impact on the availability of schooling • Impact on service infrastructure • Operation of the plant would require additional electricity supply • Impact on human health through accidental releases of the hazardous compounds • Construction and operational related health, safety and aesthetic impacts • Influx of people • Increase in social pathologies • Negative impacts related to a construction camp
Air quality	• Air emissions and occupational, public health and safety • Potential increase in sulphur dioxide, nitrogen dioxide, hydrogen sulphide, carbon monoxide and gaseous emissions • Potential increase in PM_{10} and total suspended particles • Impacts associated with Blasting Activities
Visual	• Visual impact on surrounding receptors
Noise	• Blasting noise and vibration resultant from mining activities
Radiation	• Additional sources of radioactive dust emissions • Fugitive radioactive dust emissions from construction activities • Increased emission of radon gas • Exposure to radiation though surface water and groundwater pathways
Biodiversity	• Physical destruction and/or general disturbance of biodiversity
Archaeology	• Potential disturbance/destruction of archaeological sites and landscapes.
Surface water	• Increased water consumption • Changing surface water flow through impeding existing drainage patterns • Erosion of soil from exposed areas
Groundwater	• Pollution of groundwater • Dewatering the Z20 mine pit will lower the existing ground water levels
Traffic	• Increase in traffic volumes to the mine impacting on the B2 and the B2 intersection

Assessment methodology

The methodology applied during this SEIA entailed a rating system where each impact is described according to fixed criteria to ascertain the significance of the impact, with and without mitigation.

Impact assessment

A discussion of all the potential impacts that were assessed for the proposed Z20 infrastructure corridor is provided below. A tabulated summary of the cumulative impacts is presented in Table 4 below.

Socio-economic conclusions

Most of the socio-economic issues were covered by the other specialists investigations. Therefore the conclusions for the visual-, air quality-, noise-, radiation- and biodiversity impact assessments that follows below are relevant as well as the SEMP.

The socio-economic impacts described in Section 8 shall be investigated and assessed further in the SEIA phase, and mitigation measures will be suggested.

Visual impact assessment conclusions

The Erongo Regions' most predominant features are the extreme arid nature of the coastline and surrounding Namib Desert. A component of the Erongo Region's sense of place is created by the mining industry, which plays an important role in employment, mineral production, total export earnings and social advancement in Namibia.

The Z20 uranium deposit is located south of the Khan River in the NNNP. The Khan River was identified by MME (2010) as a special red flag area and rated high for this category. The landscape along the corridor is dominated by the rocky outcrops formed by the erosion of the Khan River and a small section of the gravel plains of the Welwitschia plains to the east. With the large rocky outcrops surrounding the meandering dry Khan River, the landscape value is rated as Moderate to High. As the proposed corridor is mainly located in the lower-lying valley areas of the Panner Gorge, Khan River and Khan River tributary, the visibility of the project is contained and has a local geographic zone of influence.

The remoteness of the location reduces the visual exposure to people other than visitors in the Khan River that will be subjected to high exposure The Khan River is a known 4x4 route that is utilised by local 'Swakopmunders' and tourists for desert recreation. Should permission be granted for this proposal, it must be recognised that the current landscape character of this section of the Khan River area will be degraded.

Without mitigation, the visual significance would be High Negative due to permanent high exposure to the Khan River receptors and the proximity to the NNNP.

Should the overhead conveyor not be removed post closure, landscape decay could take place and further reduce the attraction value of the Khan River and surrounding areas. With effective mitigation, the visual significance would be reduced to Moderate in the long term with opportunities for the proposed Z20 access road winding through the Panner Gorge and across the Khan River to become a tourist route.

Biodiversity impact assessment conclusions

The current assessment showed that there are no fatal flaws from a biodiversity perspective and that most impacts can potentially be decreased to at least a level of Low to Medium Negative with appropriate mitigation or avoidance.

Important exceptions to the rule are the expected loss of two springs which could be a critical resource for numerous animals and plants and the likelihood of cumulative impacts both because of this loss and as a result of interference of movement of animals by the construction and maintenance of the access road and water pipeline. Additional cumulative impacts could occur as a result of the associated loss of small parcels of habitat in the important Khan River Mountain / Hillslope habitats.

The loss of the springs cannot be mitigated and can only be avoided by an alternative route for the access road.

There is a proviso on the expected impacts as a result of the loss of the two springs and the interference of movement by the road and pipeline. The magnitude, extent and importance of these impacts can only be assumed at this stage because there are no data available on the distribution, types and temporal dynamics of natural water points, or on the frequency of use of these resources by animals.

Archaeology impact assessment conclusions

The duration of impacts on archaeological sites must be considered as long term. However, there will be little direct impact from the aerial ropeway other than the footings of the support pylons. The other components of the infrastructure corridor will be confined to the Panner Gorge on the northern side of the Khan valley, and the area of possible encroachment on the archaeological sites is easily defined and managed.

The significance of impact in the case of the Pleistocene sites would be considered as Medium to High significance without mitigation. In the case of the relatively insignificant sites (i.e. all except the four Pleistocene sites) the impact rating of the sites could be reduced adopting appropriate mitigation measures.

Noise impact assessment conclusions

A conservative approach was followed in the estimation of predicted noise impacts. Impacts were predicted for the day- and night-time hour during which noise impacts would be most significant. Construction and decommissioning phase noise impacts are likely to be similar.
Impacts were predicted for the day- and night-time hour during which noise impacts would be most significant as follows:

- The increase in noise level over reported baseline noise levels for the construction phase were:
    - Between 1.9km and 5km during the day.
- The increase in noise levels over reported baseline noise levels for the operational phase were:
    - Between 500m and 2.5km during the day; and
    - Between 1.4km and 1.7km during the night.
- The significance of cumulative noise impacts at noise sensitive receptors located on the plains to the north of the Khan River is Very Low negative.
- The significance of cumulative noise impacts on visitors to Khan River valley close to the infrastructure corridor crossing is Medium negative due to very quiet surroundings.
- Overall, with noise mitigation and management measures in place, impacts may be reduced to range between Very Low negative and Medium negative.

Surface Water impact assessment conclusions

The planned infrastructure corridor for the Z20 mining area will consist of amongst others an aerial RopeCon/ RailCon conveyor system and a road bridge. These will cross the Khan River in the vicinity of Panner Gorge, just south of the current Rössing Mine.

The aerial conveyor system will be mounted on towers located on the rocky ridges at the edge of the river channel so this infrastructure will have no physical footprint in the Khan River.

The road bridge will cross the Khan River at Panner Gorge and will consist of a double-lane road deck approximately 10m wide (1 lane per direction) and elevated 3.6m above the river channel. From the review of available literature on rainfall and flooding in the area of interest, it is concluded that the likely risks to surface water associated with these structures are Low to Very Low.

Air Quality impact assessment conclusions

PM_{10} ground level concentrations and dust fallout rates for the proposed operations were assessed in order to identify all possible detrimental impacts on the surrounding environment and human health. It can be concluded that the proposed Z20 infrastructure corridor will have high PM_{10} impacts near the conveyor transfer points with no mitigation in place. With the recommended mitigation measures applied, concentrations will be retained at the source. Dust fallout can be of high significance along the conveyor if not controlled, but is assessed to be low based on the proposed RopeCon/ RailCon design and enclosure of the transfer points.

Radiation impact assessment conclusions

The total incremental doses due to unmitigated or mitigated infrastructure corridor operations are all below 10µSv/a. Cumulative doses, from the baseline and the proposed infrastructure corridor operations, ranged from a trivial 4.2µSv/a to a maximum value of 95.9µSv/a (at the Khan Mine site during unmitigated operations).

This low dose is approximately three times lower than the dose constraint of 300µSv/a. There seems to be no significant difference between the impacts of the current baseline operations and the cumulative impacts where the infrastructure corridor operations are added to the baseline operations.

There is no significant difference between the No-Go option and the go-ahead of the construction and operation of the infrastructure corridor. The decision to go forward with this project is therefore not depended on the radiological assessment, but rather on other specialist studies and/or project considerations.

The SEIA impact significance is therefore Very Low negative for both unmitigated and mitigated operations. There seems to be no significant difference between the impacts of the current baseline operations and the cumulative impacts where the infrastructure corridor operations are added to the baseline operations. Since the impact significance is low for both instances it implies that the No-Go option is not dependent on the outcome of this radiological assessment, but rather other specialist studies and project considerations.

Table 4: Summary of Impact Assessment Ratings for all impacts

Impact	Significance rating	
	Without mitigation	With mitigation
Socio-economic		
No social study conducted for phase 1		
Air quality		
PM_{10} impact during the construction phase	Low (-)	Low (-)
PM_{10} impact during the operational phase	High (-)	Low (-)
PM_{10} impact during the decommissioning phase	Low (-)	Very low (-)
Dust fallout impact during the construction phase	Low (-)	Low (-)
Dust fallout impact during the operational phase	High (-)	Low (-)
Dust fallout impact during the decommissioning phase	Low (-)	Very low (-)

Radiation		
Dust inhalation, external exposure and radon inhalation during construction and operational	Very low (-)	Very low (-)
Biodiversity		
Impact on watercourse habitat loss due to road construction	High (-)	Low (-)
Impact of road construction and operation on animal movement	Medium (-)	Low to medium (-)
Impact of road construction and operation on Husab Sand Lizard	High (-)	Low (-)
Impact of aquatic habitat loss due to road construction	High (-)	High (-)
Impact of Hillslope habitat loss due to conveyor construction	Very low (-)	Very low (-)
Impact of conveyor and power line on bird populations	Low (-)	Very low (-)
Impact of road operation on susceptible vertebrate populations	Low (-)	Very low (-)
Impact on Khan Hillslope habitat range-restricted endemics	Medium (-)	Medium (-)
Impact on integrity of NNNP	High (-)	High (-)
Archaeology		
Impact on sensitive archaeological sites	High (-)	Medium (-)
Noise		
Day time cumulative noise impact significance at noise sensitive receptors located on the ay plains as a result of the infrastructure corridor	Very low (-)	Very low (-)
Construction phase impacts within the Khan River valley	Medium (-)	Medium (-)
Day time cumulative noise impact significance at noise sensitive receptors located on the plains as a result of the infrastructure corridor	Very low (-)	Very low (-)
Night time cumulative noise impact significance at noise sensitive receptors located on the plains as a result of the infrastructure corridor	Very low (-)	Very low (-)
Day time cumulative noise impact significance within the Khan River valley as a result of the infrastructure corridor	High (-)	Medium (-)
Night time cumulative noise impact significance within the Khan River valley as a result of the infrastructure corridor	High (-)	Medium (-)
Surface water		
Impact assessment of aerial conveyor on surface water	Low	Very low
Impact assessment of access road on surface water	Low	Very low
Visual		
Construction phase impact assessment rating	Medium (-)	Medium (-)
Operational phase impact assessment rating	High (-)	Medium to High (-)
Decommission phase impact assessment rating	High (-)	Low (+)

The Terms of References for the specific work required to assess the social and environmental impacts associated with the other project components are described in the Final Draft Scoping Report.

SEIA STATEMENT

In the mitigated scenario, the potential negative impacts associated with the proposed infrastructure corridor are expected to be mainly between low and medium significance.

However three potential impacts relating to visual and biodiversity cannot be mitigated and the potential impacts cannot be avoided.

The potential cumulative negative impacts associated with the integrity of the NNNP was assessed as high and cannot be mitigated, taking into consideration existing and future mining and exploration activities. The proposed linear infrastructure south of the Khan River is also located within the NNNP and will cumulatively contribute to this issue.

The other potential impact that cannot be mitigated relates specifically to the proposed road and the potential impact on the Khan Hillslope habitat range-restricted endemics (i.e. loss of two springs which could be a critical resource for numerous animals and plants). It must further be noted that the potential for mitigation to decrease expected impacts on animal movement is unknown and the assessment for this impact is therefore dependent on adequately demonstrating the extent of use of the tributaries and the bridge underpass by animals, to put the impact into its proper regional context.

There is a proviso on the expected impacts as a result of the loss of the two springs and the interference of movement by the road and pipeline. The magnitude, extent and importance of these impacts can only be assumed at this stage because there are no data available on the distribution, types and temporal dynamics of natural water points or on the frequency of use of these resources by animals.

A study therefore needs to be done to properly quantify the extent of the risk that these developments pose, and to better place the overall impact into context, or to avoid the proposed road route by an alternative route for access to the proposed Z20 mining area.

Also, the proposed infrastructure corridor will run to a certain extent parallel to the proposed (already approved) linear infrastructure for the Husab mine. The two proposed “infrastructure corridors” cross the Khan River approximately 5km from each other. This contradicts the recommendation provided in the SEMP for mines to develop infrastructure corridors together, so that lines for road, power and water are clustered together to reduce to total area of disturbance.

Cumulative impacts from repeated views of mining related road and other infrastructure within the river valley could degrade the existing natural wilderness sense of place and reduce the viability of the Khan River as a tourist attraction.

In this regard, the collaboration between different mines (in this case between Rössing Uranium and Swakop Uranium) must be considered as a preferred option should the proposed Z20 mining and associated activities be approved.

It is therefore recommended that Rössing Uranium should give serious consideration to a solution for the Z20 project that does not require construction of a highly intrusive road. Two possible alternatives might be a road based on the largely unused road to Zhonghe Resources, or a possible shared-use agreement with the new Husab Project access road. Alternatives should be based on a general principle of reducing the number of infrastructure corridors across the Khan valley.

The RopeCon/ RailCon aerial conveyor system will, however, have less significant impacts when compared to the impacts of the road with its associated infrastructure (i.e. waterline and powerline). It is therefore the opinion of Aurecon and SLR that the RopeCon/ RailCon aerial conveyor can be approved based on this assessment. Approval of the other components could only be considered pending the proposed further studies prescribed in this report.

Way forward

The Draft Scoping report will be available for review for a 21-day comment period from 16 November 2012 to 14 December 2012. The closing date for comments is 14 December 2012 after which a copy of the final scoping report, including authority and IAP review comments, will be delivered to MET on completion of the public review process.

1 INTRODUCTION

The purpose of this section is to provide relevant background to Rio Tinto Rössing Uranium Limited and an introduction to the proposed mining of the Z20 uranium deposit, the associated infrastructure requirements and proposed modifications to the existing processing plant. This section further describes the motivation behind this project and introduces the social and environmental impact assessment (SEIA) process.

1.1 INTRODUCTION

Rössing Uranium has appointed Aurecon Namibia (Pty) Ltd (Aurecon) and SLR Environmental Consulting (Namibia) (Pty) Ltd (SLR) to jointly manage the Social and Environmental Impact Assessments (SEIA[1]) process for the proposed mining of the Z20 uranium deposit. SEIAs are regulated by the Ministry of Environment and Tourism (MET) in terms of the Environmental Management Act, 7 of 2007, which was gazetted on 27 December 2007 (Government Gazette No. 3966). The associated regulations, "Environmental Impact Assessment (EIA) Regulations: Environmental Management Act, 2007 (Government Gazette No. 4878)" were promulgated on 6 February 2012.

This report is structured as follows:

Section One:	Provides the introduction, the motivation for the project, introduces the SEIA process and describes the assumptions and limitations
Section Two:	Describes the scoping methodology including the public participation process
Section Three:	Describes the legal framework
Section Four:	Describes the current environment including the existing social and biophysical environment
Section Five:	Describes the proposed project
Section Six:	Discusses the identified alternatives
Section Seven:	Discusses the assessment methodology
Section Eight:	Describes identified social and environment aspects and potential impacts
Section Nine:	Assess impacts related to the infrastructure corridor
Section Ten:	Discusses the Terms of Reference for further investigations
Section Eleven:	Concludes the report and describes the way forward

[1] It is recognised that the term "environment" when applied in the context of an environmental impact assessment refers to the total environment, encompassing both the socio-economic and biophysical environments. However, Rössing Uranium prefers to retain the term "social" in the title of the present environmental impact assessment, as a clear indication of their commitment to the human element in the affected environment and in keeping with their Sustainable Development Framework.

1.2 PROJECT BACKGROUND AND INTRODUCTION

Uranium was discovered in the Namib Desert in 1928, but it was not until intensive exploration in the late 1950s that much interest was shown in the area. Rio Tinto Zinc (Rössing Uranium) secured the rights to the low-grade Rössing deposits in 1966. Ten years later, Rössing Uranium, Namibia's first commercial uranium mine, began operating.

Rössing Uranium's current mining operation is located approximately 70km inland from the coastal town of Swakopmund, north of the Khan River, in the Erongo Region of Namibia and has been operational since 1976. These mining operations include the Rössing open pit (blast, load and haul operation), waste rock disposal, ore processing, tailings disposal and ancillary activities.

The mine operates under the approval of a mining licence, environmental clearances and an approved Social Environmental Management Plan (SEMP). The Mining License Area 28 (ML28) overlaps the Namib Naukluft National Park (NNNP) south of the Khan River.

Rössing Uranium is investigating mining the Z20 ore body located south of the Khan River. In order to access the Z20 ore body, an infrastructure corridor would need to be established linking the Z20 site to the existing Rössing Uranium Mine. This infrastructure corridor would facilitate the transport of crushed ore generated at the Z20site to the existing Rössing Uranium facilities for processing, where certain modifications would also be required. The maximum extent of the envisaged project would entail, in summary, the following:

- Mining of the Z20 ore body;
- Disposal of Z20 waste rock onto the planned waste rock dump;
- Establishment of an infrastructure corridor across the Khan River housing an RopeCon/ RailCon[2] aerial conveyor, road and other services (water, power and fuel supply);
- Expansion of the approved Acid Plant;
- Processing plant modifications;
- Changes to the present Tailings Storage Facility (TSF); and
- Establishment of a new High Density TSF on the Rössing Dome.

The above mentioned is described in detail in Section 5 of this Scoping Report.

1.2.1 Existing Environmental Approvals

Rössing Uranium has previously been granted Environmental Clearances for the following activities:

- A sulfuric acid manufacturing plant;
- Associated sulphur storage on the mine;
- Transport of sulphur from the Port of Walvis Bay;
- A radiometric ore sorter plant;
- Mining of an ore body known as SK4;
- Sulphur handling facility in the Port of Walvis Bay;
- Extension of the current mining activities in the existing SJ open pit;

[2] RopeCon/ RailCon is an aerial conveyor system designed to transport product over undulating terrain- see Section 5.2.2

- Expanding the waste rock disposal capacity;
- Establishment of a new crushing plant;
- Expanding the tailings disposal capacity;
- Establishment of an acid heap leaching facility;
- Establishment of a ripios (spent, crushed “reject” ore, after being subjected to uranium leaching on heap leach facility) disposal area; and
- Additional plant infrastructure associated with the above.

1.3 MOTIVATION FOR THE PROJECT

There are currently two uranium mines operating in Namibia namely Rössing Uranium and Langer Heinrich. A third uranium mine, owned by Areva, is under construction. There are about 10 companies busy with prospecting and exploration for uranium in Namibia. Exploration licenses are issued by the Namibian government. Rössing is a significant and growing long term supplier of uranium to the world’s nuclear power industry, currently supplying about 3.9% of the world production of primary produced uranium oxide.

In the long term Rössing Uranium has a positive outlook on future business. The nuclear power industry is growing, and is being recognised as a clean, efficient, carbon free source of power, which can assist in combating global warming. Rössing Uranium therefore remains focused on both expanding their operations and also extending their mine life beyond 2023.

Rössing Uranium is continuing its planning for expansion options but, as for all Rio Tinto growth projects the timing of any capital commitments is continually reviewed. This allows the company to preserve as many options as possible, enhancing adaptability, which is key to success in the current market environment.

The motivation for the proposed mining project is therefore driven by economic informants. The Z20 ore deposit is a substantial discovery of the recent exploration activities conducted in the southern section of its Mining Licence Area (MLA). Current records indicate that the Z20 resource is similar in size to that of the new mine that will be developed to the south of Rössing Uranium. This mine is called the Husab Mine and it is owned by Swakop Uranium. The Z20 pit will therefore be similar in size to the proposed Zone 1 and Zone 2 to be developed at Husab. The Z20 pit will constitute a significant addition to the economic value of Rössing Uranium’s ore inventory.

Rössing Uranium is a major player in the Namibian mining industry, with significant contributions in sourcing of goods and services, training and development and community investments. At the end of 2011, the mine had a workforce complement of around 1,600 employees, of whom 98% were Namibians. Rössing has a stated strategic focus on training and developing its employees, and addressing skills shortages. To meet this goal, the company invests in its human capital by offering a wide range of improvement programmes and leadership development programmes, and capitalises on Rio Tinto’s exchange programmes. Rössing’s corporate social responsibility programmes extend into the work of the Rössing Foundation and have provided support in the fields of the environment, education, health and recreation for the past 30 years. The mine thus has a comprehensive Corporate Social Investment (CSI) programme, as well as contributing a fixed percentage of profits to the Rössing Foundation. Over the past five years more than N$120 million was invested in CSI programmes.

The mining project thus has the potential to benefit the country, society and the surrounding communities both directly (i.e. in terms of wages, taxes, etc.) and indirectly (i.e. in terms of procurement of goods and services, increased spending power of employees as a result of the creation of new jobs at the mine).

1.4 SEIA PROCESS

1.4.1 Approach to SEIA

The SEIA Team, in liaison with Rössing Uranium and based on discussions with MET during the initiation/screening phase, established that the infrastructure corridor could be subject to a Scoping Phase only, taking the following into consideration:

The potential social and environmental impacts relating to this type of activity (linear infrastructure) are basically well understood;

- The receiving socio-economic and biophysical environment have been studied and contextualised in detail;
- Corridor infrastructure (especially the RopeCon/ RailCon aerial conveyor) is on the critical path from a project planning point of view; and
- Additional input/assessment requirements from environmental specialists have been identified and will be included in the Scoping Report. These will be supplemented (where required) by input from Interested and Affected Parties (IAPs) during the public participation process.

The scoping phase will therefore include an assessment of the proposed infrastructure corridor and a separate SEMP (relating to the infrastructure corridor), which would enable MET to make a decision on this part of the project after the scoping phase already.

1.4.2 Activities to be undertaken in the SEIA

The activities to be undertaken as part of this SEIA are summarised in Table 5 below.

Table 5: Summary of the SEIA process

Phase 1 – Project initiation/screening (August to October 2012)
• Internal screening and appointment of independent environmental consultants (SLR and Aurecon) • Meet with MET and Ministry of Mines and Energy (MME) • Submit two applications for environmental clearance certificates to MET and copies to MME
Phase 2 – Scoping/assessment (October to December 2012)
• Notify IAPs and regulatory authorities of the proposed project (via newspaper advertisements, this document, letters, e-mails) • Public scoping meetings and open day • Key stakeholder meetings • Assess the impacts of the proposed RopeCon/ RailCon aerial conveyor • Define outstanding issues and terms of reference for further investigations relating to all other project components • Compile Scoping Report (including assessment findings and social and environmental management plan (SEMP) for the infrastructure corridor) • Make reports available for comment by regulatory authorities and other IAPs

• Submit a final Scoping Report, SEMP (for RopeCon/ RailCon aerial conveyor) and Issues and Response Report to MET
Phase 3 – SEIA/SEMP (all other project components) **(January to May 2013)**
• Commission outstanding specialist investigations • Assess impacts of proposed project and compile SEIA/SEMP report • Make the report available to regulatory authorities and other IAPs for review • Submit final SEIA/SEMP report and Issues and Response Report to MET • Circulate notification of record of decision to IAPs

1.4.3 SEIA Team

Aurecon and SLR have selected a group of highly experienced specialists and multi-disciplinary practitioners in order to execute this project as efficiently as possible. Where possible, team members with experience in the area and with Rössing Uranium projects/processes, have been selected.

The team of consultants and specialists as well as a description of the function and/or specialist discipline is included in the Table 6 below.

Curriculum Vitae's (CVs) of the SEIA Project Management Team (Aurecon and SLR) are included in Annexure A.

Table 6: SEIA Team

Area of Responsibility	**Specialist Name**	**Company**
Project Director / Aurecon Namibia Country Manager	Lukie van Staden	Aurecon
Project Technical Director / Contract Manager / Internal Reviewer	Andries van der Merwe	Aurecon
Local Coordinator / Joint Project Manager	Werner Petrick	SLR
Joint Project Manager	Stephan van den Berg	Aurecon
Project Support Staff	Ilze Rautenbach	Aurecon
Project Support Staff	Robyn Christians	SLR
Project Support Staff	Karen de Bruyn	Aurecon
Project Support Staff	Grace Shipepo	Aurecon
Internal reviewer	Brandon Stobart	SLR
Biodiversity Specialist	Dr. John Irish Dr. Theo Wassenaar	Biodata African Wilderness Restoration
Socio-Economic Specialist	Ilse Aucamp San-Marie Aucamp	Ptersa Environmental Management Consultants
Geohydrology Specialist	Jeff Jolly	RPS Aquaterra
Visual Specialist	Steve Stead	VRMA
Archaeology Specialist	Dr. John Kinahan	QRS
Traffic Specialist	Theo Potgieter	Burmeister & Partners

Air Quality Specialist	Hanlie Liebenberg-Enslin	Airshed Planning Professionals
Noise Specialist	Nicolette von Reiche	Airshed Planning Professionals
Public Dose Specialist	Dr. Dawid de Villiers	NECSA
Independent PPP Meeting Facilitator	Bea Whitaker	Independent
Surface Water Specialist	Jonathan Church	SLR

2 LEGAL FRAMEWORK

This section describes the policy and legal framework within which the SEIA is undertaken.

2.1 THE CONSTITUTION OF THE REPUBLIC OF NAMIBIA

There are two clauses contained in the Namibian Constitution that are of particular relevance to sound environmental management practice, viz. articles 91(c) and 95(l). In summary, these refer to:

- guarding against over-utilisation of biological natural resources;
- limiting over-exploitation of non-renewable resources;
- ensuring ecosystem functionality;
- protecting Namibia's sense of place and character;
- maintaining biological diversity; and
- pursuing sustainable natural resource use.

The State is thus committed to actively promoting and maintaining the environmental welfare of Namibians by formulating and institutionalising policies that can realise the above-mentioned sustainable development objectives.

2.2 VISION 2030

The principles that underpin Vision 2030[3], a policy framework for Namibia's long-term national development, comprise the following:

- good governance;
- partnership;
- capacity enhancement;
- comparative advantage;
- sustainable development;
- economic growth;
- national sovereignty and human integrity;
- environment; and
- peace and security.

2.3 APPLICABLE LAWS AND POLICIES, STANDARDS AND CONVENTIONS

In order to protect the environment and ensure that projects such as mining of the Z20 Uranium deposit project is undertaken in an environmentally responsible manner, there are applicable several laws and policies, standards and conventions. These are reflected below. This section draws information from the Strategic Environmental Assessment for the central Namib Uranium Rush (SEA)

[3]Derived from Namibia's Green Plan drafted by MET in 1992 and followed by the sequence of National Development Plans.

(MME, 2010) and other legal sources in Namibia. It also considers international treaties such as the Convention on Biological Diversity and the Equator Principles.

2.3.1 Legislation relating to socio-economic issues

- Communal Land Act (2002);
- Hazardous Substances Ordinance (1956);
- Labour Act (1992);
- Marriage Equality Act (2002);
- Traditional Authorities Act (1995);
- National Employment Policy (1997);
- Pending Minerals Safety Bill;
- Primary Health Care Policy (1990);
- Public Health Act (1919);
- Road Traffic and Transport Act (1999); and
- National Code on Human Immunodeficiency Virus / Acquired Immune Deficiency Syndrome (HIV/AIDS) and Employment (1996).

2.3.2 Namibia's Environmental Assessment Policy of 1995

Namibia's Environmental Assessment Policy promotes informed decision making through the requirement of SEIAs for listed programmes and projects. Annexure B of the Policy contains a schedule of activities that may have significant detrimental effects on the environment and which require authorisation from MET (DEA). A more detailed list of activities is provided in the EIA Regulations.

2.3.3 The Environmental Management Act

In giving effect to articles 91(c) and 95(l) of the Constitution of Namibia, general principles for sound management of the environment and natural resources in an integrated manner have been formulated. This has resulted in an Environmental Assessment and Management Act being approved by the Namibian Parliament in October 2007. It was gazetted on 27 December 2007 as the Environmental Management Act (Act No. 7 of 2007), Government Gazette No. 3966. Part 1 of the Environmental Management Act describes the various rights and obligations that pertain to citizens and the Government alike, including an environment that does not pose threats to human health, proper protection of the environment, broadened *locus standi* on the part of individuals and communities, and reasonable access to information regarding the state of the environment.

Part 2 of the Act sets out 13 principles of environmental management, as follows:

- Renewable resources shall be utilised on a sustainable basis for the benefit of current and future generations of Namibians;
- Community involvement in natural resource management and sharing in the resulting benefits shall be promoted and facilitated;
- Public participation in decision-making affecting the environment shall be promoted;
- Fair and equitable access to natural resources shall be promoted;
- Equitable access to sufficient water of acceptable quality and adequate sanitation shall be promoted and the water needs of ecological systems shall be fulfilled to ensure the sustainability of such systems;
- The precautionary principle and the principle of preventative action shall be applied;

- There shall be prior environmental assessment of projects and proposals which may significantly affect the environment or use of natural resources;
- Sustainable development shall be promoted in land-use planning;
- Namibia's movable and immovable cultural and natural heritage, including its biodiversity, shall be protected and respected for the benefit of current and future generations;
- Generators of waste and polluting substances shall adopt the best practicable environmental option to reduce such generation at source;
- The polluter pays principle shall be applied;
- Reduction, reuse and recycling of waste shall be promoted;
- There shall be no importation of waste into Namibia; and
- The List of Activities that may not be undertaken without an Environmental Clearance Certificate and the Environmental Impact Assessment Regulations: Environmental Management Act, 2007 (Government Gazette No. 4878) were promulgated on 6 February 2012.

2.3.3.1 Relevant Listed activities

The following listed activities in terms of the Environmental Impact Assessment Regulations: Environmental Management Act, 2007 are applicable to this project:

Mining and Quarrying

3.1 The construction of facilities for any process or activities which requires a license, right or other form of authorization, and the renewal of a license, right or other form of authorization, in terms of the Minerals (Prospecting and Mining Act), 1992.

3.2 Other forms of mining or extraction of any natural resources whether regulated by law or not.

3.3 Resource extraction, manipulation, conservation and related activities.

Water Resource Developments

8.5 Construction of dams, reservoirs, levees and weirs.

8.8 Construction and other activities in water courses within flood lines.

8.9 Construction and other activities within a catchment area.

Hazardous Material Treatment, Handling and Storage

9.1 The manufacturing, storage, handling or processing of a hazardous substance defined in the Hazardous Substances Ordinance, 1974.

9.2 Any process or activity which requires a permit, licence or other form of authorisation, or the modification of or changes to existing facilities for any process or activity which requires an amendment of an existing permit, licence or authorisation or which requires a new permit, licence or authorisation in terms of a law governing the generation or release of emissions, pollution, effluent or waste.

9.3 The bulk transportation of dangerous goods using pipeline, funiculars or conveyors with a throughout capacity of 50t or 50cm^3 or more per day.

9.4 The storage and handling of a dangerous goods, including petrol, diesel, liquid petroleum gas or paraffin, in containers with a combined capacity of more than 30cm^3 at any one location.

Infrastructure

10.1 The construction of-

(a) oil, water, gas and petrochemical and other bulk supply pipelines

(b) public roads
(f) cableways.

2.3.4 Namibia's Minerals Act

A provision of the Minerals Act (Act No. 33 of 1992), specifically Section 48 (2) (b) (i) of the Act, is that *"environmental impact studies"* may be called for by the Minister of Mines and Energy when mineral licences - or their renewal or transfer - are applied for.

Rössing Uranium is presently operating under a mining licence 28 (ML 28) issued by MME and this will remain unaffected for the current mining operation and the proposed mining of the Z20 uranium deposit project.

2.3.5 The Water Act and Water Resource Management Act

The Water Act (54 of 1956) regulates the abstraction of groundwater for mining purposes. The Water Resources Management Act (24 of 2004) however has been drafted and published but it still has to come into force. This Act is more relevant to addressing Namibia's geohydrological and climatic context.

2.3.6 Namibia Water Corporation Act

The Namibia Water Corporation Act (12 of 1997) designates the corporation to supply bulk water, based on need and availability. This Act refers amongst others to water resources and water pollution control.

2.3.7 Atmospheric Pollution Prevention Ordinance

The Namibian Atmospheric Pollution Prevention Ordinance, 11 of 1976 does not include any ambient air standards. Typically when no local ambient air quality criteria exist, reference is made to international criteria. The most widely referenced international air quality criteria are those published by the World Bank Group (WB), the World Health Organisation (WHO) and the European Community (EC). South Africa has also recently (1st of April 2010), as part of the Air Quality Act No. 39 of 2004, published listed Activities and Associated Minimum Emission Standards for most significant industrial processes. These standards will thus be used in determining air quality impacts.

2.3.8 Nature Conservation Ordinance

The Nature Conservation Ordinance (4 of 1975) provides for the declaration of protected areas and protected species, which will inform how such species will be managed, should they occur in the affected area.

2.3.9 Parks and Wildlife Management Bill

The Parks and Wildlife Management Bill (2009) will repeal the Nature Conservation Ordinance (4 of 1975) in future. This Bill permits the MET and MME to allow mining and associated activities within parks subject to the relevant SEIAs and authorisations. It aims to provide a legal framework for the sustainable use and maintenance of Namibia's ecosystems, biological diversity and ecological processes. These principles will be used to inform the study.

2.3.10 Namib Naukluft National Park Management and Tourism Development Plan

The NNNP Management and Tourism Development Plan (2004) provide a set of policies and guiding principles of which a key topic is restoration of degraded ecosystems. These principles will be used to inform the study.

2.3.11 National Heritage Act

The National Heritage Act (27 of 2004) provides protection and conservation of significant places and objects from a heritage point of view. It further makes provision for heritage impact assessments, which will be incorporated into this study.

2.3.12 Inland Fisheries Resources

The Inland Fisheries Resources Act 1 of 2003 provides for the protection of aquatic ecosystems and applies to any freshwater body that is not situated on private property. 'Fish' is defined to include freshwater crustaceans. Section 20 prohibits the erection or installation of any structure in a river or stream in the absence of consultation with the Minister. This has relevance due to location of certain activities within the Khan River.

2.3.13 Forest Act

Forest Act 12 of 2001, as amended in 2005 aims to conserve soil and water resources, maintain biological diversity and to use forest produce in a way which is compatible with the forest's primary role as the protector and enhancer of the natural environment. These principles will be used to inform the study.

2.3.14 Pollution Control and Waste Management

The Draft Pollution Control and Waste Management Bill of 1999 provides for the control and management of several types of pollution, inter alia to reduce their effects on species; until the bill is enacted, the draft bill serves as guideline for the design of future compliance. These principles will be used to inform the study.

2.3.15 Atomic Energy and Radiation Protection

The Atomic Energy and Radiation Protection Act (5 of 2005) regulates exposure to radioactive sources or materials and lists all activities requiring authorisation. This includes, amongst others, disposal, storage and the operation or use of radiation sources. These requirements will be addressed in the study.

The National Radiation Protection Authority of Namibia promulgated the Radiation Protection and Waste Disposal Regulations under the above mentioned Act. The aim of this regulatory framework is to ensure the protection of individual members of the public and their surrounding environment. As such, dose limits and dose constraints (some fraction of the dose limit) and other appropriate criteria are defined.

2.3.16 Strategic Environmental Assessment for the central Namib Uranium Rush

The Strategic Environmental Assessment for the central Namib Uranium Rush (SEA) (MME, 2010) was conducted to determine cumulative social and environmental impacts relating to the development/expansion of various uranium mines in the Erongo Region. The Strategic Environmental Management Plan (SEMP) for the central Namib Uranium Rush is described as:

> "An over-arching framework and roadmap for addressing the cumulative impacts of a suite of existing and potential developments. The manner in which this is achieved is by setting limits of environmental quality (i.e. performance targets) that need to be achieved by the proponents of individual projects. The central Namib Uranium Rush Environmental Management Plan (EMP) is neither a policy, plan nor programme, but rather a collection of mining and related projects, each being conducted by individual companies that are not related to each other, and in many cases, undertaken in isolation of each other." ~ MME, 2010.

The outcome was a Strategic Environment Management Plan (SEMP) which provides a framework to plan, collaborate, monitor, and manage issues that can impact on society, the economy and the environment. The purpose of this SEMP is not to remove the obligation from developers to develop project-specific EMPs, but rather to be incorporated therein. Fundamental to the development of the SEMP was setting the Environmental Quality Objectives (EQOs) to try and define the limits of acceptable change for the region that can be tolerated as a result of the Uranium Rush.

Important biodiversity, tourism and archaeology areas that were not already compromised by mining were declared red or yellow flag areas that require special justification for any prospecting and/or mining applications. The Figure below indicated these red and yellow flag zones on a map of the area.

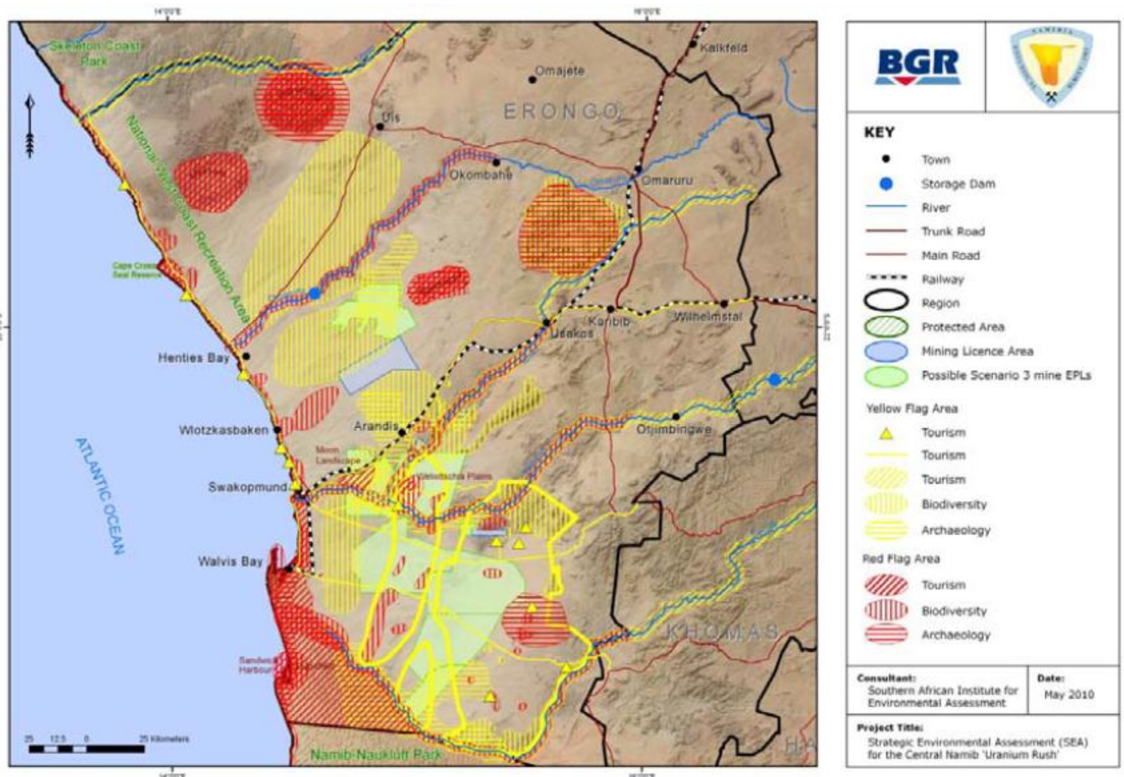

Figure 2: Red and yellow flag areas based on ecological criteria (MME, 2010)

Key recommendations from the SEA and SEMP that relate to the proposed project and SEIA are as follows:

- Mining in protected areas to be avoided where possible.
- Important biodiversity, tourism and heritage hotspot areas (red and yellow flag areas which are identified as unavailable for mining and prospecting unless an extraordinary mineral deposit of national importance occurs within the area) should be avoided.
- Mines must have specific biodiversity plans to minimise footprints, avoid impacts, and where impacts cannot be avoided, to mitigate, restore or offset impacts.
- Infrastructure corridors are to be carefully planned to avoid ecologically sensitive areas, and demonstrate:
  - consideration of alternatives;
  - optimization of service provision; and
  - commitment to the “green route”.
- Mines to share infrastructure to the greatest extent possible, thus minimising the proliferation of infrastructure.
- Infrastructure planning and investment to take into account future demand, thus reduces the need for additional infrastructure with resulting additional impacts (e.g. one shared pipeline as opposed to three).
- All EIAs must consider the possibility of extinction of biotic species and resources must be available for reasonable investigation to determine the risk and avoid such an impact.
- Areas of importance for recreation that are not yet alienated by mining or prospecting are declared ‘red flag’ areas for prospecting or mining (i.e. to be avoided). This includes the Khan River.
- Direct and indirect visual scarring is to be avoided and if this is not possible, to be kept within acceptable limits.
- Planning should ensure that accidents on public roads and at key intersections should decline from current trends. In addition, all roads carrying more than 250 vehicles per day must be strengthened, tarred and provided with proper intersections to the mines. The mine intersections need to have clear road signs and road markings.
- Disease rates amongst the public must not increase as a result of activities/impacts related to the uranium mines.
- Cumulative radiation doses to the public must not exceed one milliSieverts per annum (mSv/a) above background.
- Annual human exposure to particulate concentrations and dust fall out must comply with the limits as determined by the SEA evaluation criteria.
- Mines are to implement mitigation measures to control dust emissions at all major dust generating sources such as haul roads, materials transfer points and crushing operations. These measures must be monitored by a network of fallout buckets and by ambient monitoring.
- Public roads that will act as main access routes to mining operations should be paved or changed into salt roads to reduce dust generation.
- Uranium mines do not compromise surface and groundwater quality movement and availability.
- All mines must use desalinated water for operational phase activities.
- In order to conserve water and control dust from roads, dust emissions from un-surfaced roads should be controlled by chemical binding agents rather than water.
- All mining and related developments must be subject to archaeological assessment and no unauthorised archaeological impacts should occur.

- Existing proclaimed towns must be supported by mines.
- Mines must employ mainly locals.

2.3.17 Convention on Biological Diversity

Conceived as a practical tool for translating the principles of Agenda 21 into reality, the Convention recognises that biological diversity is about people and the need for food security, medicines, fresh air and water, shelter, and a clean and healthy environment in which to live. The Convention has three main goals, namely the conservation of biodiversity, sustainable use of the components of biodiversity, and sharing the benefits arising from the commercial and other utilisation of genetic resources in a fair and equitable way. The principles of the Convention, specifically those related to the sustained use of biological diversity and Impact Assessment have formed an important informant to this study.

2.3.18 The Convention on International Trade in Endangered Species

The Convention on International Trade in Endangered Species (CITES) of 1973 regulates trade in endangered species, through listing in appendices:

- Appendix I include species threatened with global extinction, and trade in these is subject to particularly strict regulations. It is only authorized under exceptional circumstances.
- Appendix II includes species that are not necessarily now threatened with extinction, but may become so unless trade in them is strictly regulated to avoid utilisation incompatible with their survival. It also includes any other species for which trade needs to be regulated in order to effectively control trade in strict Appendix II species.
- Appendix III includes species where trade regulation to prevent exploitation is mainly needed on the individual country or regional level. Namibia currently has no CITES Appendix III species.

2.3.19 Convention to Combat Desertification

This convention aims to prevent excessive land degradation that may threaten livelihoods.

2.3.20 Rössing Uranium/Rio Tinto’s Internal Standards

Rio Tinto, Rössing Uranium’s parent company, operates a comprehensive Health, Safety, Environment and Quality (HSEQ) management system (MS) that accords with international standards of best practice and is certified to comply with the International Organisation for Standardisation (ISO) ISO:9001, ISO:14001 and ISO:18001 MS’s. The objective is to measure, record and demonstrate on-going compliance with relevant legislation and Rössing Uranium’s company policies regarding occupational Health, Safety, Environment and Community (HSEC) management through implementation of specified actions. Certification per the ISO 14 001 Environmental MS standard was obtained by Rössing Uranium in 2000. Recertification was obtained in 2004 and 2007. Certification services and independent third party auditing will continue through a Rio Tinto nominated international auditing organisation, to ensure continued compliance with the standard throughout the group.

An array of environmental standards are thus in place and all Rio Tinto businesses, such as Rössing Uranium, are committed to maintaining such international standards. Rio Tinto’s policy statement entitled The Way We Work provides the overarching governance touchstone, while matters of planning, implementation and operation, checking and corrective action, and management review, are embodied in HSEQ MS that each business is obliged to maintain.

2.3.21 Other Legislation and Conventions

Rio Tinto subscribes to the International Council on Mining and Metals (ICMM) and as such adheres to their suite of policies on best practice and improved performance standards, which are:

- Principle 1: Implement and maintain ethical business practices and sound systems of corporate governance.
- Principle 2: Integrate sustainable development considerations within the corporate decision-making process.
- Principle 3: Uphold fundamental human rights and respect cultures, customs and values in dealings with employees and others who are affected by our activities.
- Principle 4: Implement risk management strategies based on valid data and sound science.
- Principle 5: Seek continual improvement of our health and safety performance.
- Principle 6: Seek continual improvement of our environmental performance.
- Principle 7: Contribute to conservation of biodiversity and integrated approaches to land use planning.
- Principle 8: Facilitate and encourage responsible product design, use, re-use, recycling, and disposal of our products.
- Principle 9: Contribute to the social, economic, and institutional development of the communities in which we operate.
- Principle 10: Implement effective and transparent engagement, communication and independently verified reporting arrangements with our stakeholders.

3 SCOPING METHODOLOGY

This section describes the sources of information used to compile the scoping report and also provides the purpose of the scoping report with references to requirements in the EIA regulations. It furthermore describes the proposed public participation process as engagement with the public and stakeholders forms an integral component of the social and environmental assessment process.

3.1 INFORMATION COLLECTION

Various methods and sources were utilised to identify the social and environmental aspects associated with the proposed project and to develop the Terms of Reference (ToR) for the required specialist studies. The sources of information for the preparation of this scoping report include, amongst others, the following:

- Information regarding the project as provided by Rössing Uranium:
  - Project description;
  - Methodology for construction of the various components of the project;
  - Methodology during operations;
  - Preliminary closure objectives;
  - Expected time table for project development;
  - Maps and figures, outlining the proposed facilities;
  - Technical information relating to design;
- Rössing monitoring results;
- Information provided by the supplier of the conveyor;
- Other relevant SEIAs;
- Site Visit by the SEIA project team;
- Consultation with the technical project team including a two day workshop;
- Consultation with IAPs; and
- Consultation with relevant authorities.

During the initiation/screening phase of the SEIA, reference was made to the various SEIAs conducted in the area to date used to inform social and environmental aspects relating to the proposed project, specifically the infrastructure corridor. These include, amongst others, the following SEIAs, which were reviewed and considered:

- SEIA for the Proposed Expansion of Rössing Uranium Mine Phase 1: Acid Plant, Ore Sorter and SK4 Pit (2008);
- SEIA for the Proposed Expansion of Rössing Uranium Mine Phase 2A: Sulphur Handling Facility in the Port of Walvis Bay (2009);
- SEIA for the Proposed Expansion of Rössing Uranium Mine Phase 2B (2011):
  - Extension of current SJ open pit mining activity,
  - Increased waste rock disposal capacity,
  - Establishment of a new crushing plant,
  - Increased tailings disposal capacity,
  - Establishing of an acid heap leaching facility,

  - Establishing of a ripios disposal area,
  - Additional plant associated with the above,
- EIA for the Swakop Uranium Mine (Metago 2010); and
- EIA for the Husab Mine Linear Infrastructure (Metago 2011).

3.2 SCOPING REPORT

The purpose of this Scoping Report is to provide information relating to all the components of the proposed project, to indicate potential aspects of social and environmental risk and to detail ToR for further assessment of the potential impacts. The assessment of the impacts relating to the infrastructure corridor is, however, included in the Scoping Report. The Scoping Report further provides information and proof of the public participation process followed as part of the Scoping Phase of the process.

Section 8 of the Environmental Impact Assessment Regulations, promulgated in in February 2012, under the Environmental Management Act, 7 of 2007, provides details on the regulatory expectations of a scoping report. These requirements are outlined in Table 7 below, with reference to relevant sections in this report.

Table 7: Details of the regulatory expectations of the Scoping Report

Section 8: Environmental Impact Assessment Regulations	Report Reference
(a) the curriculum vitae of the EAPs who prepared the report;	Annexure A
(b) a detailed description of the proposed activity;	Section 5
(c) a description of the site on which the activity is to be undertaken and the location of the activity on the site	Section 4.1
(d) a description of the environment that may be affected by the proposed activity and the manner in which the geographical, physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed listed activity;	Sections 4.2– 4.5 and Section 8
(e) an identification of laws and guidelines that have been considered in the preparation of the scoping report;	Section 3
(f) details of the public consultation process conducted in terms of regulation 7(1) in connection with the application, including - (i) the steps that were taken to notify potentially interested and affected parties of the proposed application; (ii) proof that notice boards, advertisements and notices notifying potentially interested and affected parties of the proposed application have been displayed, placed or given; (iii) a list of all persons, organisations and organs of state that were registered in terms of regulation 22 as interested and affected parties in relation to the application; and (iv) a summary of the issues raised by interested and affected parties, the date of receipt of and the response of the EAP to those issues;	Section 2 and Annexure B
(g) a description of the need and desirability of the proposed listed activity and any identified alternatives to the proposed activity that are feasible and reasonable, including the advantages and disadvantages that the proposed activity or alternatives have on the environment and on the community that may be affected by the activity;	Section 1.3 and Section 6
(h) a description and assessment of the significance of any significant effects, including cumulative effects, that may occur as a result of the undertaking of the activity or identified alternatives or as a result of any construction, erection or decommissioning associated with the undertaking of the proposed listed activity;	Section 8
(i) terms of reference for the detailed assessment; and	Section 9

(j) a draft management plan, which includes - (i) information on any proposed management, mitigation, protection or remedial measures to be undertaken to address the effects on the environment that have been identified including objectives in respect of the rehabilitation of the environment and closure; (ii) as far as is reasonably practicable, measures to rehabilitate the environment affected by the undertaking of the activity or specified activity to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development; and (iii) a description of the manner in which the applicant intends to modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation remedy the cause of pollution or degradation and migration of pollutants.	Annexure D, Sections 8 and 9

3.3 PUBLIC PARTICIPATION PROCESS

Engagement with the public and other stakeholders that are interested in, or affected by the development proposals forms an integral component of any SEIA process. Therefore, IAPs will have an opportunity to gain more knowledge about the proposed project, to provide input through the review of documents/reports and to voice any issues of concern at various stages throughout the SEIA process.

The objectives of public participation are to provide information to the public, identify key issues and concerns at an early stage, respond to the issues and concerns raised, provide a review opportunity, and to document the process properly. The public participation process will be managed to meet these objectives throughout the SEIA.

3.3.1 Identification of Stakeholders

A list of authorities and IAP groups that were identified during the initiation/screening phase of the SEIA process has been included in Annexure B. Table 8 indicates the various groups of stakeholders identified to date.

Table 8: Stakeholders in the SEIA process

Grouping	Organisation

Government: National, Regional & Local	• Ministry of Environment and Tourism (MET);
	  ○ Directorate of Environmental Affairs
	  ○ Directorate of Parks and Wildlife;
	• National Heritage Council of Namibia;
	• Ministry of Mines and Energy (MME);
	• Ministry of Education
	• Ministry of Agriculture, Water and Forestry (MAWF);
	  ○ Department of Water Affairs;
	• Ministry of Health and Social Services (MHSS);
	• Ministry of Labour and Social Welfare; and
	• Ministry of Works, Transport and Communications.
	• Arandis Town Council (ATC), Erongo Regional Council, Walvis Bay and Swakopmund Town Councils

Private company with the Republic of Namibia as the sole Shareholder	Epangelo Mining Company
Government Parastatal	Namibian Power Corporation (Pty) Ltd (NamPower); Namibian Water Corporation (Pty) Ltd (NamWater); Namibian Ports Authority

	(NamPort); TransNamib; Roads Authority; Erongo Red; Telecom Namibia
Neighbouring Mines / Exploration companies	Areva Resources; Swakop Uranium (Husab) and Bannerman (Etango), Langer Heinrich Uranium; Valencia; Reptile Uranium.
NGOs	!O ‡egan Traditional Authority; Namibian Nature Foundation; WWF in Namibia; Desert Research Foundation of Namibia (DRFN); Wildlife Society of Namibia; Earthlife Namibia; Rössing Foundation; Wildlife Society of Namibia; Eco Africa; NEWS; Legal Assistance Centre; DRFN (Gobabeb); SAIEA; Walvis Bay Corridor Group; Birdlife Africa; Namibian Coast Conservation and Management project (NACOMA); United Nations Development Programme (UNDP) - Environment Unit; National Society for Human Rights; Greenearth; Vultures Namibia; Greenspace
National Chambers	Chamber of Mines of Namibia; National Chamber of Commerce and Industry
Business and Commerce	Various in Arandis, Swakopmund and Walvis Bay
Non-Governmental Organizations	Rössing Foundation; Namibia Non-Governmental Organizations' Forum (NANGOF); Walvis Bay Corridor Group; Coastal Tourism Association of Namibia (CTAN); Hospitality Association of Namibia (HAN); Fauna & Flora International (FFI)
Media	Newspapers: The Namibian; Allgemeine Zeitung; Die Republikein; Namib Times. Television: Namibian Broadcasting Corporation (NBC)
Other interested and affected parties/stakeholders	Consultants; Academic institutions; Farmers; Media; Other industries associations; Tourism; Private citizens; and any other people with an interest in the proposed project or who may be affected by the proposed project

3.3.2 Phases in the PPP

The Scoping Phase public participation process is summarized in Table 9 below:

Table 9: Summary of the SEIA Scoping public participate process

TASK	DETAILS	DATE
	Stakeholders notification (relevant authorities and IAPs)	
Notification to MET (DEA) and submit Applications for Authorisation	SLR met with MET:DEA to provide information on the proposed project; to discuss the proposed SEIA process to be followed; to provide information on the public participation process; and to obtain initial comments on the project and the proposed SEIA process. A follow up meeting was held with the MET Environmental Commissioner on the 7th of November 2012. The two applications for authorisation were submitted to MET and copies submitted to MME: 3. The Infrastructure corridor associated with the proposed mining of the Z20 resource by Rössing Uranium 4. The proposed mining of the Z20 resource by Rössing Uranium Refer to Annexure B for the minutes of the meeting with MET (DEA) and a follow up meeting with the MET Environmental Commissioner, as well as proof of submission of the two applications.	**18 October 2012**

Stakeholder identification	A stakeholder database was developed for the project by referring to various other projects' databases in the Erongo Region. This database will be updated during the SEIA as required. A copy of the IAP database is attached in Annexure B.	**September/ October 2012**
Distribution of background information document (BID)	BIDs with covering letters were distributed via email to the authorities and IAPs on Rössing Uranium's stakeholder database and hard copies were placed at the following places: • Swakopmund Public library, • Arandis Public library, and • The Uranium Institute in Swakopmund. Hard copies of the BID were also distributed during the Scoping focus group meetings, public meetings and public open day. The purpose of the BID was to provide stakeholders with the opportunity to register as IAPs in the SEIA process and to obtain their initial comments on the proposed mining project and SEIA process of the Z20 uranium deposit. A copy of the BID is attached in Annexure B.	**12 October 2012**
Site notices	Site notices were erected to inform the general public of the proposed project and the public participation process. One was placed at Rössing Uranium's Swakopmund office and another at the entrance to the mine site. A further nine copies of these notices (A3 size) were placed at the following places in Swakopmund: • Stadtmitte; • Woermann & Brock in Mondesa; • Woermann & Brock in Vineta; • Spar in Ocean View; • Two inside the Woermann & Brock complex in the Sam Nujoma Drive; • Pick & Pay; • Rossmund Conference Centre; and • Brauhaus Restaurant. Photos of the site notices and notices around Swakopmund are attached in Annexure B.	**12 October 2012**
Newspaper Advertisements	Block advertisements were placed as follows: • The Republikein; and • The Namib Times. Copies of the advertisements are attached in Annexure B.	**12 & 19 October 2012**
Focus Group Meetings, public meetings, open day and submission of comments		
Focus group meetings	Focus group meetings were held with key stakeholders and affected parties as follows: • Representatives of the media in Swakopmund; • The ATC in Arandis; • The Labour Unions at Rössing Uranium; • Members of the Erongo Regional Council, NACOMA and the local Ministry of Environmental and Tourism (Directorate Parks and Wildlife) at the Rossmund Conference Centre in Swakopmund. The Swakopmund Town Council was invited to the same meeting but an apology was send that no one could attend. The Director and Chief Park Warden from the MET – Directorate of Parks and Wildlife in Windhoek.	**23-26 October 2012**

	• Two separate meetings with representatives from MAWF (Hydrology and Geohydrology). • The Mining Commissioner (Ministry of Mines and Energy) in Windhoek. The same project information was presented at all the meetings. (Refer to Annexure B for a copy of the information that was presented at the meetings). A focus group meeting was arranged for the River Farmers and the Tourism Industry in Swakopmund but no one attended. A number of apologies were, however, received.	
Open day and Public meetings	A public meeting was held on the 23rd of October in Arandis. This meeting was very well attended. A public open day was held between 13:00 and 18:00 on 24 October 2012 at the Rossmund Conference Centre in Swakopmund where relevant project and social and environmental related information was presented by means of a poster display. A public meeting followed in the same venue at 18:00 on the same day where the project and SEIA process were presented and comments/concerns recovered and discussed. The same project information was presented at all the meetings.	**23-26 October 2012**
Comments and Responses	Minutes of the meetings and all comments received during the meetings and open day, by email, fax and SMS as well as the Summary Issues and Response Report are attached in Annexure B.	**12 - 31 October 2012**
	Review of Draft Scoping Report	
IAPs and authorities (excluding MET) review of scoping report and SEMP	Copies of the Scoping Report (and SEMP) are available for review at the following places: • Swakopmund Public Library, • Arandis Public Library; • The Uranium Institute in Swakopmund; and • Rössing Uranium corporate office in Swakopmund. Electronic copies of the report will be made available on request (on a CD). Summaries of the scoping report were distributed to all authorities and IAPs that are registered on the IAP database via e-mail. Authorities and IAPs will be given 21 days to review the scoping report and submit comments in writing to SLR. The closing date for comments is 14 December 2012.	**16 November to 14 December 2012**
MET review of scoping report and SEMP	A copy of the final scoping report, including authority and IAP review comments, will be delivered to MET on completion of the public review process.	**December 2012**

3.3.3 Summary of Issues Raised

Please refer to the Issues and Response Report attached in Annexure B for detailed information on the comments received during the SEIA process to date.

4 DESCRIPTION OF THE CURRENT ENVIRONMENT

This section provides an overview of the receiving socio-economic and biophysical environment. It is based on information extracted from previous social and Environmental Impact Assessments done for Rössing Uranium and supplemented with updated information from the various specialist studies as included in Annexure C.

4.1 SITE LOCATION, EXTENT AND CONTEXT

Namibia is situated on the south-western portion of the African continent, bordered by Angola, Zambia, Botswana and South Africa. The Erongo Region is one of four coastal regions of Namibia and covers an area of approximately 64,000km^2. Two large urban centres, Swakopmund and the fishing and port town of Walvis Bay, as well as the smaller towns of Arandis, Henties Bay, Omaruru, Uis, Karibib and Usakos, are located within the Erongo Region.

This region is strongly characterised by mining activity and mining for various minerals has been on-going in the central Namib since 1901. Continued growth in the tourism industry, recent upsurges in the mining sector as well as the development of strategic regional infrastructure is such that the Erongo Region, particularly the coastal centres of Walvis Bay and Swakopmund, could potentially undergo rapid and significant growth in the years ahead.

The Rössing Mine is found at 15°27'50" East and 22°02'30" South, approximately 70km inland from the coastal town of Swakopmund in Namibia's Erongo Region. The dominant geomorphologic features are large, gentle south-sloping gravelly plains, and deeply incised river valleys. Geologically the area is characterised by granites, gneisses, meta-sediments, marble ridges, and unconsolidated gravels and sands. Soils are shallow and, as is generally the case in the central Namib, organic components are poorly developed. The northeast-southwest flowing ephemeral Khan River forms the main drainage. The Khan valley is bordered along its length by deeply incised and twisting side valleys, which have been cut through granites and meta-sediments and which contain saline and fresh springs.

The 18,411ha MLA and accessory works area is bordered by the town of Arandis, approximately 12km to the north-west, and by the incised Khan River valley, approximately 4.5km to the south-east. Walvis Bay, Namibia's only deep-water harbour is located 30km south of Swakopmund.

Although of considerable extent, the Rössing ore body is of a low uranium grade and consequently large volumes of rock have to be mined to extract the uranium ore and to produce the processed (powdered) uranium oxide (U_3O_8) concentrate that is the final product. The mine has a nameplate capacity of 4,500 tonnes (t) of uranium per year and, by the end of 2011, had supplied a total of 120,754t of U_3O_8 to the world (Aurecon, 2011).

4.2 EXISTING SOCIAL ENVIRONMENT

Namibia is sparsely populated with approximately 33% of the population residing in urban areas. It is considered as a relatively wealthy country and is classified as an upper-middle income country with a projected per capita income of U$5,330 (World Bank, 2011). However, Namibia's relative good economic growth averaging close to 5% over the last decade (2001 -2011) and higher per capita income masks significant socio-economic imbalances (Namibian Statistics Agency (NSA), 2012). Based on estimates from the national labour force survey of 2008, the unemployment rate was found to have worsened to an all-time high of 51.2%, from 36.7% in 2004 (MoL&SW, 2010). Latest estimates from the national household income and expenditure survey have since dramatically reduced this figure to the usual trend of just 33.8% (NSA, 2012). Nevertheless, the country still remains one of the most unequal societies in the world with a Gini-coefficient of 0.60 albeit with some improvement from the 0.63 recorded in 2004 and about one fifth (22%) of the population is considered poor (NSA, 2012). In 2010, it was ranked at 105 out of 169 countries on the Human Development Index (UNDP, 2011).

The Erongo Region is home to almost 108,000 people, representing approximately 6% of Namibia's population in 2001 (CBS, 2003). By 2011 the Erongo Region's population was estimated at 150,400 people, representing a massive growth of 40%, highest in the country and indicative of a high migratory trend (NSA, 2012). The majority of this population (71%) reside in the two urban centres, namely, the tourist town of Swakopmund and Walvis Bay south of Swakopmund (NSA, 2012).

Regardless of the dramatic population growth in its larger urban centres, the Erongo Region boasts the lowest level of household poverty (5%) and a mean per capita income almost twice the national average (NSA, 2012). Approximately 11% of people in Erongo depend on pensions for cash income, in line with the national average (Aurecon, 2011).

In 2010, the unemployment rate for the Erongo Region, measured broadly, stood at 23.6%, second lowest in the country and this despite the high population growth (NSA, 2012). Nevertheless, unemployment among women was estimated to be higher at 29% compared to 17% among men (NSA, 2012).

Namibia is generally considered to suffer from a high skills deficit. This is reflected in the fact that only 6.4% of the country's working population (labour force) have tertiary education though secondary educational attainment remains favourably high at 51% (NSA, 2012). By comparison, the Erongo Region seems better place with tertiary attainment at 7% and secondary education at just over 70%, highest in the country (NSA, 2012). The Namibian Institute of Mining and Technology's (NIMT) main campus is located in the region and is a key source of skilled individuals for the mining industry and Rössing in particular (MME, 2010).

4.2.1 Rössing employees

At the end of 2011, the mine had a workforce complement of around 1,600 employees, of whom 98% were Namibians. It is estimated that about 5000 persons (including workers and their direct dependants) rely on Rössing Mine for their livelihood. Nearly 1000 of the workers were residing in Swakopmund and the rest in the towns of Walvis Bay (about 250) and Arandis (just over 350). The latter is home to mostly low skilled employees of the mine. Due to limited company accommodation, the majority of employees either own or rent houses in the three towns. In 2011, Rössing owned 115 houses and 36 flats in Swakopmund and 20 houses and two single quarters with 30 rooms each in Arandis and further rented 17 houses from the ATC.

4.2.2 Household water

In 2010, 94% of households had access to piped water, making the Erongo Region the second highest Region in Namibia with regard to the provision of improved water to individual households (NSA, 2012). It was also estimated to have the highest percentage of households (99%) within 2km access to drinking water in the country (NSA, 2012).

4.2.3 Health services

Omaruru, Usakos, Swakopmund and Walvis Bay each have a state hospital. Swakopmund and Walvis Bay have a private hospital each, and numerous clinics serve both the urban and rural population. These new health facilities have brought health services closer to the communities. Health services in the Region are relatively good, however clinic services are inadequate, as it is difficult to attract staff to rural areas, and the renovation of existing facilities has been very slow (Aurecon, 2011).

4.2.4 Education services

The Erongo Region is relatively well served by education services as compared with other Namibian Regions. In 2008 the Erongo Region had the lowest pupil to teacher ratio in Namibia (Ninham Shand, 2008). The region has 45 state schools and 13 private schools (Aurecon, 2011). The Rössing Foundation operates two maths and science centres and libraries in the towns of Swakopmund and Arandis in addition to other school development initiatives.

The 2010 SEA, however, underlined the need for improved quality of school education to assist with growing the technical skills available in the Erongo Region (MME, 2010).

Adult literacy rates are high at 98% compared to the national average of 88% people older than 15 years classified as literate (NSA, 2012).

4.2.5 Other services

The Erongo Region, particularly the coastal towns of Swakopmund and Walvis Bay, is well served with transport infrastructure and police services amongst others (Ninham Shand, 2008).

The region has good access to the infrastructure necessary for economic development. The port at Walvis Bay recorded positive growth during recent years, and is one of the key economic features in the region. The Walvis Bay Corridor connects the port to the rest of Southern Africa via the Trans-Caprivi and Trans-Kalahari Highways. Rooikop airport, near Walvis Bay, provides links to neighbouring countries (Aurecon, 2011).

4.3 EXISTING ECONOMIC ENVIRONMENT

Namibia is heavily reliant on the primary sector for its Gross Domestic Product (GDP), although a slow progression toward a less mining-based economy has been occurring during the past 15 years or more. During this period, the rate of growth of the mining sector has diminished and there has been an upsurge in the services and manufacturing sectors (Ninham Shand, 2008).

The SEA noted that the main economic sectors in the Erongo Region are mining, tourism, fisheries and agriculture (MME, 2010).

4.3.1 Minerals sector

The mining sector, which contributed nearly 10% of GDP in 2011, is dominated by diamond and uranium production as well as zinc and gold to a lesser extent among others (NSA, 2012). Rich alluvial diamond deposits makes the country's diamonds being one of the most sought after globally, whereas the country was in 2011 the 6th largest producer of uranium dioxide in the world (RUL, 2012). The minerals sector plays a key role in economic and social development in Erongo with new mines planned and existing mines proposing expansion projects. It is a substantial employer of labour, and its service and goods requirements, together with the consumer needs of employees, stimulate secondary industries and further job creation (Aurecon, 2011).

The economic influence of the Rössing mine is far more pronounced on a local economic scale, in particular the centres of Swakopmund, Arandis and Walvis Bay. Whilst value added contributions, particularly taxes, are injected into the national economy, salaries and wages have a marked contribution at the local economic scale. Payments benefiting employees by Rössing during 2011 amounted to N$736 million and regional suppliers (within the Erongo Region) received N$922 million. In the same year, Rössing paid N$196 million to the Namibian Government in royalty taxes.

4.3.2 Fishing and marine resources

The fishing sector remains one of the key sectors in the Namibian economy and is after mining the second largest foreign exchange earner (NSA, 2012). The sector's contribution to GDP has been declining over years, from nearly 5% in 2001 to 3% in 2011 (NSA, 2012).

4.3.3 Tourism

A large number of tourists pass through the region annually, which is an important link between attractions such as Etosha National Park and Sossusvlei. In 2007 Erongo recorded the second highest number of bed nights sold, and in January and February 2008, the third-highest bed occupancy in the country. The region also has the highest number of registered tourist accommodation establishments (Aurecon, 2011).

The tourism sector is of significance to the Namibian economy as it provides over 18,000 direct employment opportunities and N$1,600 million in revenue per annum (MME, 2010).

4.3.4 Agriculture

Erongo has very little agricultural potential due to the arid nature of the area. A mere 10km² of the Erongo Region is cleared for cultivation. Small stock farming is the most important agricultural activity in the region and is mostly restricted to communal land which includes the Swakop River bed, and small areas at Omaruru and Okombahe (MME, 2010).

4.4 EXISTING BIOPHYSICAL PROPERTIES

4.4.1 Climate

4.4.1.1 Local wind field

In the area where the proposed conveyor crosses the Khan River, the wind field is likely to be at an angle to the valley for most of the time with perpendicular winds for less than 4% of the time (based on the Rössing historical data). The flow characteristics are therefore more likely to increase towards the south-eastern slope of the Khan River valley with the highest potential for deposition on the south-eastern high lying areas.

The period, day-time and night-time wind roses for Rössing Mine are provided in Figure 3 with the annual wind roses[4] provided in Figure 4.

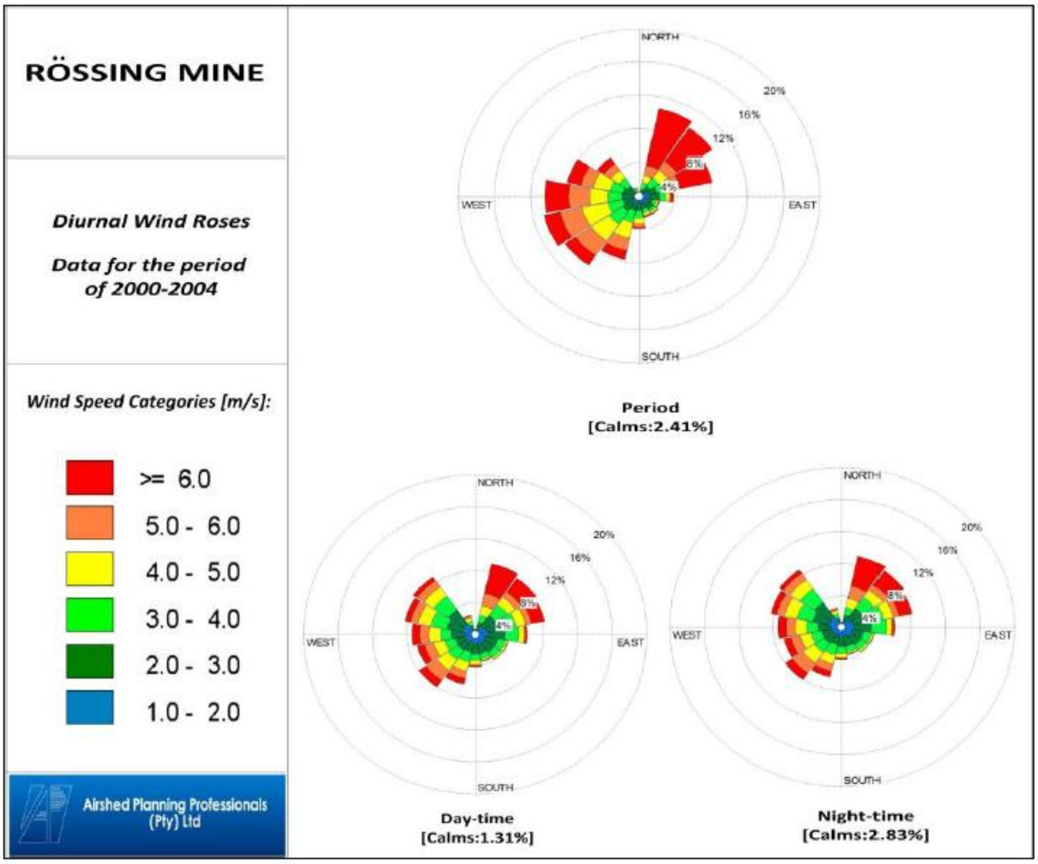

Figure 3: Period, day-time and night-time wind roses for Rössing (2000-2004)

[4]Wind roses comprise 16 spokes which represent the directions from which winds blew during the period. The colours reflect the different categories of wind speeds, the grey area, for example, representing winds of 1m/s to 3m/s. The dotted circles provide information regarding the frequency of occurrence of wind speed and direction categories. For the current wind roses, each dotted circle represents 5% frequency of occurrence. The figure given in the centre of the circle described the frequency with which calms occurred, i.e. periods during which the wind speed was below 1m/s.

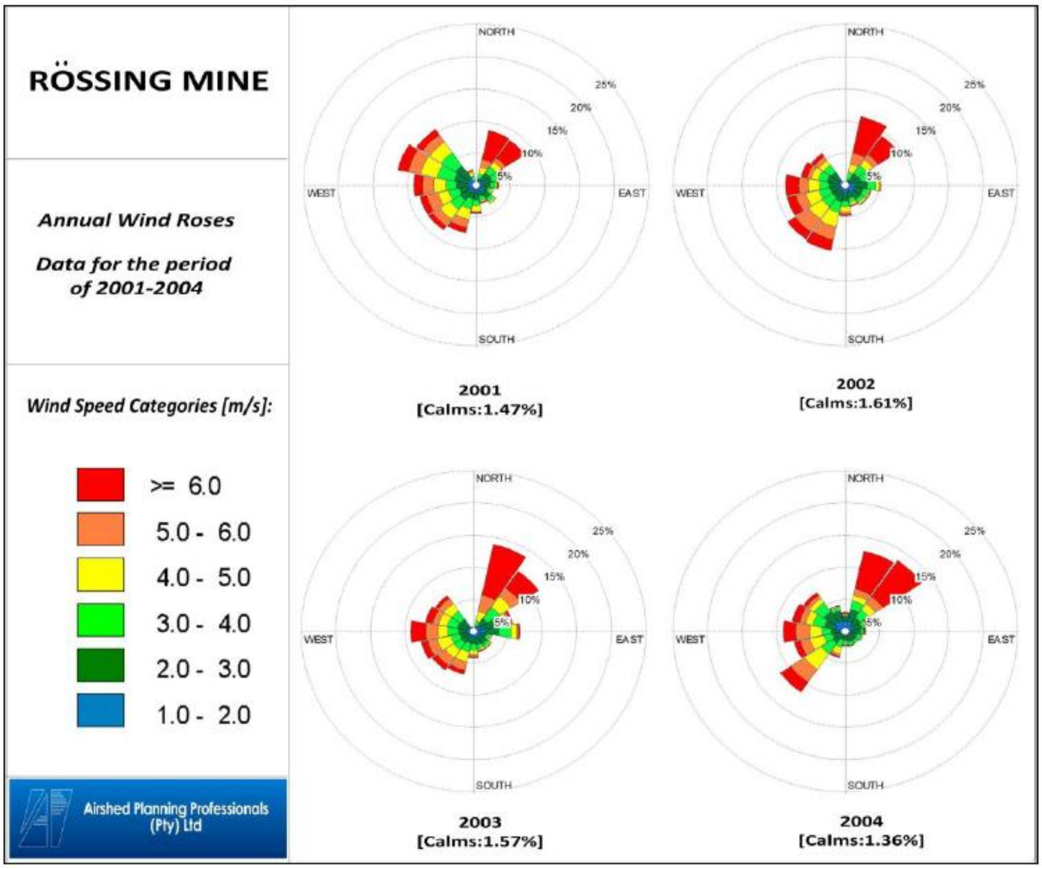

Figure 4: Yearly wind roses for Rössing (2000-2004)

Winds within valleys are complex and influenced by the orientation of the valley walls towards the sun. The area where the conveyor crosses the Khan River is indicated in Figure 9. The prevailing wind direction according to the Rössing weather station data is north-easterly and south-westerly with the river valley orientated the same.

The prevailing wind direction at Rössing for the five year period is from the north-northeast (with approximately 10% frequency of occurrence) and is characterised by the occurrence of high wind speeds (less than 10 metre per second (m/s)) with the maximum recorded at 18.67m/s. This wind direction also dominates day-time and night-time wind patterns. Dominant winds during the period also occur from the north-western, western and south-western sectors. Calm conditions (less than 1m/s) occur for 3.3% of the period. During the day, winds from the south-westerly sector increases. Nocturnal flow reflects increases from the north-westerly sector and associated lower wind speeds. As is typical of night-time conditions, an increase in calm conditions from 1.7% (during day-time) to 4.9% is noted.

Annual wind roses reflect similar wind fields throughout 2001 to 2004 with a slight increase in frequency of north-easterly and south-westerly winds during 2004. The wind rose for the year 2011 from the tailings dam station also show prevailing north-easterly and south-westerly winds with infrequent flow from the south-east.

Seasonal average wind roses reflected distinct shifts in the wind field between the summer, autumn, winter and spring months. During the summer months the average wind direction was from the westerly sector, ranging from the southwest to the northwest with a low frequency of winds from the southeast. An increase in frequency of winds from the north-northeast and northeast was evident during the autumn months. Similar wind field patterns are presented for the winter months with more frequent flow from the north-northeast (less than 15%) and northeast, east-northeast (approximately 14%). Springtime indicate a reduction of north-easterly wind flow with frequent winds from the westerly sector. The frequencies of calms are given as 3.3%, 3.3%, 2.1% and 4.7% for summer, autumn, winter and spring, respectively.

4.4.1.2 Wind speed

The highest wind speed as recorded in the Rössing historical data is 18.7m/s. However, there is more detailed and longer term data available and more extreme wind speeds have been recorded previously. Wind velocities above 17m/s, classified as "Fresh Gales" according to the Beaufort scale, only occurred for 0.02% over the five years of data (2000 - 2004). A "fresh breeze" or "strong wind" is a wind above 14m/s and these occurred for 0.2% over the time. The United States Environmental Protection Agency (US.EPA) uses 5.4m/s as the indicator threshold wind speed to initiate windblown dust and winds exceeding this threshold were recorded for 20% of the time.

4.4.1.3 Rainfall

In Namibia the mean annual rainfall decreases from east to west and from north to south. In the central Namib Desert rainfall is low and its distribution is highly erratic. The reliability of rainfall varies greatly and variability increases sharply to the west (Aurecon, 2011).

Rainfall measurements at Rössing Uranium mine indicate that the mine receives on average some 35mm to 40mm per year. The Namib receives the approximately 73% of the rain in late summer, between January and April. Much of this rainfall occurs as late summer and autumn showers or thunderstorms of high intensity and short duration. The driest periods are from September to December (MME, 2010). A summary of the recorded rainfall date is presented in the Table below.

Table 10: Rainfall data

Rainfall Site	Years of Record	MAP (mm)	Max. Recorded 1 day rainfall (mm)	1:100 year rainfall (mm)	Data Source
Swakopmund	31	14	39	48	See Surface Water specialist study
Walvis Bay	40	23	42	61	See Surface Water specialist study
Rössing Mine	45	12	Blank	51	See Surface Water specialist study
Rössing Mine	22	28	Blank	27.2	See Surface Water specialist study

4.4.1.4 Fog

Fog is a highly significant source of water for the coastal vegetation of the Namib Desert but the quantity of water derived from fog is difficult to measure. Fog is an effective source of moisture for plants up to approximately 35km inland from the coast. The distribution of some well-known fog-dependant plants such as *Arthaeura leubnitzia* corresponds largely to that of the fog zone. Since this species is represented by a few scattered individuals confined to a few of the west-facing ridges at Rössing Uranium mine, fog would appear to account for an insignificant component of the total precipitation at the mine (Aurecon, 2011).

4.4.1.5 Evaporation

Evaporation is a main cause of water loss with an average daily rate of 7mm, as monitored by Rössing Uranium. On an annual basis evaporation significantly exceeds rainfall (Aurecon, 2011).

4.4.1.6 Humidity

Atmospheric humidity levels at Rössing Mine are very variable on both an hour-to-hour and day-to-day basis. The lowest values (5% to 8%) are recorded during midday whilst the highest values (up to 84%) are usually recorded during the early morning. Humidity levels rise rapidly immediately after one of the infrequent rainfall events and the afternoon sea breezes also contain appreciable humidity levels. However, these high humidity levels are usually of short duration and the diurnal average humidity level is usually below 15% (Aurecon, 2011).

4.4.1.7 Surface temperature

As the earth cools during night-time the air in direct contact with the earth's surface are forced to cool accordingly. This is clearly evident from Figure 5, reflecting the diurnal temperature profiles at Rössing Uranium. The coldest time of the day appears to be between 04h00 and 07h00, which is just before or after sunrise. After sunrise surface heating occurs and as a consequence the air temperature gradually increases to reach a maximum at approximately 14h00 in the afternoon.

The annual maximum, minimum and mean temperatures are given as 32.7°C, 16.4°C and 23.2°C respectively s shown in Figure 5.

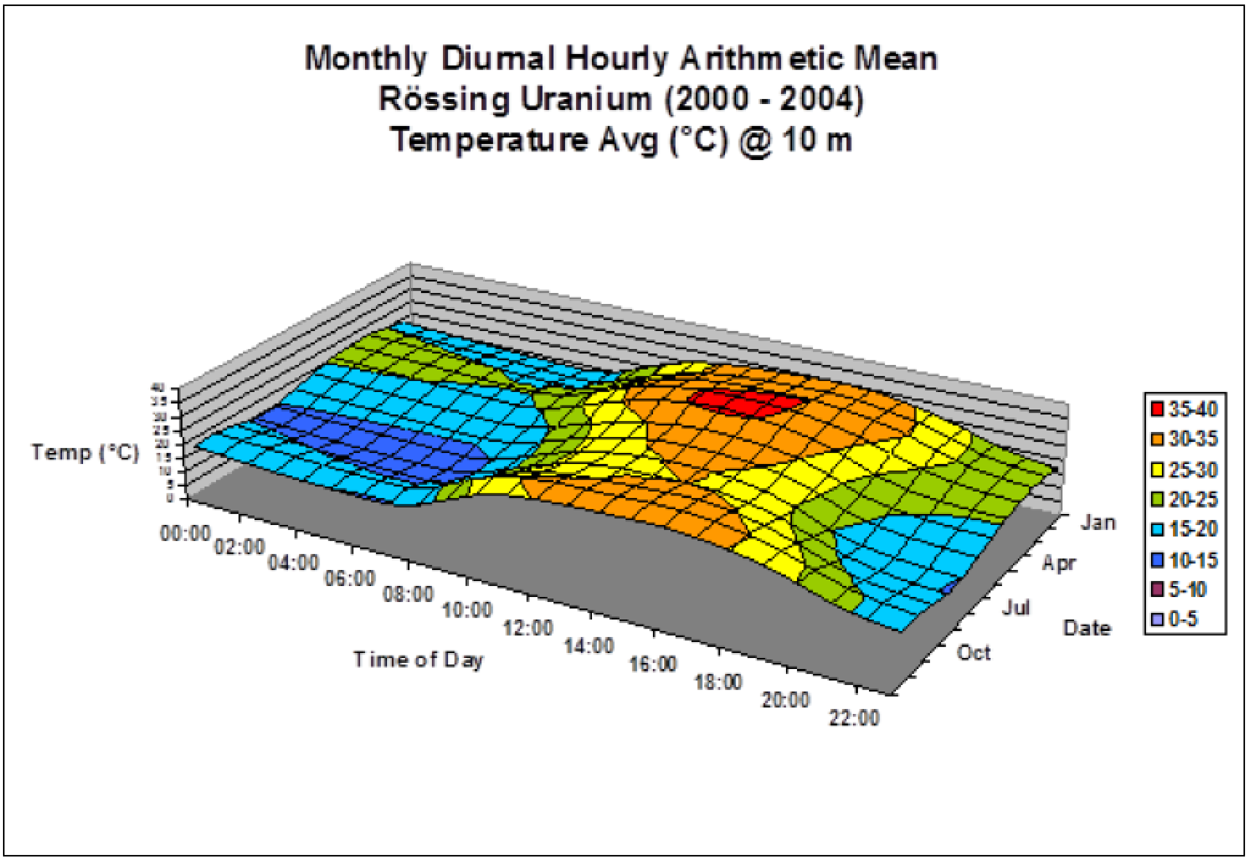

Figure 5: Mean hourly temperature for Rössing (2000- 2004)

A maximum temperature of 35.8°C for Rössing Uranium was recorded during May and a minimum temperature of 12.9°C was recorded in September as indicated in Figure 6.

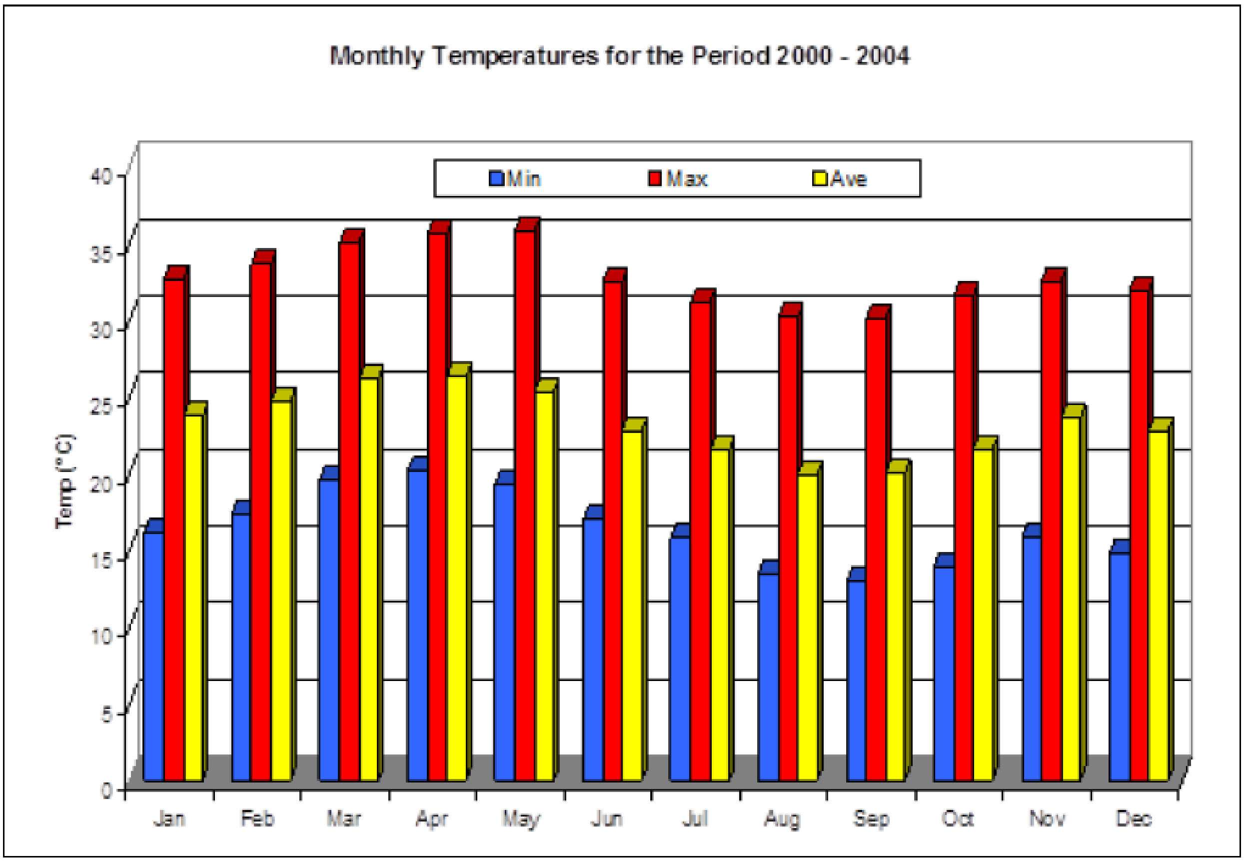

Figure 6: Monthly temperatures for Rössing (2000 - 2004)

The variation of stability with wind direction for Rössing (for the period 2000 – 2004) is given in Figure 7. It is noted that the winds are more frequent from the north-northeast to east-northeast and from the south-southwest to the north-west. A high frequency of neutral conditions occurs from the north-northeast to east-northeast with a high frequency of unstable to neutral conditions occurring from south-southwest to west-northwest.

4.4.2 Topography

Rössing Uranium is located on generally south-east-facing, rough and undulating slopes at a mean elevation of 575mamsl near the Western edge of the central Namib Dessert. The topography in the southern reaches of the site is characterised by the several steeply incised and deep storm-wash gullies and gorges that drain into the Khan River to the South, resulting in a rugged and hilly landscape as shown in Figure 8. As one moves north from the Khan River, toward the town of Arandis the storm-wash gullies become less pronounced and are interspersed with resilient rock ridges and occasional inselbergs, resembling a more typical Namibian desert plain (Ninham Shand, 2008).

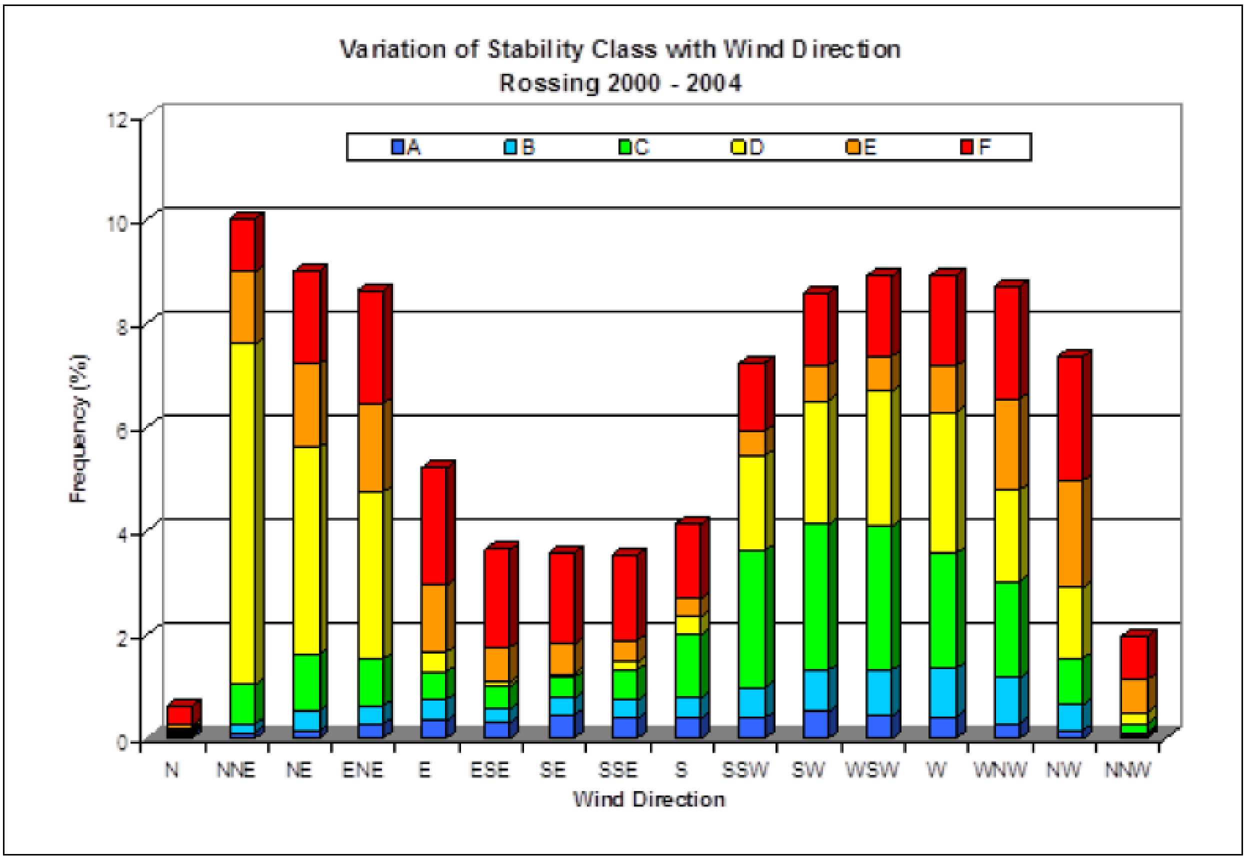

Figure 7: Variation of stability with wind direction for Rössing (2000 – 2004)

Figure 8: West facing aerial photo of the Rössing Dome (Ninham Shand, 2008)

The site is divided into two sections by a steep-sided north easterly trending ridge of hills between Pinnacle Gorge and Dome Gorge, rising to 707mamsl at Westdome Hill. The areas to the north and west of the ridgeline are characterised by rolling hills, whilst areas to the east are more rugged, with crested and steep-sided hills. These hills and ridges continue to the south of the Khan River, where after they dissipate abruptly giving way the gravel plains of the Welwitschia Plains, which cover almost the entire area between the Khan and Swakop Rivers up to the confluence between them, an area forming part of the NNNP (Ninham Shand, 2008).

The proposed Z20 site is situated on the eastern rim the Khan River valley characterised by steep inclines on the eastern side of the river and varying topography towards the western side. The topography around this site is likely to have a significant influence on the dispersion potential of the air emissions from the proposed conveyor and road as shown in Figure 9.

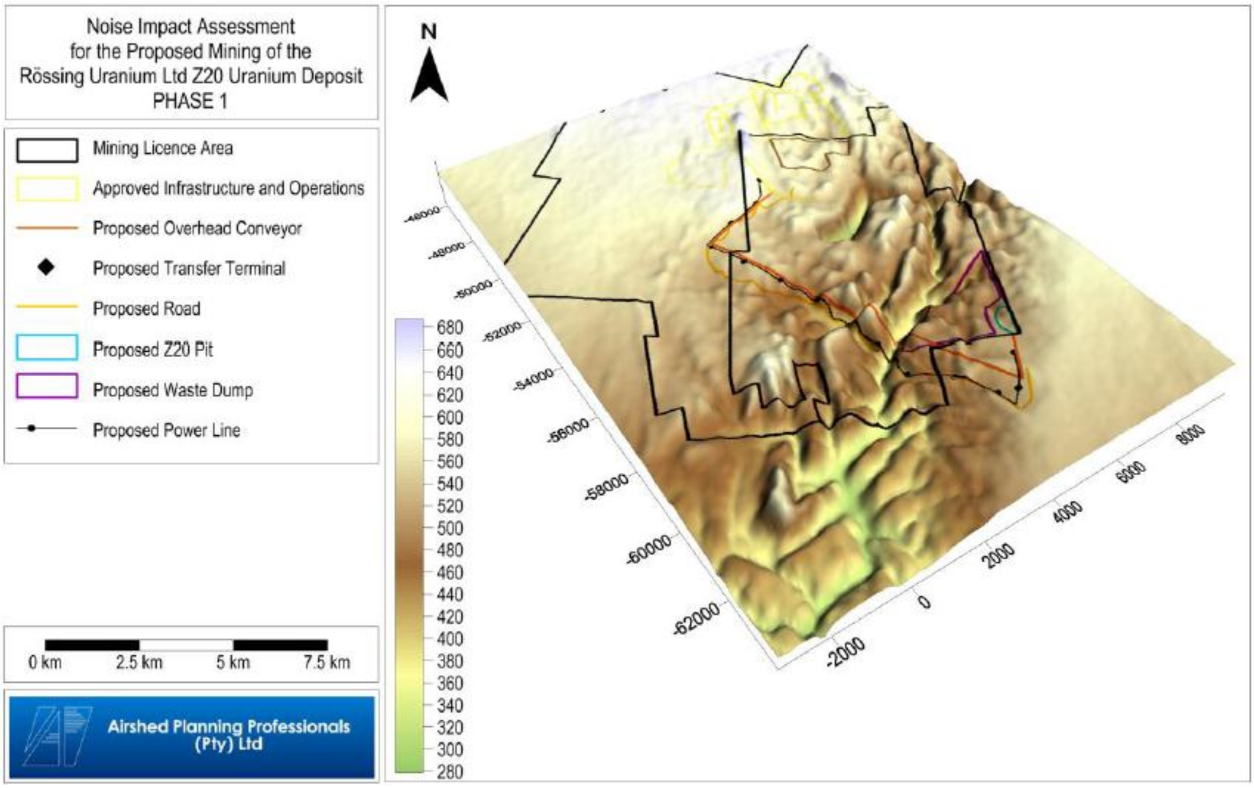

Figure 9: Dispersion potential of the air emissions from the proposed conveyor and road

4.4.3 Geology

The Rössing Uranium deposit lies within the Central Zone of the late pre-Cambrian Damaran orogenic belt that occupies much of central and northern Namibia. The early pre-Cambrian Abbabis formation is overlain by the Etusis and Khan formations of the Nosib group. The Abbabis rocks, which include variegated gneisses, phyllites, recrystallised carbonates and biotite schists, are exposed in the cores of anticlinal or domal structures. Intense deformation and high grade metamorphism are characteristic for the entire district (Ninham Shand, 2008).

The Etusis and Khan formations consist of metasediments that are overlain by marble, biotite-cordierite gneiss, conglomerates and feldspathic quartzite of the Rössing Formation. Various types of granitic rocks were generated by syntexis and partial melting, and emplaced into the

Damaran metasediment sequence some 510 million years ago. Dolerite dykes of Triassic age are prevalent and crosscut all older features (Ninham Shand, 2008).

4.4.3.1 Uranium Mineralogy

Uraninite is the dominant radioactive mineral present and it occurs as grains ranging in size from a few microns to 0.3mm, while betafite contains a minor proportion of the uranium in the ore. The primary uranium minerals uraninite and betafite give rise to secondary minerals that are usually bright yellow in colour. These occur either *in situ*, replacing the original uraninite grains from which they were formed, or along cracks as thin films and occasional discrete crystals. Of these secondary uranium minerals, beta-uranophane is by far the most abundant. This mineral is not always confined to the alaskite, but may also be dispersed into the enveloping country rocks along cracks and fracture lines. Ore-grades at the Rössing Uranium mine are very low, averaging 0.035%. Uraninite comprises about 55% of the uranium minerals present in the orebody, while betafite contributes less than 5% and the secondary minerals account for 40% (Aurecon, 2011). The mineralogy of the Z20 ore body will be discussed in the SEIA.

4.4.3.2 Soils

Soils are a significant component of most ecosystems. Saline soils are a feature of most deserts and the Namib Desert is no exception. Rocks are broken down first by physical and chemical weathering processes, after which chemical decomposition processes transform the stone fragments to progressively finer particles. The predominance of chemical weathering processes is accentuated by the dry climate and the occasional deposition of wind-blown salt of marine origin (Aurecon, 2011).

Saline soils are a feature of most deserts and the Namib Desert is no exception. Rocks are broken down first by physical and chemical weathering processes, after which chemical decomposition processes transform the stone fragments to progressively finer particles. The predominance of chemical weathering processes is accentuated by the dry climate and the occasional deposition of wind-blown salt of marine origin (Aurecon, 2011).

The soils in the vicinity of the Rössing mine are generally very shallow (less than 25cm) and greyish or ochre in colour, with a large proportion of coarse fragments and occasional calcium carbonate concentrations. In areas with surface calcrete or limestone deposits, “schaumboden” or “foam soils” are frequently found. These are characterised by high soil pH values and the formation of a crusted surface layer. Hard surface crusts, often bound by an overlying layer of blue-green algae (cyanobacteria), are found in lower Panner Gorge. These surface soil crusts can reduce rainfall infiltration rates and accentuate runoff (Aurecon, 2011).

Aeolian sand deposits of varying depth are found in sheltered areas in the upper gorges and are particularly prominent on the leeward (wind protected) slopes of Rössing Mountain. These sands are a mixture of dark to light brown grit, quartz and feldspar fragments, and biotite flakes (Aurecon, 2011).

Colluvium has been deposited on the shallower slopes of some hills, as well as at the base of steeper hills. The colluvium slope wash varies in thickness up to a maximum of about 1.5m. The material consists of a mixture of grey-brown silty sand with an open, angular pebble layer and its consistency varies from medium-dense to dense. Alluvial silty sands and gravels form an almost horizontal fan in the valley bottoms, having been laid down during the infrequent flash floods. The material is laminated, consisting of layers of slightly coarse sand interspersed with layers of angular gravel and pebbles, in a matrix of grey-brown silty coarse sand. In the gorges, the alluvial deposits are estimated to vary in thickness up to about 8m (Aurecon, 2011).

Alluvial deposits up to about 20m in thickness are also found in the bed of the Khan River, with a composition very similar to those found in the gorges. However, successive layers of gravels, sands, and silts are visible in flood-cut terraces, which vary in width from a few metres to several tens of metres. These stratification patterns indicate successive settling out of transported material with decreasing flood-water velocities. An important distinction of these Khan River bed deposits is the presence of conspicuous laminations of mid-brown or ochre, fine silt clay, reflecting the higher silt loads that are brought down by occasional surface floods (Aurecon, 2011).

4.4.4 Namib Naukluft National Park

The NNNP is an important wilderness reserve where the lack of manmade activities is a predominant characteristic, providing a benchmark for the Namibian "place of open spaces" sense of place and heritage. The NNNP was originally established as a buffer zone in 1908 to protect the diamond mining interests on the coast, especially as the land was not suitable for agricultural land use (MME, 2010). The MET carries responsibility for management of these protected areas, and proclaimed the Dorop Park during December 2010.

4.4.4.1 Tourism

The tourism sector is of significance to the Namibian economy as it provides over 18,000 direct employment opportunities and N$1,600 million in revenue per annum (MME, 2010). A large number of tourists pass through the region annually, which is an important link between attractions such as Etosha National Park and Sossusvlei. In 2007 Erongo recorded the second highest number of bed nights sold, and in January and February 2008, the third-highest bed occupancy in the country. The region also has the highest number of registered tourist accommodation establishments (Aurecon, 2011).

There are a number of significant tourist attractions within the NNNP including:

- the Khan River valley;
- the big tourist Welwitschia; and
- the Moon Valley landscape.

4.4.5 Biodiversity

The study area falls in the "Namib Desert" biome. Biogeographically the part of the Namib between the Kuiseb and Ugab Rivers, excluding the Brandberg, forms a distinctive subunit within the wider Namib Desert. This central Namib region harbours high numbers of range-restricted endemic invertebrates plants, reptiles, and mammals and may be divided into the Inner and Outer Namib. Invertebrates especially exhibit high levels of range-restrictedness, with a median calculated distribution area of 25km^2. Many distribution ranges tend to be of a narrow elongated north-south orientation. Distribution range size and shape can be correlated with the east-west environmental gradient in the Namib, and show high correspondence to calculated bioclimatic envelopes for the same areas. A targeted survey (Irish, 2011) to test the hypothesis that these observed small ranges were not real but an artefact of insufficient sampling confirmed the validity of the predicted bioclimatic envelopes in the cases considered.

The key characteristic of the approximately 40km-wide Inner Namib, and most likely the principal driver of biogeographical patterns, is the frequent occurrence of fog and the scarcity of rain. Invertebrates in this ecological zone tend to be highly range restricted, and a high proportion is endemic. Fog seldom reaches the Outer Namib, and this ecosystem is driven by episodic rain events, as opposed to fog. Although it also has many endemic invertebrates, distribution ranges tend to be larger and extend further along a north-south axis. Many invertebrates from adjacent inland areas (e.g. the escarpment zone) also occur marginally in the Outer Namib.

These large-scale climatic drivers of biogeographical patterns, overlaid onto smaller-scale geological and substrate factors, result in relatively well-defined plant and animal communities. Vegetation cover is sparse, mostly concentrated in washes and ravines and on rocky marble ridges. In the fog zone, fog-dependent species such as Dollar Bush (*Zygophyllum stapffii*) and a number of Bushman grasses (*Stipagrostis* spp.) are generally dominant, but plant communities are characterised by numerous endemic and near-endemic taxa, including Swakopmund Corkwood (*Commiphora oblanceolata*), *Euphorbia giessii*, *Ruellia diversifolia*, Kraal Aloe (*Aloe asperifolia*) and others. The Vulnerable (IUCN, 2008) Hartmann's mountain zebra (*Equus zebra hartmannae*) is perhaps the most important of the large mammal fauna, but gemsbok (*Oryx gazella*) and springbok (*Antidorcas marsupialis*) also occur. Important small mammals are endemic species such as the dassie rat (*Petromus typicus*), the pygmy rock mouse (*Petromyscus collinus*) and Setzer's hairy-footed gerbil (*Gerbillurus setzeri*). Numbers of larger predators, like the cheetah (*Acinonyx jubatus*) seem to be increasing, with animals being spotted in close vicinity to the project area.

4.4.5.1 Floristic Biogeography

Namibia falls into two floristic regions, the Karoo-Namib and the Sudano-Zambezian regions, belonging to the Palaeotropical floristic kingdom. White (1983) followed a similar phytogeographical approach but emphasised the importance of specific combinations of endemic species in distinguishing between regions. He assigned three floristic regions to Namibia, namely the Zambezian regional centre of endemism, the Kalahari-Highveld transition zone and the Karoo-Namib regional centre of endemism, which includes both the Namib Desert (the location of the current study area) and the escarpment zone.

The biomes described by Irish (1994) (Savanna, Nama-Karoo, Succulent Karoo and summer-rainfall Desert) correlate well with the vegetation types of Giess (1971, 1998). Importantly, Irish (1994) also described an east-west zonation in the desert with the western-most section bounded by the 20mm rainfall isohyets.

This zone, where average annual fog precipitation usually exceeds rainfall, is dominated by fog-dependent chamaephytes, specifically *Arthraerua leubnitziae* and *Zygophyllum* spp. with the occurrence of annuals limited by extremely low rainfall. Further east therophytes dominate, although they grow only in the rainy season and are otherwise present as seed. As a result vegetation in the dry season is very sparse indeed. The easternmost zone exhibits chamaephytic-therophytic co-dominance.

Mendelsohn *et al*. (2002) defined 29 vegetation types grouped into five biomes, based on the work of Giess (1971, 1998) and modified in the light of later work by a number of ecologists in Namibia. Similar to Giess (1971, 1998) it distinguishes between the winter and summer rainfall areas of the Namib and divides the latter into three sections, the southern Namib from around Lüderitz to the

Kuiseb River, the central Namib between the Kuiseb and Huab rivers and the northern Namib between the Huab and the Kunene rivers.

Only approximately 17% of the Namibian flora as a whole is thought to consist of endemic species (i.e. species restricted to within the political boundaries of Namibia). However, over 30% of plants that occur in the Namib Desert in Namibia are believed to be endemic to the Namib, although this is mostly influenced by high endemism in the Kaokoveld and the southern Namib.

Although the central Namib is therefore not generally regarded as a 'hotspot' of endemics for plants, about 36% of the plants recorded or expected in the two quarter-degree squares centred on the study area (2215Ac and 2215CA) are either endemic to Namibia or near-endemic (species whose range extend somewhat over the Namibian borders).

Overall, of the list of 222 species that could occur in the habitats of the study area there are 18 species that enjoy differing levels of legal protection (either under the Forestry Act or the Nature Conservation Ordinance), and only one (*Lotononis tenuis*) is listed as near-threatened on the Namibian Red Data List.

Those species listed by Burke (2009) and in Aurecon (2011) could be added to these lists of important species noted above, although it is not possible to confidently assign them to specific habitats in the current study.

4.4.5.2 Habitats and their sensitivity

The biotopes of Burke (2009) and as described in Aurecon (2011) were used as is for plants, with the addition of two habitats gleaned from the Husab studies: Plains (≈Gypsite Plains in AWR 2010a) and Aquatic Habitat. For animals, the three basic animal habitats of the Rössing Study (Pallet *et al.* 2008) were used as the common denominator.

Biotopes are assumed to represent distinct habitats from the vegetation perspective. Habitats for animals essentially represent a coalescing of all drainage habitats into one singe Watercourse habitat, and all mountainous habitats into Hillslope habitat. Aquatic Habitat is represented by Springs. The additional two animal habitats are the same Aquatic and Plains habitat as for the vegetation.

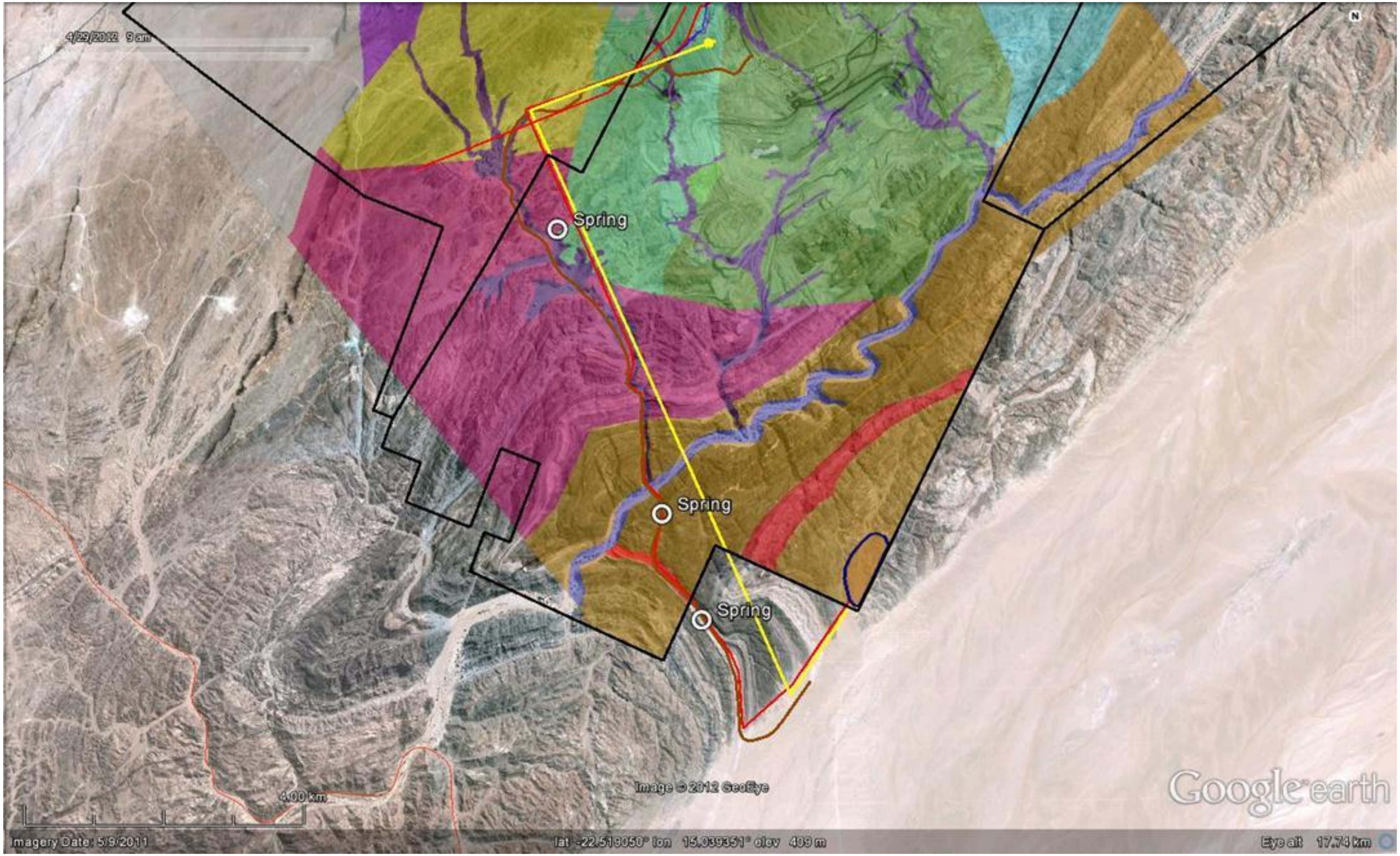

Figure 10: Biotopes of the study area, following Burke (2009)

The part of the linear infrastructure south of ML28 crosses three habitats defined in the Husab mine EIA study (AWR 2010a): "Black Gramadoelas" (analogous to Khan River Mountains), "Marble in Gramadoelas" (~Khan Marble Ridges), and "Rocky Valley Drainages" (~Southwestern Rivers). The road further crosses onto the "Gypsite Plain", which has no analogy amongst the Biotopes.

Table 11 indicates how the other habitat categorisations were correlated with this. The Aquatic Habitat from AWR (2010a) was also added as a main habitat for animals.

Table 11: Correlation of habitat types across different studies

Pallett et al. (2008)	Burke (2005; 2009)	AWR (2010b)	Current study (Plants)	Current study (Animals)
Watercourses	Khan River	Khan River	Khan River	Watercourse
	Southwestern Rivers	Rocky Valley Drainages	Southwestern Rivers Southern tributaries	
	Gorges			
Hills and Mountains	Western Granite Hills	Blank	Western Granite Hills	Hillslope
	South-western Hills	Blank	South-western Hills	
	Khan River Mountains	Pink Gramadoelas	Khan River Mountains	
		Black Gramadoelas		
	Khan Marble Ridges	Marble in Gramadoelas	Khan Marble Ridges	
Plains	Blank	Gypsite Plain	Plains	Plains
	Blank	Aquatic Habitat	Aquatic habitat	Aquatic habitat

The ecological characteristics of the different plant and animal habitats, with an emphasis on the occurrence of ecological functions and processes, as well as each habitat's sensitivity rating, are described in Table 12. For plants, Burke (2009) classified the biotopes into three categories based on the occurrence of a set of species conservation concern: critical, rare and general. Here these categories are assumed to correlate more or less to sensitivity ratings of very sensitive, sensitive and least sensitive respectively and are treated as such.

The proposed road is located almost entirely within the Watercourse habitat, and also crosses two of only three Aquatic habitats in the corridor. The proposed conveyor mostly crosses Hills and Mountains habitat. The proposed pipeline is aligned entirely with the road, and different parts of the proposed power line are aligned with either the road or the conveyor, so from a habitat loss view they can be considered together. The Plains habitat is confined to a narrow strip along the southern border of the corridor, and would potentially be crossed by all linear infrastructure considered here. The expected impact of development on these habitats is expected to be direct habitat loss in some cases, and loss of ecosystem functionality in others.

4.4.5.3 Expected / Recorded plant species

A comprehensive list of the plant species that could occur in the study area, including their endemic and other conservation status, can be found in Biodiversity Specialist Study (attached as an Annexure C). Although vegetation communities in habitats along the linear infrastructure routes have not been verified in the field, it is unlikely that they will differ significantly from those described in Pallett *et al*. (2008), Burke (2009), AWR (2010a, 2010b) and Aurecon (2011). As in these previous studies, the main factors that distinguish different species associations appear to be geology/substrate, topography/landform and drainage pattern.

In terms of the current study, important species are associated with the following habitats:

- The Watercourse habitat: Species include the camel thorn (*Acacia erioloba)*, the ana tree (*Faidherbia albida)*, the Lammerdrol (*Maerua schinzii)*, the leadwood (*Combretum imberbe)*, the sycamore fig (*Ficus sycomorus)*, the tamarisk (*Tamarixus neoides)* and the Salvadora bush (*Salvadora persica*).
- The large marble ridge: The conveyor system will also cross, where species such as elephant's foot (Adenia pechuelli), *Aloe asperifolia*, *A. namibensis*, *A. dichotoma*, *Commiphora oblanceolata*, *C. saxicola*, *Euphorbia guerichiana* and *E. virosa*, *Monechma cleomoides* and *Sarcocaulon marlothii* are important species that either are protected or have restricted ranges.
- Aquatic habitat: The proposed road will cross this area, where thicker vegetation consisting of Salvadora bush, *Cyperus* sp. and *Eucleapseudebenus* provide important habitat and resources for invertebrate and vertebrate animals.

The Hillslope habitat harbours fewer species of conservation concern, with an important exception being the protected succulent *Lithops ruschiorum (*Nature Conservation Ordinance 4 of 1975, Schedule 9, Protected Plants), which has been negatively affected by uranium mining in the past and is known to occur here (and on marble ridges) (Loots, in press, AWR 2010b). Similarly, the Plains habitat affected by the project is very small and therefore not important in the assessment of impacts on vegetation.

In all cases, the principal risk to species and populations comes from a direct loss of individuals (thus impacting population dynamics) and destruction of habitat.

Table 12: A description of the ecological characteristics of habitats likely to be affected by the proposed linear infrastructure, with an indication of their sensitivity ratings

PLANTS			ANIMALS		
Name	**Ecological characteristics**	**Sensitivity**	**Habitat Name**	**Ecological characteristics**	**Sensitivity**[5]
Khan River	• Discrete vegetation assemblage that includes large trees that depend on regular replenishment of aquifer and in turn provides habitat to a suite of invertebrate trophic guilds dependent on large woody vegetation; • Dominant species: *Acacia erioloba*, *Faidherbia albida* (ana tree) and *Tamarix usneoides*; dense thickets of *Salvadora persica*; undergrowth comprises a diverse assortment of herbs, shrubs and grasses. Invasive aliens: *Prosopis glandulosa* (mesquite) and *Nicotiana glauca* (wild tobacco) are a threat to indigenous species, communities and ecosystem functioning. • Seasonal standing water; • The valley walls and large trees provide shelter from wind, blown sand and sun; • High disturbance rate with regular flooding (disturbance is an important ecological process); • Regular re-charge of aquifer; and • Species richness medium (56 species).	General	Watercourse	• Well-defined movement corridors for wildlife - route for animal dispersal and movement, access route to critical resources such as water and food; • Critical corridor for zebra and other game to access springs and also to respond to spatial and temporal variability of available grazing; • Supports seasonal standing water; • Supports kudu and ostrich populations, as well as predators preying on them; • Large trees and thickets are important as both shelter and food sources for invertebrates, reptiles, birds and small mammals; • Large trees are important sources of shade for birds and large mammals; • Vegetation, both perennial and seasonal, provide grazing and browsing for large mammals; • Small perched aquifers may be common, and consequently also springs (forming the Aquatic Habitat - see below); • Larger, wider watercourses also supports	Very Sensitive
Southern Tributaries	• Often contain saline or fresh perennial or ephemeral springs with associated vegetation and birdlife; • Springs are considered a habitat on their own (see Aquatic Habitat below); • Supports a diverse assemblage of herbs and grasses: *Stipagrostis hochstetteriana* (gemsbok-tail grass) and	General			

[5] Sensitivity ratings for plants follow the ratings of biotopes as per Burke (2009) and Aurecon (2011), except for the last two habitats which are correlated with AWR (2010a, 2010b). Sensitivity ratings of animal habitats follow Pallet *et al.* (2008). Ecological characteristics are based on those for similar habitats in AWR (2010a and 2010b) and in Aurecon (2011).

PLANTS			ANIMALS		
Name	**Ecological characteristics**	**Sensitivity**	**Habitat Name**	**Ecological characteristics**	**Sensitivity**[5]
	Blepharis pruinosa (desert thistle) are locally dominant. Trees, such as (camel thorn) occur occasionally, attracting birds and other wildlife; and • Species richness is high (74).			Rüppel's Korhaan and Ludwig's Bustard; • The occurrence of trees and freshwater seepages after good rains makes these gorges important habitats for animals; and • They function as resource reservoirs in unfavourable seasons in that animals from the Hillslope habitat through which they run temporarily descend into watercourses to feed when resources become scarce in the hills.	
South-western Rivers	• Two larger rivers draining into the Khan River; • Filled with coarse sand, boulders and other erosion material and receiving most of the run-off from the mountains; • Supporting different vegetation to the surrounding mountain slopes; • *Zygophyllum stapffii* dominant in many sections, but the herb *Cleome foliosa* var. *foliosa* and the tall, endemic grass *Stipagrostis damarensis* also locally abundant; • Contains similar species composition to the Khan River with trees such as *Acacia erioloba*, *Parkinsonia africana* and *Tamarix usneoides*; • Endemic species recorded were Aizoanthe mumdinteri, Arthraerua leubnitziae, Hermbstaedtia spathulifolia and Sesamum marlothii; and • Species richness is low at 45.	General			
Gorges	• The lower sections of water courses contain sandy gorges that support a range of plants also found in the Khan River itself and typical of river courses in this area (*Acacia erioloba*, *A. reficiens*, *Salvadora persica* and *Tamarix usneoides*; and • Species richness medium to high (70 species).	General			
Western Granite Hills	• Although granite is prominent, other rock types also occur here; • Supporting diverse assemblages of plants: locally dominant are Arthraerua leubnitziae, Euphorbia gariepina and Petalidium variabile, Adenia pechuelii, Aloe asperifolia, several Commiphora species,	Rare	Hillslopes	• High diversity of nooks and crannies forming shelter for a range of small mammals, reptiles and invertebrates; • Forms the only habitat for klipspringer, dassie rat, pygmy rock mouse, mountain ground squirrel and red rock rabbit,	Very Sensitive

PLANTS			ANIMALS		
Name	**Ecological characteristics**	**Sensitivity**	**Habitat Name**	**Ecological characteristics**	**Sensitivity**[5]
	Sarcocaulonmarlothii and Zygophyllum stapffii; • Several populations of *Lithops ruschiorum* occur here; and • Species richness is medium (75), but the biotope is rated "rare" because of several range-restricted plants.			amongst other rupicolous species; and • Very inhospitable to average life forms, therefore those that do live here have evolved to adapt to the adverse conditions. The result is a high percentage of endemic, range-restricted species, particularly among the invertebrates.	
South-western Hills	• Relatively low and patchy plant cover; • Nevertheless support species of conservation importance such as Arthraerua leubnitziae, Dauresia alliariifolia, Hermbstaedtia spathulifolia and Lotononis bracteosa; • Locally dominant perennials on the hillslopes are *Commiphora saxicola* and *Tetragonia reduplicata*; and • Species richness is relatively high at 71.	Rare			
Khan River Mountains	• Small gullies contain sandy substrates with many plant species, including *Commiphora oblanceolata*; • Steep schist mountains (of Kuiseb and Chuos formations) line the north- and south-banks of the Khan River, intruded by bands of granite and quartz; • Incised by deep channels, contains seepage areas; • Diverse microhabitats, supporting by far the highest number of plant species of all biotopes in the study area; • Several *Commiphora* species, *Euphorbia virosa*, *Maerua schinzii*, and *Sterculia africana* are some of the more conspicuous plants on these slopes; and • Species richness is high at 136 species.	Critical			
Khan Marble Ridges	• Folded bands of marble of the Karibib formation cutting across the Khan River Mountains, with layers striking nearly vertical; • Layered stone structure, many nooks and crannies; • Water retention probably high; • Layered character may result in water percolation and retention in rock fractures;	Sensitive			

PLANTS			ANIMALS		
Name	**Ecological characteristics**	**Sensitivity**	**Habitat Name**	**Ecological characteristics**	**Sensitivity**[5]
	• Shares many plant species with the Khan River mountains, but also contains species that appear to be restricted to this habitat type: *Aloe namibensis*, *Commiphora oblanceolata*, *Euphorbia virosa*, and *E. lignosa* are only found here; and • Richness is high at 88 species.				
Plains	• Indistinct area, located more or less along the Khan-Swakop watershed; • Hardpan gypsite layer, with shallow loamy gravel or sand cover; • Specific erosion pattern with sharp edges on small gullies, associated with high plant productivity; • Forms small (0.5m to 2m) mostly circular depressions that store water seasonally and result in vegetation rings, often containing perennial and annual grasses and herbs, including endemics such as *Cleome carnosa*, *Jamesbrittenia barbata* and *Sporobolus nebulosus*; • Strong association of *Arthraerua leubnitziae* with gypsite plains; *A. leubnitziae* may represent a minor keystone structure; and • Species richness is unknown (did not form part of biotope assessment).	Least Sensitive	Plains	• The habitat represents a narrow outlier of the Inner Namib fog zone, due to higher fog precipitation on the edge of the Khan valley; • High percentage of fog-dependent species, all endemic, many range-restricted and substrate specific; • Gypsum substrate highly sensitive to disruption. Disrupted substrate renders habitat unsuitable for substrate specific taxa; • On the gypsite plains small mammal (primarily gerbil) burrows are apparently strongly associated with -depressions, possibly resulting in localised fertilisation and increased water penetration; may thus be a keystone feature; although under-represented in the study area; and • Elsewhere, ample evidence of zebra grazing in this habitat, less so in study area.	Very Sensitive, but small part of study area
Aquatic Habitat	• Occurs mostly in the form of seepages or springs in the rocky valleys adjacent to the Khan River, but specifically as a spring in the southern tributary that leads up to the ore body; • Springs may be ephemeral or perennial;	Sensitive	Aquatic Habitat	• Provides critical habitat for specific plants, potentially some amphibians and a range of poorly-known but invariably water-associated invertebrate species; • Provides critical resource for a number of	Very Sensitive

PLANTS			ANIMALS		
Name	**Ecological characteristics**	**Sensitivity**	**Habitat Name**	**Ecological characteristics**	**Sensitivity**[5]
	• Species richness is unknown (did not form part of biotope assessment).			water-dependent mammal species such as zebra, as well as for many passerine birds; • Seasonal effect of ephemeral springs will be important determinant of space use by zebra; • High water temperature, high salinity and high risk of desiccation restricts possible range of aquatic taxa to those adapted to adverse conditions, expected to show high endemicity as a result.	

4.4.5.4 Expected / Recorded animal species

The following 17 taxa of concern have been identified for the project area (Table 13). The most significant impact would be loss of potential habitat and interference with movement and dispersal. In the case of range-restricted species, habitat loss equates to a decline in living space and population viability. If severe enough, population numbers may decline and extinction becomes a possibility.

Collisions are another concern, both by birds colliding with aerial infrastructure, and vehicles colliding with animals. If sufficiently severe, population numbers could be negatively affected, compounding any potential effects of habitat loss for the same species. The genetic contamination concerns for some species in the area are real, but the proposed development *per se* is largely neutral to the issue. Lastly, poaching is always a concern.

Table 13: Species of concern for study area

Species	Common name	E	T	L	P	H	W	A	Potential impacts
REPTILES									
Pedioplanis husabensis	Husab Sand Lizard	X				X			Habitat loss. Range-restricted endemic species confined to core of Uranium Province. High potential of cumulative impacts. Seems to prefer marble substrates.
Varanus albigularis	Rock Monitor			X			X		Risk of poaching, but probability of occurrence low.
BIRDS									
Aegypius tracheliotus	Lappet-faced Vulture		X	X	X	X	X		Powerline collisions (which includes potential conveyor collisions, pending outcome of suggested monitoring study, also for next four species). Loss of nesting sites. Regular visitor, potential resident..
Aquila verreauxii	Black Eagle			X			X		Powerline collisions. Habitat loss. Known visitor, but not known to be resident currently.
Eupodotis rueppellii	Rüppell's Korhaan	X		X	X		X		Powerline collisions. Habitat loss. Habitat fragmentation.
Neotis ludwigii	Ludwig's Bustard		X	X	X		X		Powerline collisions. Habitat loss. Habitat fragmentation.
Polemaetus bellicosus	Martial		X	X			X		Powerline collisions.

	Eagle								Known visitor, but unlikely to be resident in the area.
Struthio camelus	Ostrich			X	X		X		Genetic contamination concerns.
MAMMALS									
Equus zebra	Namibian Mountain Zebra	X	X	X		X	X		Habitat loss. Near-endemic subspecies with fragmented range. Important ecological role. Previous presence in the study area is evidenced by remains of zebra wallows, but no recent observations.
ARACHNIDS									
Heradida griffinae	Ant spider	X	X		X		X		Habitat loss. Range-restricted endemic only known from three samples from the Rössing area.
Moggridgea eremicola	Tingle trapdoor spider	X	X			X			Habitat loss. Range-restricted endemic, known from a single specimen from Lower Dome Gorge only. Has never been recaptured despite intensive efforts. The proposed Z20 pit is 7.5km from the Lower Dome locality.
Namundra griffinae	Prodidomid spider	X	X			X			Habitat loss. Range-restricted endemic, known from two samples only, both within Rössing Uranium's mining area.
INSECTS									
Acmaeodera liessnerae	Jewel beetle	X	X		X	X	X		Habitat loss. Central Namib endemic, also recorded from the Rössing area.
Hedybiusirishi	Flower beetle	X	X				X		Habitat loss. Range-restricted endemic. Known from three specimens from Lower Ostrich Gorge (10km NW of proposed Z20 pit) only.
Iselma deserticola	Blister beetle	X	X		X	X			Habitat loss. Range-restricted endemic, known only from the

									Arandis – Rössing Mine area.
Metaphilhedonusswakopmundensis	Flower beetle	X	X			X	X		Habitat loss. Range-restricted endemic, known only from three localities within a 10km radius of the proposed Z20 pit.
Notho morphoidesirishi	Jewel beetle	X	X		X		X		Habitat loss. Range-restricted endemic, known only from the Arandis – Rössing Mine area.
Legend: E = Endemic, T = Threatened, L = Legal status, P = Plains habitat, H = Hillslope habitat, W = Watercourse habitat, A = Aquatic habitat.									

4.4.5.5 Important habitat features and movement of species

The following habitat features are important:

- The Khan and Swakop act as linear oases and are characterised by high plant biomass and diversity (as well as a high number of trophic guilds for invertebrates and high vertebrate species diversity);
- Large riparian trees (*Acacia erioloba*, *Faidherbia albida*) are both protected and keystone species, and form habitat for a range of other organisms;
- Permanent springs are important resources for mammals (and habitat for aquatic invertebrates and frogs); and
- The presence of woodland and savanna species in this hyper-arid zone is facilitated by the intact riparian vegetation in the Khan River.
    - Animal movement must be understood in view of the fact that part of the project area falls inside a national park where animals are supposed to have the freedom to roam. This places a strong emphasis on the preservation of species and natural processes and an onus on the proponent to prevent local extinction. Additionally, the proliferation of linear infrastructure serving the mines in the region, as well as the presence of the mines themselves with the attendant traffic and disturbance, means that animal movement is already being severely hampered.

Although theoretically none of the linear obstructions are impermeable to wildlife, a rapid assessment of wildlife overpasses and pipe sections the Langer Heinrich Uranium (LHU) pipeline next to the C28 road showed very little usage of the approximately 30m wide wildlife overpasses, and high density of movement at the point where the pipeline goes underground. The low frequency of crossing along the length of the aboveground pipeline is evidence of the potentially disastrous effect that aboveground pipes, (even relatively small obstructions of 400mm in height) may have on the movement of large mammals. In the specific case of the LHU pipe, the impact was almost solely on springbok and gemsbok, but any aboveground pipes in the Khan-Swakop triangle may potentially also interfere with zebra movement.

A number of bird species of conservation concern are either present in or move through the region including resident or nomadic the Lappet-faced Vulture, Ludwig's Bustard and Rüppell's Korhaan.

Example of migratory species that may use the affected area as migratory corridors are the Lesser Flamingo, the Greater Flamingo, and the Great White Pelican. The Lappet-faced Vulture and White-backed Vulture are important scavengers and the presence of the Namib endemic habitat specialist Rüppell's Korhaan is of conservation importance.

4.4.5.6 Key functional and cross-cutting issues

The following could impact on key functions:

- Surface and/or subsurface flow of water maintaining perennial species typical of washes and drainages. These species, including several central Namib endemics, are threatened by potential cumulative losses due to uranium mining throughout the central Namib;
- Access routes for wildlife to the Khan area and the springs and grazing areas in its adjacent valleys;
- Normal movement of large mammals between foraging and water, and as part of their normal social behaviour, especially in the corridor formed by the Khan River;
- Connectivity and linkages of sub-populations of a number of larger vertebrates (mammals and the Common Ostrich) across the central Namib region;
- Intactness of riparian vegetation which depends on groundwater in the sandy river aquifers.

4.4.6 Water

Virtually the whole of the central Namib Desert is drained by four river systems, namely the Omaruru, Khan, Swakop and Kuiseb Rivers that flow westwards to the Atlantic Ocean. Each of these rivers has its source in the high interior plateau of Namibia. Because of the rapid decrease in rainfall from east to west, these rivers function mainly as runoff courses for the precipitation that falls in the interior. The erratic and episodic nature of regional rainfall patterns combined with high rates of evaporation limit both the quantity of water carried by these rivers and the duration of flows (Aurecon, 2011).

4.4.6.1 Geohydrology

Groundwater resources in this part of the Namib Desert are confined to the alluvium of ephemeral rivers. The Khan River contains appreciable quantities of groundwater that sustains riparian vegetation in spite of its brackish quality. The Khan alluvium reaches a thickness of up to 20m and the mine’s boreholes show yields of 20 to 50 cubic metre per hour (m^3/h). The sediment fill of the tributaries is only 5m to 10m thick, but it can be very permeable in the lower gorges.

The Karibib Marble ridge adjacent to the Khan River has relatively low permeability and is considered a barrier to flow, except where this formation is transected by the Dome, Pinnacle, and Panner gorges. The alluvial fill in the drainage networks (particularly in the gorges) is characterised by high hydraulic conductivity and high specific yields.

Hydrogeological information about the primary and secondary aquifers at Rössing mine has been collected since 1980 and various numerical groundwater flow models have been established. The regional flow pattern shows a gradient from north-east to south-west towards the Khan River in accordance with the topography. Flow in the alluvial aquifers follows the course of the dry riverbeds, which are aligned roughly north-south.

Table 14: Hydrogeological Parameters of Rock Formations at Rössing Mine

Period	Formation	Lithology	Hydrological property	Permeability (m/d)	Storage capacity
Recent		Alluvium	Aquifer	2-80	0.1-0.2
Damara System	Intrusives	Alaskite	Aquitard	0.01-0.1	0.001
		Granite-gneiss	Aquitard	0.005	0.001
	Karibib Formation	Metasediments	Aquifer	0.15	0.01
	Chuos Formation	Meta-tillite	Aquitard	0.005	0.001
	Rössing Fm	Metasediments	Aquifer	0.1-1.0	0.01-0.15
	Khan Formation	Schist	Aquifer	0.1-0.5	0.01
		Gneiss	Aquitard	0.01-0.1	0.001

The primary porosity and hydraulic conductivity of the Damara metamorphites and intrusives is very low and these rock types are mostly classified as aquitards as shown in Table 14. Secondary aquifers exist in places where the bedrock is sufficiently fractured. Sub-surface flow is mainly along larger fracture systems and is focused towards the Dome, Pinnacle and Panner gorges, which then drain to the Khan River. There is also a minor element of direct discharge from the bedrock to the Khan River. Typical borehole yields in secondary aquifers are below $1m^3/h$, but wells on fracture zones can produce up to $5m^3/h$. Groundwater encountered in bedrock aquifers is saline as described in the following paragraph.

4.4.6.2 Surface water

The four main rivers in the Erongo Region contain intermittent surface flows following rain, but most of the time, water 'flows' below the surface in the sediments of the riverbed (MME, 2010).

The Khan River is an ephemeral river, which only has surface flow after major rainfall events in the catchment. Most runoff is generated further upstream in the catchment, where the annual rainfall is significantly higher. The river channel in this section is generally sandy with no visible rock outcrops. There is scattered vegetation (grasses, shrubs, trees) and the width is between approximately 80m and 150m wide throughout. The edges of the river channel are constrained by the bedrock outcrops that rise steeply from the channel as indicated in Figure 11.

Several ephemeral springs occur at points along the Khan River and in the gorges that drain into the Khan River, apparently at local fracture points or at the interface of porous and impervious rocks. Their flows are insignificant and persist for short periods after local rainfalls only (Aurecon, 2011).

Prior to the onset of mining activities, three sources of surface water were important in the Rössing area, namely the Khan River and the ephemeral and permanent springs. The non-perennial Khan River runs in an east to west direction. The Khan River catchment below Rössing Mine has a capacity of approximately $8,200km^2$, of which $6,000km^2$ is considered to generate runoff. Approximately 25km downstream of the Rössing Mine, the Khan River flows into the Swakop River which then flows westwards to the Atlantic Ocean at the town of Swakopmund. The mine is situated within the catchment of four main tributaries of the Khan River, namely Dome Gorge, Boulder Gorge, Panner Gorge and Pinnacle Gorge (Aurecon, 2011).

Figure 11: Khan River in vicinity of planned infrastructure corridor (looking upstream)

The Dome Gorge flows in a south easterly direction draining runoff from the catchment upstream of the main water supply line situated to the east of the tailings facility. The Boulder Gorge catchment contains the bulk of the mine plant and the watercourse drains to the east of the plant. Panner Gorge is orientated in a southerly direction and drains to the west of the mine. Pinnacle Gorge has its catchment to the southern part of the tailings facility and flows along the south western side of the open pit (Aurecon, 2011).

Only one natural perennial spring is known to occur in the Rössing area and this is located in a side-arm of Panner Gorge. The slow-flowing outflow from the spring fills a small shallow pool (approximately 1.5m by 4.0m, with a maximum depth 10cm), before overflowing. The overflow consists of a shallow (less than 5cm deep) stream that meanders over a sand and gravel bed for some 15m before disappearing underground. Occasionally the spring does not overflow, though the water level in the pool remains more or less constant. Several highly saline permanent springs occur at various points around the margin of the gravel plains of the Namib Desert and provide important sources of drinking water for animals, despite their salinity (Aurecon, 2011).

4.4.6.3 Water quality

Flowing rivers in the vicinity of the mine are only found after heavy rainfall. Flood water quality analyses of the Khan River indicate that the total dissolved solids content of flood water can be quite variable. A few samples taken during the 1970s showed an increase from 261mg/L at Usakos to 877mg/L at the Khan/Swakop River junction. Samples of the 1995 flood varied from 270 to 430mg/L at the mine to 730mg/L in the Swakop River just downstream of the confluence.

The natural groundwater quality in the vicinity of Rössing Mine is very saline with total dissolved solids (TDS) concentrations of 20,000mg/L to 40,000mg/L on the desert plains in the north-west. The water quality improves gradually to TDS of less than 10,000mg/L in a south-easterly direction towards the Khan River. Groundwater quality data for the Khan and Swakop rivers indicate a variable composition that improves after floodwater recharge, but generally deteriorates with distance downstream. Khan groundwater in the vicinity of the mine is brackish with an average TDS concentration around 5000mg/L. The lower courses of the Khan and Swakop rivers contain brackish to saline groundwater that is not suitable for human consumption. The Khan River water, being naturally brackish, is unsuitable for most purposes other than livestock watering and sustaining hardy vegetation (Aurecon, 2011).

The only other natural surface water is found in small springs or groundwater seeps, three of which are located within a radius of 15km around the mine. Even though the spring water is saline, animals sometimes make use thereof.

Rössing Uranium has a ground water pollution control system in place, whereby potentially polluted ground water is abstracted and recycled. To monitor this, Rössing Uranium undertakes annual ground water quality monitoring of between 80 and 120 of its boreholes per year, around the mining site and reports the findings directly the Department of Water Affairs, who monitor compliance with the permit conditions (Ninham Shand, 2008).

4.4.7 Archaeology

Detailed archaeological surveys at several points along the Khan River valley have revealed a consistent pattern of human occupation during the last 5,000 years. It appears from these survey results that the Khan River valley itself, as well as the many tributary ravines that drain towards it, were not the main focus of settlement. Although episodic flooding of the Khan River valley would have removed evidence of settlement, it does appear that the desert areas to the north and south of the valley were more important.

The bulk of archaeological sites dating to the last 5,000 years in this area reflect the initial re-occupation of the Namib Desert following the mid-Holocene Climatic Optimum, when hunter-gatherer groups began to develop increasingly specialized modes of subsistence. Evidence of earlier occupation is scarce, and while this must reflect the differential preservation of earlier evidence, there are indications that the Namib was subject to brief spells of occupation, interspersed by long periods of relative inactivity. One of these occupation events that appears more intense than any other, could relate to the Eemian, or Riss-Wurm Interglacial during the late Pleistocene, approximately 120,000 years ago.

Holocene occupation evidence is relatively diverse, and includes local concentrations of stone features representing the remains of windbreaks and hunting blinds, small surface scatters of stone artefact debris and suchlike. The Holocene sites clearly show the use of the landscape as a resource base, as a strategic terrain for ambush hunting, and as a complex set of communication routes. In contrast, the earlier, Pleistocene, evidence appears to indicate heavy concentration of effort on prime resources, especially high quality chert, used in the manufacture of stone artefacts. While the climatic conditions of Holocene settlement were much as we know them today, Pleistocene occupation probably occurred under far wetter conditions.

The archaeological sites located in relatively close proximity to the proposed infrastructure corridor are shown in Figure 12. Four of the sites relate to local exploitation of chert as raw material for artefact production (QRS 72/13, 14, 48 and 49). At least one of the sites is considered to have a high potential for further research. Site QRS 105/31 and 32 relate to recent pre-colonial occupation. A radiocarbon sample from QRS 105/32 yielded a date of 250 ± 40 years BP (Beta-259158). Evidence of recent historical occupation was found at QRS 72/11 which was used as a geologist's field camp during the early exploration of the Rössing Uranium find.

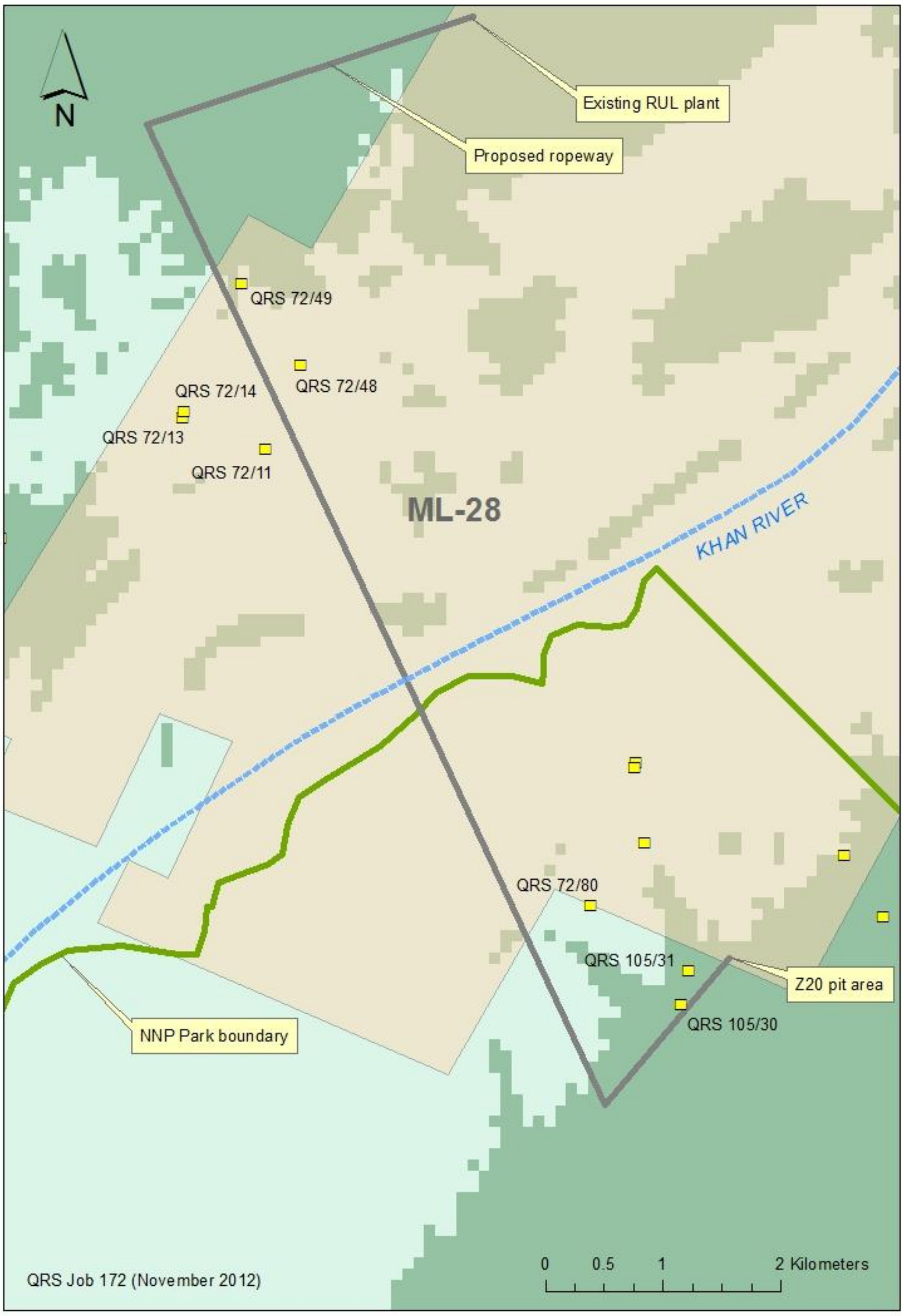

Figure 12: The location of archaeological sites (labelled) in close proximity to the proposed aerial ropeway

4.5 AMBIENT BASELINE CONDITIONS

4.5.1 Radiological baseline

Radiation is travelling energy in the form of electromagnetic waves or subatomic particles. Low-energy radiation is encountered in everyday life from radio and TV waves, visible light, ultraviolet radiation and high-energy microwaves. These forms of low-energy radiation lack the energy to remove electrons from the shells of atoms are therefore referred to as non-ionising. Radiation associated with x-rays, nuclear medicine, radiation from the sun, nuclear energy and nuclear processes such as natural (spontaneous) and man-made radioactivity (X-rays, some cancer treatments), as well as terrestrial radiation from soils and rocks is referred to as ionizing radiation. This means that the radiation has sufficient energy to interact with atoms in matter, strip them of electrons and thereby produce charged particles called ions. Uranium mines are a source of ionizing radiation as uranium is a radioactive metal (MME, 2010). Materials containing enhanced levels of radium-226 are sources for radon exhalation. Most notably are tailings dams, with lower emissions possible from the ripios and waste rock piles and even lesser amounts from the ore stockpiles.

The individual dose limit places an upper limit on the dose from all controllable sources to which an individual may be exposed. It is roughly estimated that the average natural background exposure in the Erongo Region is around 1.97mSv/a, which is composed of 30% dust, 28% terrestrial, 24% radon and 18% cosmic radiation. This is about 13% lower than the world background average of 2.4mSv/a (MME, 2010).

The background level of radiation differs from place to place. Some migmatitic dome structures contain abnormally high concentration of uranium, giving rise to an increased local, natural radioactivity level. Naturally elevated radioactivity levels can be found in water samples taken from the Khan and Swakop Rivers.

The Rössing Uranium Mine is situated in an area of elevated levels of natural radioactivity. For example, the background radon doses are normally in the low mSv/a range. It is therefore expected that the total background dose is higher than the worldwide average of 2.4mSv/a (NECSA, 2012).

4.5.2 Air quality

Mining operations is a potential the source of fugitive dust emissions (PM_{10} and Total Suspended Solids (TSP)) with small amounts of nitrogen oxides (NOx), carbon monoxide (CO), SO_2, methane and carbon dioxide (CO_2) potentially released during blasting operations.

Sampling was performed at twelve sites, in and around Rössing Uranium. The measured concentrations obtained from this monitoring campaign is an indicator of ambient air quality levels, but data of at least one year should be assessed in order to determine average ambient concentrations as this will take into consideration temporal variations. The results of the monthly dust fallout monitoring data are shown in Figure 13.

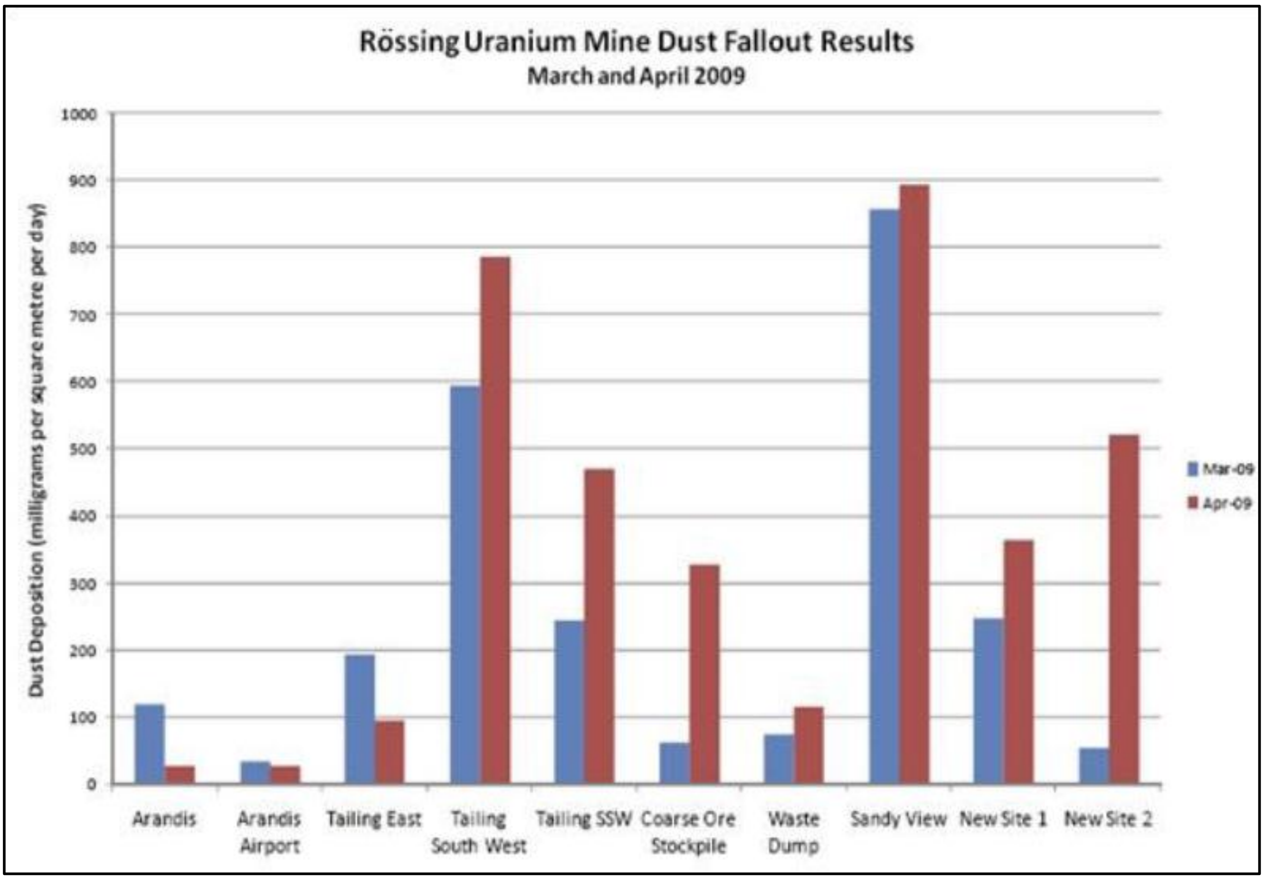

Figure 13: Monthly average dust fallout results at Rössing during March and April 2009

Dispersion modelling was undertaken to determine highest daily and annual average PM_{10} ground level concentrations and dust fall rates from current routine operations. The modelled ambient air quality assessment indicates that the selected ambient guideline for PM_{10} concentrations of 75µg/m³ is exceeded within the mine boundary around the main mining activities. However it must be noted that this assessment is based on modelled quality and monitoring needs to be undertaken to confirm this. The model indicated that the majority of dust fall occurs within the mine boundary. The predicted dust fallout rate at the mine boundary is below 600mg/m²/day which are the maximum dust fall rate for residential areas.

4.5.3 Noise

Noise is generally defined as unwanted sound transmitted through a compressible medium such as air. Sound in turn, is defined as any pressure variation that the ear can detect. Human response to noise is complex and highly variable as it is subjective rather than objective.

Noise is reported in decibels (dB). “dB” is the descriptor that is used to indicate 10 times a logarithmic ratio of quantities that have the same units, in this case sound pressure. The relationship between sound pressure and sound pressure level is illustrated in the equation below.

$$L_p = 20 \cdot \log_{10}\left(\frac{p}{p_{ref}}\right)$$

Equation 1

Where:

L_p is the sound pressure level in dB

P is the actual sound pressure in Pa; and

P_{ref} is the reference sound pressure (P_{ref} in air is µPa).

The number of pressure variations per second is referred to as the frequency of sound and is measured in Hertz (Hz). The hearing of a young, healthy person ranges between 20Hz and 20,000Hz (20kHz).

In terms of sound pressure level, audible sound ranges from the threshold of hearing at 0dB to the pain threshold of 130dB and above. Even though an increase in sound pressure level of 6dB represents a doubling in sound pressure, an increase of 8dB to 10dB is required before the sound subjectively appears to be significantly louder. Similarly, the smallest perceptible change is about 1dB.

4.5.3.1 Effect of topography on noise levels

The Rössing Uranium Mine, at 575 metres above mean sea level (mamls), is located on the generally south-east-facing, rough and undulating slopes near the Western edge of the central Namib Dessert. Terrain in the southern parts of the MLA is characterised by the several steep gullies and gorges that drain into the Khan River resulting in a rugged and hilly landscape. As one moves north from the Khan River, toward the town of Arandis the storm-wash gullies become less pronounced and are interspersed with resilient rock ridges resembling a more typical Namibian desert plain (Aurecon, 2012). The Khan River valley may serve as a natural noise barrier between the activities within the valley and communities on the gravel plains i.e. Arandis. Noise reduction caused by a barrier (natural terrain or installed acoustic barrier) feature depends on two factors namely the path difference of the sound wave as it travels over the barrier compared with direct transmission to the receiver and the frequency content of the noise. Low frequency noise is difficult to reduce with barriers.

Sound reflected by the ground interferes with the directly propagated sound. The effect of the ground is different for acoustically hard (e.g., concrete or water), soft (e.g., grass, trees or vegetation) and mixed surfaces. Ground attenuation is often calculated in frequency bands to take into account the frequency content of the noise source and the type of ground between the source and the receiver barriers. Ground cover consists of gravel plains with sparse vegetation and is considered acoustically hard i.e. not conducive to noise attenuation. The reflection of noise generated within the valley, specifically during the construction has been raised as a concern by farmers residing to the west of proposed operations.

4.5.3.2 Baseline noise

Noise measurements were conducted at nine background positions near the Rössing Mine boundary and three at affected community sites as indicated in Figure 14. Measurement results reported included the impulse weighted equivalent continuous A-weighted sound pressure level (LAIeq)1 and L90, the A-weighted 90% statistical noise level, i.e. the noise level that is exceeded during 90% of the measurement period. It is a very useful descriptor which provides an indication of what the Equivalent continuous A-weighted sound pressure level (LAeq) could have been in the absence of noisy single events and is considered representative of background noise levels. Measured LAIeq and L90 levels are summarised in Table 15. It should be noted that the 2010 report compiled by Dracoulides does not specify the time of day measurements represent. It is therefore unclear whether the measurements refer to day-time, night-time or 24 hour average levels.

It is important to note that the increase in ambient noise level as a result of the introduction of an industrial noise source into the environment depends largely on existing noise levels in the project area. Higher ambient noise levels will result in the less noticeable noise impacts. The opposite also holds true. Increases in noise will be more noticeable in areas with low ambient noise levels. In order to quantify existing noise levels in the vicinity the project, reference is made to the results of ambient noise measurements and noise propagation modeling results reported by DDA Environmental Engineers in association with J.H. Consulting (2010).

Measured background noise levels ranged between 25dBA and 45dBA. Measurements were found to correlate well with typical noise levels in reported for rural districts, i.e. 45dBA during the day and 35dBA during the night (South African National Standards (SANS) 10103, 2008). Levels at Arandis were found to be similar to levels typically found in suburban districts i.e. 50dBA during the day and 40dBA during the night (SANS 10103, 2008).

In addition to baseline noise measurements, environmental noise levels as a result of existing Rössing mining operations were calculated. It was concluded that existing noise levels along the proposed infrastructure corridor varies as follows:

At noise sensitive receptors located on the plains (i.e. those located on the plains and in close proximity to the B2 and existing Rössing mining operations):

- Day-time noise level – 45dBA to 50dBA
- Night-time noise level – 35dBA to 40dBA

Remote wilderness areas i.e. the Khan River valley:

- Day-time noise level – 30dBA
- Night-time noise level – 30dBA
- Baseline day-time noise levels – 35dBA to 65dBA
- Baseline night-time noise levels – 35dBA to 65dBA

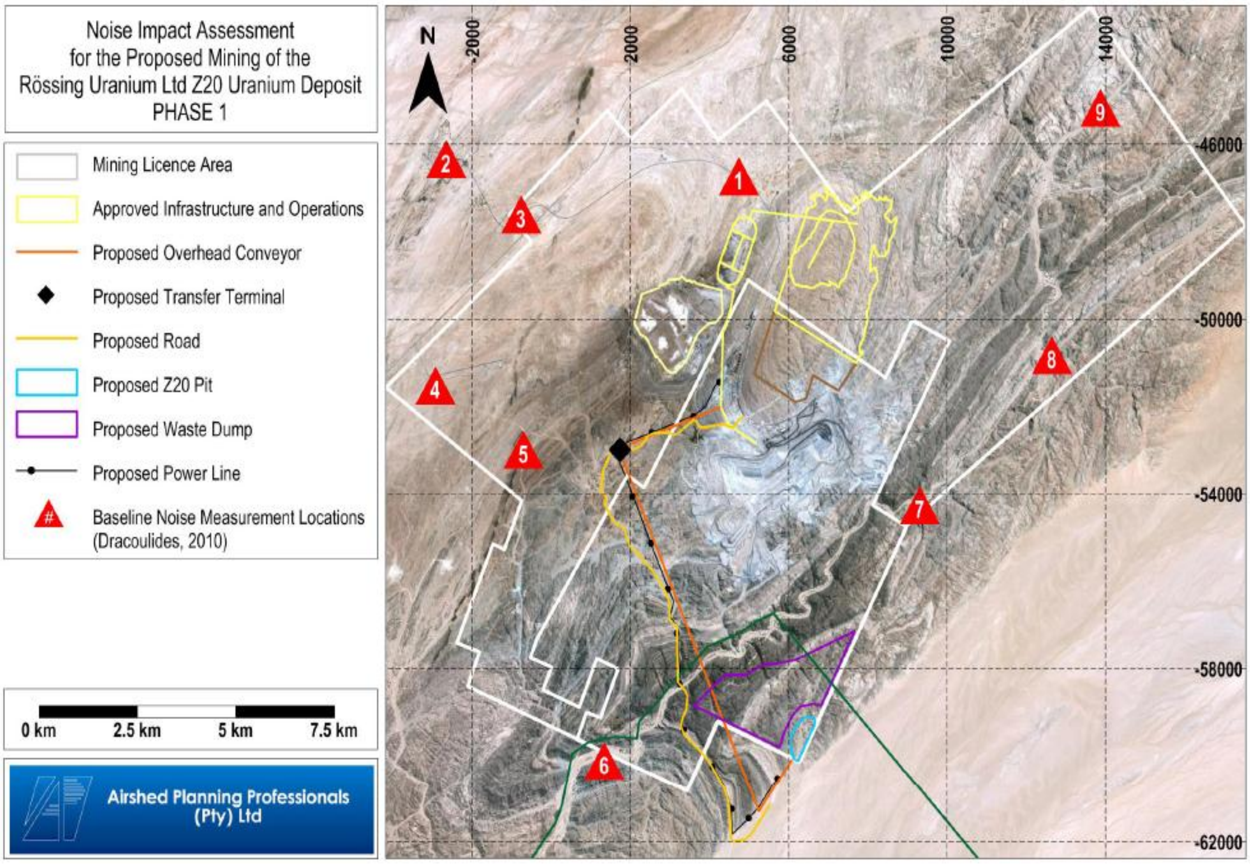

Figure 14: Baseline noise measurement locations (Dracoulides, 2010)

Baseline noise levels at nearby noise sensitive communities and residences, as applied in the calculation of cumulative noise impacts, area:

- Day-time noise level – 45dBA to 50dBA
- Night-time noise level – 35dBA to 40dBA

As a conservative measure, the following were therefore used in the estimation of cumulative impacts:

- Baseline day-time noise level – 45dBA

Table 15: Baseline noise measurement results

Location	Description	L_{aleq} (dBA)	L_{90} (dBA)
1	Along the main access road, 45 m from road centreline	45	29
2	Arandis	53	45
3	Next Arandis road intersection	50	37
4	On Arandis airport	41	34
5	Along dirt road towards the Khan Mine	38	29
6	In the Khan River Valley	40	28
7	Along the Khan River valley (close to open pit)	43	28
8	Along Khan River valley	41	25
9	Along Khan River valley at a remote site	45	34

4.5.4 Visual

The country's most predominant features are the extreme arid nature of the coastline and surrounding Namib Desert, the oldest desert in the world. 'Namib' means 'open space' and the

Namib Desert gave its name to form Namibia – the "***land of open spaces***". Namibia is known for its contrasting landscapes and its many-facetted grandeur and harsh splendour. The population density of Namibia is one of the lowest in the world at less than two people per km² which has resulted in an unspoilt coast, and vast untouched scenery and nature conservation areas. These landscapes include the shifting sand dunes of the desolate Namib Desert with its high dunes and wilderness sense of space, the vast interior plateau, and the awe-inspiring mountains and spectacular gorges which run along the coast where extremely slow-growing lichen fields are dependent on coastal fog for survival.

Landscapes associated with the Erongo area are diverse. The open desertscapes have a very attractive landscape character and thus a high visual aesthetic value. This sense of place is significant in terms of sustaining the existing, and promoting future, tourism in the region which is a key component in the long-term economic success of the area. The Khan River is a known 4x4 route that is utilised by local 'Swakopmunders' and tourists for desert recreation.

The significance of the landscape comes from the fact that it is a natural landscape, within which there are significant wilderness properties with limited man-made modifications. The variation in geological features creates a rugged and harsh beauty which adds to the significant desert sense of place. The mountain features, as a result of their prominence, are visually very significant. These elements are all raised and are prominent and, as such, they add to the landscape character and increase the value of the several important tourist view corridors in the area.

The existing landscape character has been shaped historically by man's need to make use of the resources associated with this area in context with the limited water resources of this desert. Consequently, a component of the Erongo Regions' sense of place is created by the mining industry, which plays an important role in employment, mineral production, total export earnings and social advancement in Namibia. The mining activities have to date been of a small to medium scale and located in isolated areas. This has resulted in the protection of the wide open spaces of the desert landscape in this region.

The Rössing Mine has resulted in a number of major mining-related landscape modifications. Much of the land surrounding the Rössing mining area remains uninhabited and unproclaimed, apart from the designated National Parks and state-controlled recreational areas further to the west. The Z20 uranium deposit is located south of the Khan River in the NNNP, in biodiversity sensitive areas along the upper bank of the Khan valley.

Due to the remoteness of the area where the projects are proposed, the high exposure areas include few receptor locations. The northern sections of the project are located adjacent to the existing Rössing mine and overlap with the existing mine's zone of visual influence (ZVI). The zone of visual influence will result in the Panner Gorge areas being exposed to near views of the project construction and operation.

4.5.5 Energy

Namibia has only three power generation sources with a generation capacity of 384MW which does not meet the national demand of 550MW (MME, 2010). In 2005 Rössing Mine consumed approximately 30MW of electricity, which was about 3% of Namibia's installed capacity. At that point, approximately 60% of Namibia's energy is supplied via the Southern African Power Pool

(SAPP) with largest generation contributor being the South African-based Eskom (Ninham Shand, 2008).

Rössing started to monitor Green House Gases (GHG) emissions in 2003. Initially some of the data was estimated, but improvements were made in the data capturing and calculation methodology. Metering and recording of electricity use and diesel consumption, however, has been done throughout and prior to the 1990s.

More recently, Rössing started to express energy consumption in megajoules per tonne (MJ/t) of ore processed, which is the combined energy usage incorporating electricity and fuels per tonne of ore processed, allowing for the measurement of total energy efficiency (Ninham Shand, 2008). Presently the GHG-emission sources at Rössing are well known and calculations are done and documented on a monthly basis. This is reported on a monthly basis, half yearly and annually. This is done through monthly metering and recording in an excel database and reported in applicable formats.

Energy usage and GHG-emissions are regularly (at least annually) reviewed and submitted to Rio Tinto for approval. Annual management reviews look at all set targets and performances of Rössing, including GHG and energy efficiency targets. A GHG and energy efficiency plan is in place and is continuously updated.

The mining sector is a large consumer of power and it is estimated that Rössing consumes about 7% of Namibia's total electricity supply, but is also one of the most important drivers of economic development in Namibia as described in Section 4.3.

5 DESCRIPTION OF THE EXISTING OPERATIONS AND PROPOSED PROJECT

The purpose of this section is to provide a technical description of the activities associated with the proposed mining of the Z20 uranium deposit.

5.1 EXISTING OPERATIONS

The Rössing Mine has been producing a single product (U_3O_8) since 1976. Current mining operational activities are focused to the north of the Khan River which include mining the present Rössing open pit (blast, load and haul operation), waste rock disposal, ore processing, tailings disposal and ancillary activities.

Rössing Uranium is mining the SJ mineral deposit, as well as a small area within the SK deposit referred to as SK4, which is processed through the current acid tank leaching process. Mining is undertaken in a conventional open pit blast, load, and haul operation.

The open pit currently measures approximately 3,000m long, 1,500m wide, and 390m deep and is excavated in 15m lifts. With the deepening and expanding pit, an overhead electrical trolley assist system was installed in 1986 to improve the efficiency (reduces fuel consumption and increases speed) and longevity of the haul trucks carrying ore from the pit.

Currently, the ore is processed by tank leaching, which is preceded by four stages of crushing, rod-milling, and acid leaching followed by solid/liquids separation and tailings disposal. Uranium is recovered from the leach liquor in a Continuous Ion Exchange (CIX) plant after which the solution is concentrated by solvent extraction (SX) and precipitated to recover yellowcake which is roasted to produce U_3O_8. The plant has a nameplate design capacity to treat 14 Megatonne (Mt) per year of feed and produces up to 4,500t per year U_3O_8 product (was 3,628t in 2010).

The basic existing infrastructure servicing the mine and its surrounds consists of the following:

- **Road:** Vehicle access to site is gained via a government national road (D1991) and private road off the B2 highway which serves to connect the mine to Arandis, Swakopmund, Walvis Bay, and Windhoek. The roads between the mine and these centres are tarred and single lane in each direction. The main road through the mine complex is also tarred but there are numerous un-tarred roads linking the lower portions of Dome, Pinnacle, and Panner Gorges to the central mine operations.
- **Rail:** A full gauge railway line links the mine’s services areas with the main railway line between Walvis Bay and Windhoek via Swakopmund. Main supplies brought in by rail include sulfuric acid, diesel, ammonia, manganese, and ammonium nitrate with drums of U_3O_8 product loaded into containers and railed to Walvis Bay for export.

- **Port:** The Port of Walvis Bay is predominantly utilised by Rössing Uranium for the importation of sulfuric acid. Rössing Uranium controls a leased facility in the port which comprises four 30kiloton acid storage tanks.
- **Water:** Water is supplied by NamWater (Namibian's bulk water supplier) via a pipeline from Swakopmund to storage reservoirs located at the mine. The current source of water is predominantly the Omdel aquifer north of Henties Bay. Desalinated seawater will potentially supplement existing water supplies due to the increase of mining activities in the region and the associated demand for water in mining operations.
- **Electricity:** Namibia has only three power generation sources with a total generation capacity of 384MW which does not meet the national demand of 550MW (MME, 2010). In 2005 Rössing mine consumed approximately 30MW of electricity, which was about 3% of Namibia's installed capacity. Electricity is supplied by NamPower off the Omburu (close to Omaruru) to Walmund (close to Walvis Bay) 220kV line which forms part of the national grid. This power line also supplies power to Arandis, Swakopmund, and Walvis Bay. The mining sector is a large consumer of power, but is also one of the most important drivers of economic development in Namibia as described in Section 4.3.

5.2 PROPOSED PROJECT

After successful exploration, Rössing Uranium is now considering mining the Z20 ore body, located south of the Khan River, where Rössing Uranium's mining license area ML28 and the NNNP overlap. The Z20 ore deposit is a substantial find of the recent exploration activities Rössing Uranium has conducted in its ML28 Mining Licence Area, reaching to the south across the Khan River. The Z20 resource will constitute a significant addition to the economic value of Rössing Uranium's ore inventory.

In order to access the Z20 ore body, an infrastructure corridor would need to be established linking the Z20 site to the existing Rössing Uranium Mine. This infrastructure corridor would facilitate the transport of crushed ore generated at the Z20 site to the existing Rössing Uranium facilities.

The proposed project includes the following components:

- Mining of the Z20 ore body including disposal of waste rock;
- An infrastructure corridor across the Khan River;
- Production of sulfuric acid at Rössing;
- Processing plant modifications;
- Changes to the present tailings storage facility; and
- Establishment of a new high density tailings storage facility on the Rössing Dome.

Each of these project components is described in more detail below. Figure 15 indicates the layout of the project components.

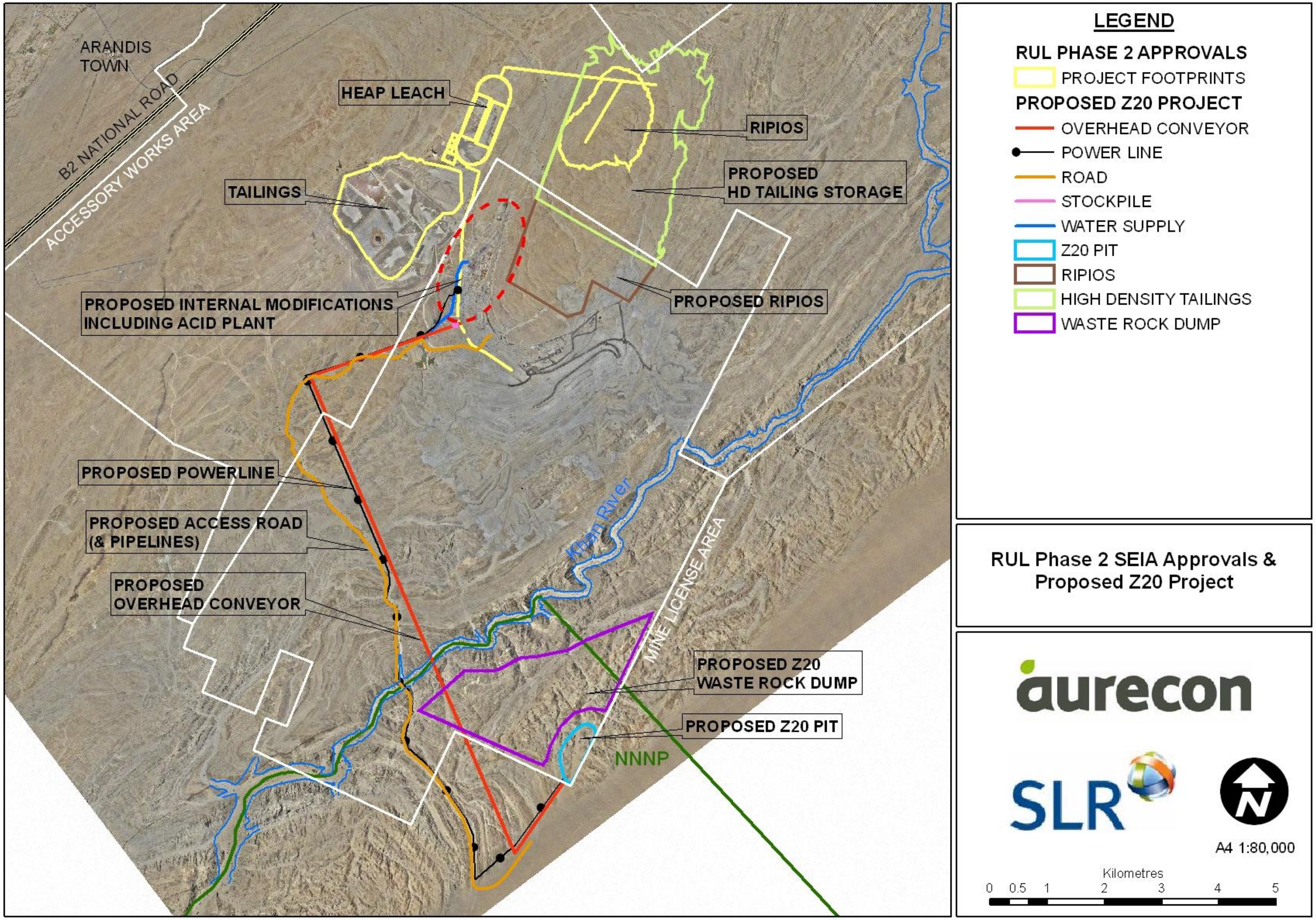

Figure 15: Proposed Z20 Project Components

5.2.1 Mining of the Z20 Pit

The Z20 ore body is situated within the Rössing geological formation, south of the Khan River between the Welwitschia Plains and the Khan River bed, and contains uranium bearing alaskite rocks, similar to the ore found in the present Rössing open pit. Successful exploration showed that the Z20 uranium deposit is one of a number of similar anomalies where Rössing Uranium's ML28 and the NNNP overlap.

It is envisaged that the Z20 ore body would be mined as a satellite open pit, utilising the same methodology (conventional blast, load and haul) as is used currently in the main Rössing Uranium mine SJ pit. Suitable waste rock dump areas will be identified in the vicinity of the Z20 pit as shown in Figure 16. The Z20 deposit contains roughly 720Mt of ore and waste, of which 160Mt of ore could potentially be mined. The Figure below shows a modelled version of the maximum waste rock scenario for the proposed Waste Rock Dump, which will be situated next to the proposed Z20 mining pit (the oval shaped area). The proposed waste rock dump will not extend into the Khan River and the height of the proposed waste rock dump will be similar to the height of the Welwitschia Plains in meters above sea level (refer to the colour scheme which indicates height above mean sea level).

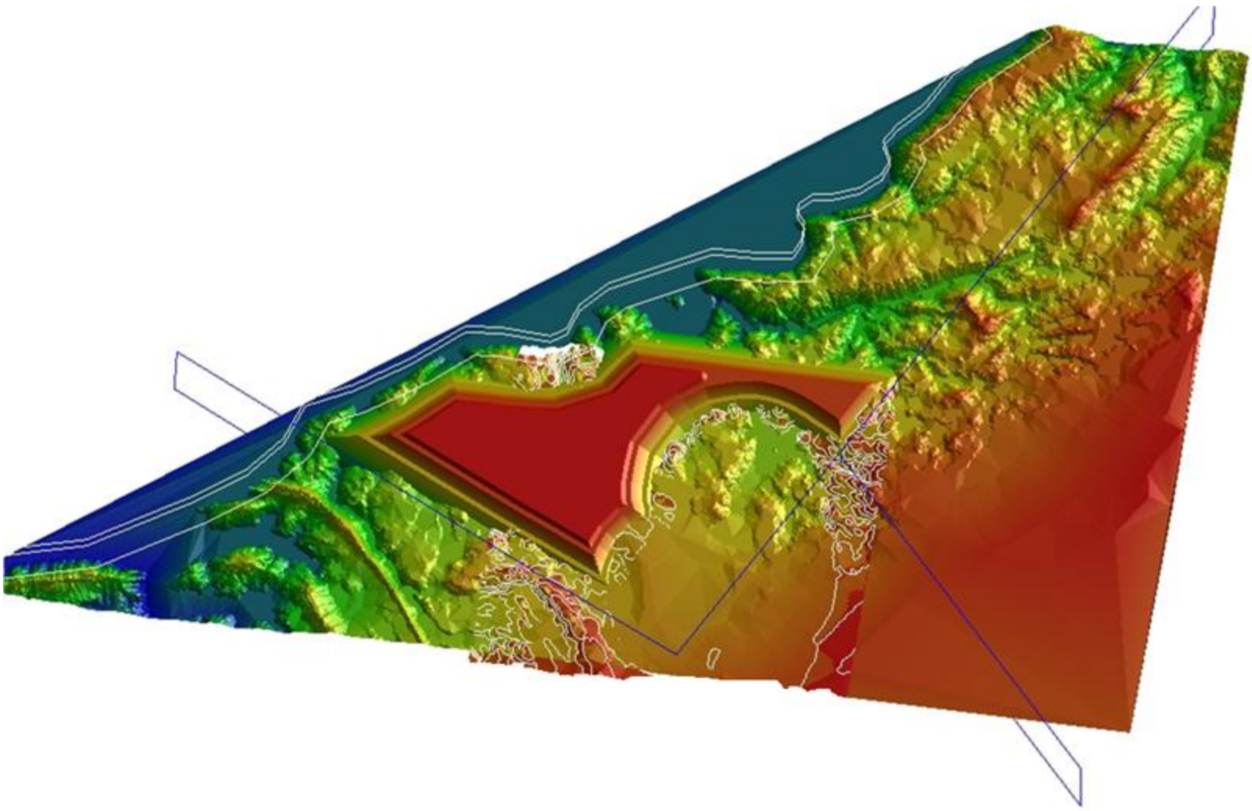

Figure 16: Proposed design of Z20 Waste Rock Dump

5.2.2 Linear infrastructure corridor

Rössing Uranium is proposing to develop an infrastructure corridor from the existing operations to the Z20 pit on the southern side of the Khan River. The following infrastructure is proposed:

- RopeCon/ RailCon aerial product transportation system;

- Tarred access road;
- Water supply pipeline;
- Diesel supply pipeline; and
- Power supply infrastructure.

MME (2010) recommended that infrastructure corridors should be created so that lines for road, power and water are clustered together, to reduce the total area of disturbance. Rössing Uranium supports this approach and therefore has clustered the proposed infrastructures far as possible.

5.2.2.1 RopeCon/ RailCon Aerial Conveyor System

The RopeCon/ RaiCon aerial conveyor system consist of a continuous flat belt that is able to easily transport products across existing infrastructures and undulating terrain. The RopeCon/ RailCon is anchored with anchor points (see image A in Figure 17) where it cross points of high elevation and elevated off the ground by towers at low elevation (see image B in Figure 17).

The components of the RopeCon/ RailCon include:

- Motor and Drive Assembly;
- Tensioning system;
- Towers;
- Track ropes and rope frame;
- Conveyor belt;
- Roof cover; and
- Belt turning device.

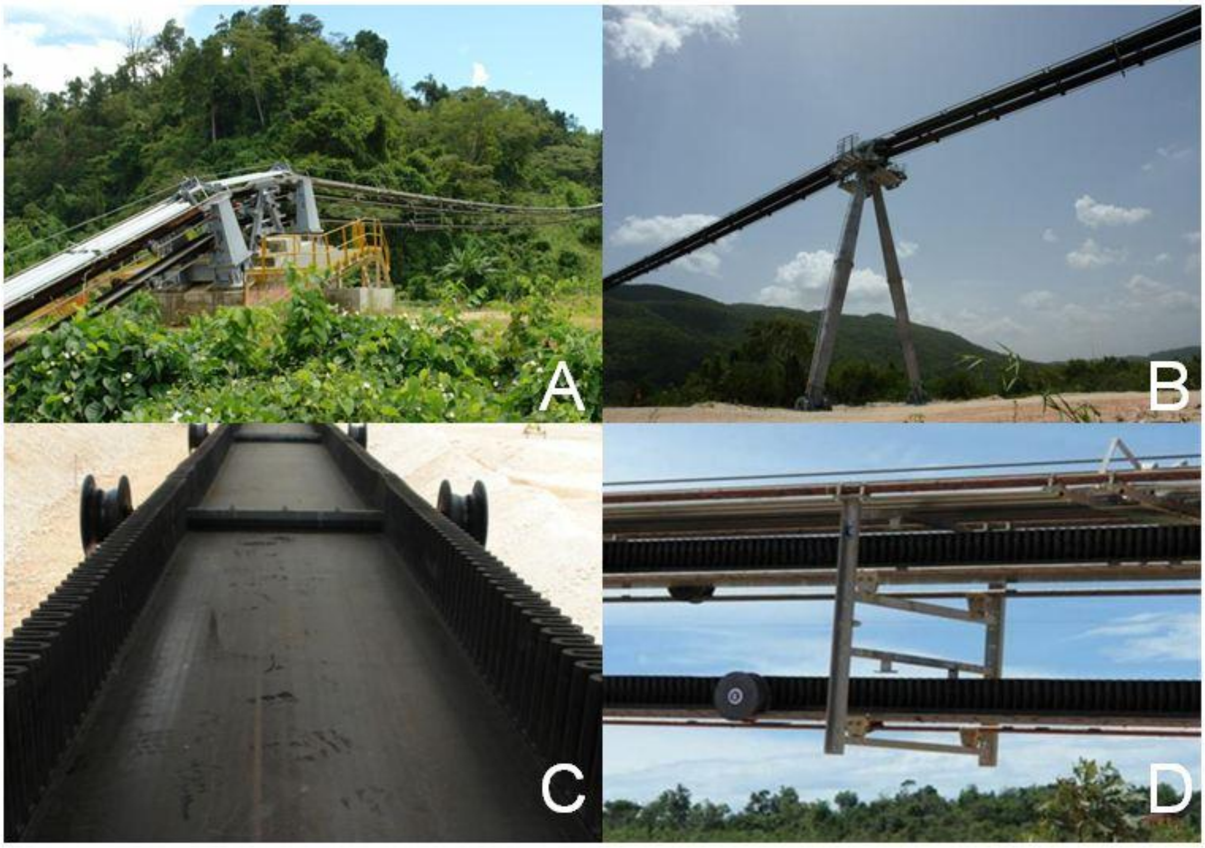

Figure 17: RopeCon/ RailCon tower structures and conveyor belt

The conveyor consists of cross-reinforced steel cord belt with ridged sidewalls (see image C in Figure 17). The sidewalls are corrugated to ensure that no ore falls from the belt which is turned around to prevent spillage. The belt is supported by fixed axles arranged at approximately 6m apart. Running wheels are fitted to either end of the axles which either run on six full-locked coil track cables that is anchored on both ends. Since the wheels are fixed the material is stationary and the belt is subject to minimum flexing. The empty belt returning to the Z20 uranium deposit will run along the same cables, but will be below the loaded belt (see image D in Figure 17). The loaded belt is covered by a roof cover to protect the material from the effects of the weather to prevent the loss of any ore (see image A in Figure 18).

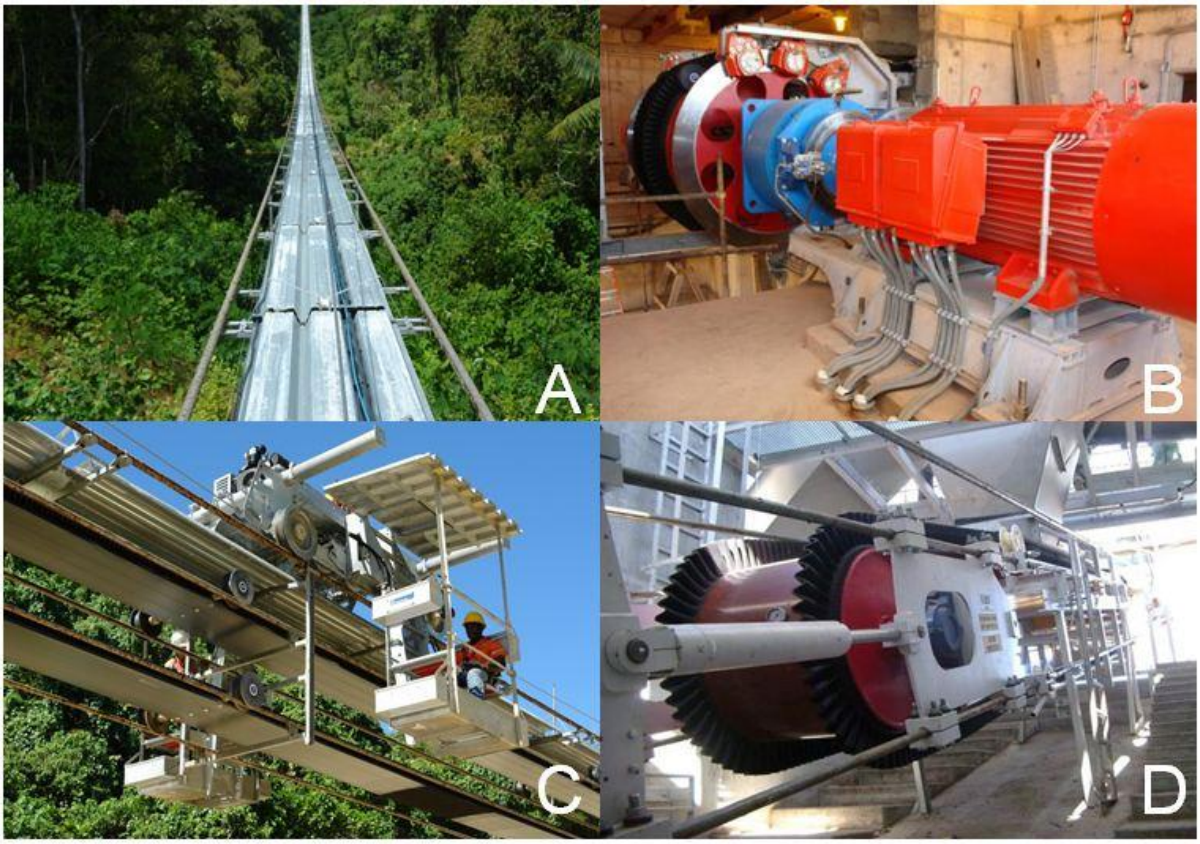

Figure 18: RopeCon/ RailCon roof design, drive machinery, inspection trolley and tensioning device

The system is driven by a drive drum in the head or tail station (see image B in Figure 18). The electric drive system achieves constant acceleration during start-up under all loading conditions. The tensioning device (see image D in Figure 18) ensures that the belt is kept at the optimum elevation. The speed is regulated by a suitable electronic control circuit and can be adjusted variably. By adjusting the speed of the conveyor in accordance with the load, the cross section of the belt can be utilised to the full even with low loads. This enables energy savings.

After passing the drum at the unloading position and before passing the drum at the loading position the belt is turned by 180° by means of a turning device so that the belt can be guided over the towers also on the slack side with the dirty side up. This ensures environmental protection and prevents the conveying line from getting dirty.

The RopeCon/ RailCon conveyor will be designed to withstand the strongest winds speeds measured at the Rössing mine. A safety factor margin will also be designed into the system. The supporting towers are anchored with flexible structures, thus allowing the A-frame towers to move backwards and forwards in order to compensate for the strong winds.

A maintenance trolley is used for inspection and maintenance (see image in C Figure 18). The maintenance trolley's wheels can be supported by the RopeCon/ RailCon and therefore there is no need to construct costly service roads or maintenance platforms along the line. The maintenance trolley has inspection baskets on each side.

5.2.2.2 Proposed route of the aerial conveyor

The proposed route for the RopeCon/ RailCon was designed to follow the shortest route from the Z20 uranium deposit to the existing operations at Rössing Uranium Mine. The system is designed to transport ore over a total length of approximately 13km at speeds of up to 4.65m/s with a capacity in one direction of 2,250t/h.

The proposed RopeCon/ RaiCon consists of two sections:

- Section 1 will consist of both RopeCon/ RailCon and stretches from the Z20 uranium deposit in a north westerly direction towards the Rössing Uranium complex for a distance of 10km to a transfer point.
- Section 2 is a RopeCon/ RailCon system with a length of approximately 3km transferring ore from the transfer point to the coarse ore stockpile close to a new milling circuit located on the Rössing processing plant premises.

Section 1 will consist of 24 anchor or tower points and section 2 of nine anchor or tower points. The RopeCon/ RailCon will cross the Khan River and be suspended 121m above the natural ground level as indicated by Figure 19.

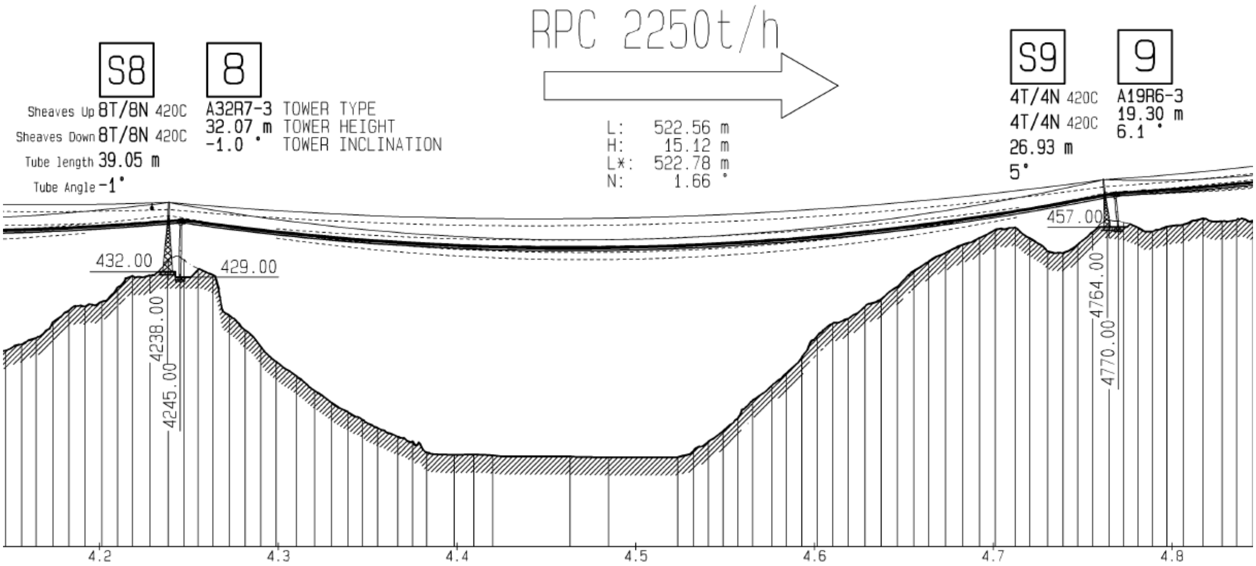

Figure 19: RopeCon/ RailCon crossing with the Khan River

The RopeCon/ RailCon will cross the Khan River and be suspended 121m above the natural ground level.

5.2.2.3 Proposed access Road

The required14km access road, for vehicles traveling between Rössing Uranium mine and the Z20 mine, will be 12m wide with 7.2m wide asphalt surfacing. The road is proposed to start at Rössing Uranium Mine behind the coarse ore stockpile from where it would continue on an existing gravel track to the south of the tailings dam. The alignment would then cut across a relatively flat dry river bed area with rock outcrops until it turns southwards following a dry river bed with rocky slopes from through Panner Gorge to the Khan River. The Khan River will then be crossed via a reinforced concrete bridge (approximately 160m in length), after which it traverses a narrow gorge with extensive rock slopes to the end point at the Z20 ore body.

The road will have one 3.6m wide lane and a 2.4m wide shoulder per direction to handle average speeds of 60 Kilometre per Hour (km/h) as indicated in Figure 20.

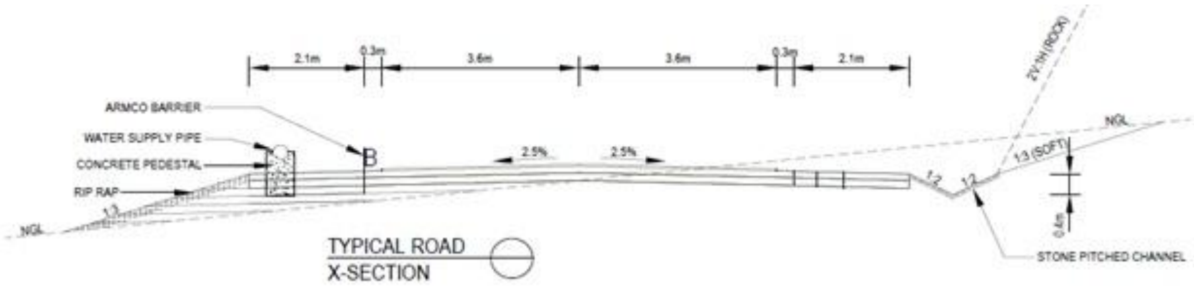

Figure 20: Typical cross section of the access road

Since the route proposed for the road is not uniform, certain areas would need to be cut to allow for the road whereas lower lying areas would have to be filled with material to allow for an acceptable road gradient of less than 8%. Where feasible, fill was favoured to cut, due to the availability of overburden and the properties of the in-situ material (typically hard rock).

A preliminary pavement design was undertaken which is in line with MME (2010) water saving recommendations to tar the access roads to reduce the need for water as dust suppression agent. Four layers are deemed adequate for the functionality of the asphalt road. Asphalt, base and sub-base material could be imported from a quarry at Walvis Bay. Roadwork ancillaries such as guardrails, line marking and signage will be constructed with reference to the length of road, its primary purpose, and site conditions.

5.2.2.4 Khan River Bridge

The access road would cross the Khan River and a bridge has therefore been proposed. The bridge will be 160m in length and approximately 3.6m from the natural ground level. Twenty-two support pillars will be constructed 8m apart as shown in Figure 21. The bridge has been designed to withstand the 1:50 year flood.

5.2.2.5 Drainage

For the first 3.6km of the proposed road, the natural contours of the terrain typically fall across the road, with pipe culverts being placed at low points and natural water courses to allow the transfer of run-off. Storm water drainage is required for areas where the road is in fill as well as low points. From the 3.6km mark to the endpoint the natural contours of the terrain tend to fall with the proposed road. This section of the proposed road predominantly follows a gorge resulting in run-off concentrating in the proposed road area. Drainage for this section is to be managed by stone pitched channels for cut sections and pipe culverts are to be placed where run-off can no longer follow the natural slope direction and has to cross under the proposed road area. Rip rap (from rock excavated on site) is also to be utilised to protect fill slopes where necessary.

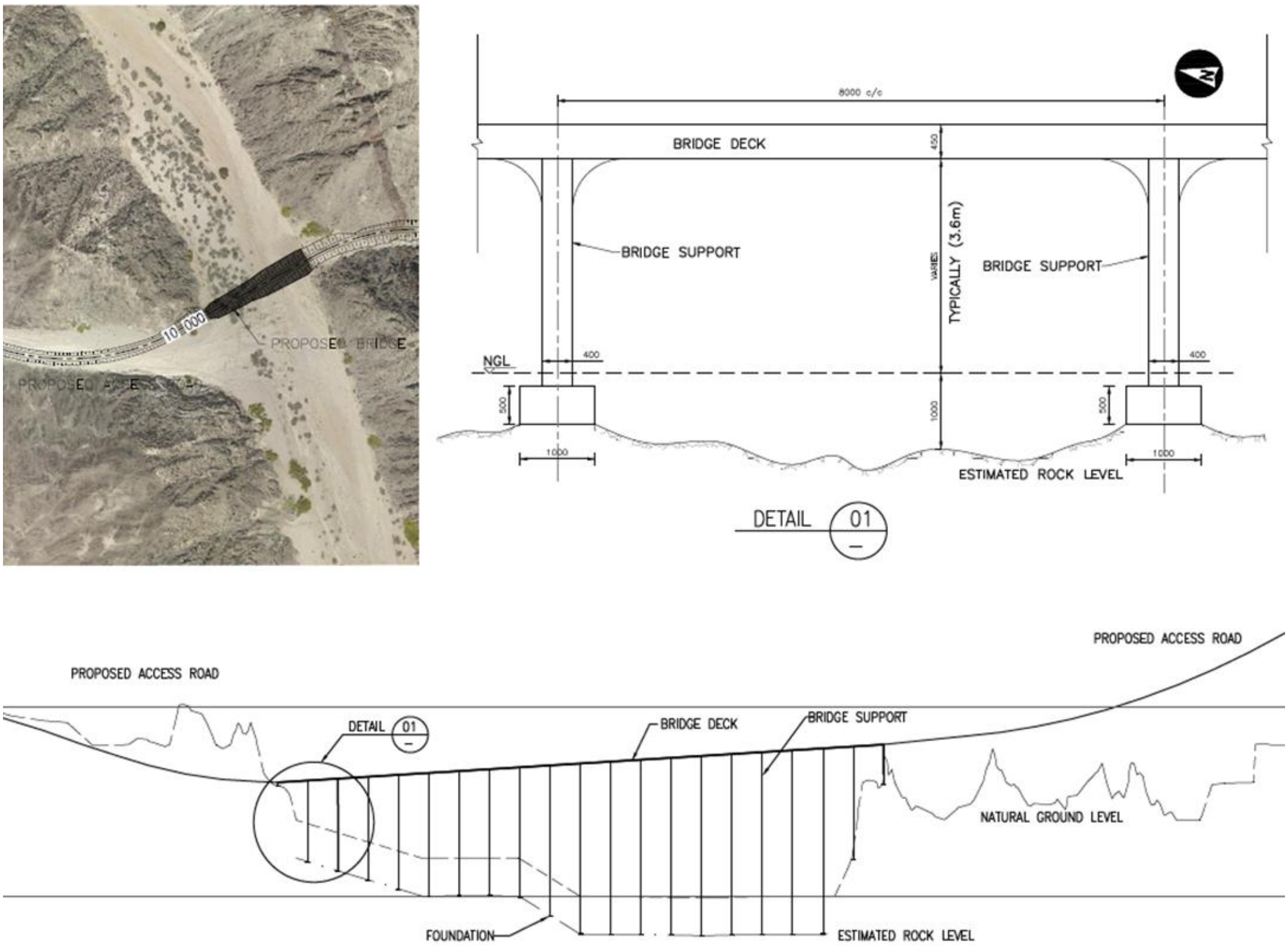

Figure 21: Proposed Access Road Bridge over the Khan River

5.2.2.6 Water Supply

The MME SEA (2010) strongly recommends that in order to minimise the cumulative footprint of the bulk water supply infrastructure, water supply schemes should comprise only one pipeline along a demarcated corridor following other infrastructure. Rössing Uranium supports this by proposing the water supply pipeline alignment follow the proposed access road alignment.

The selected pipe material for the various above-ground pipe installations is required to withstand the harsh corrosive and desert environment as per Rössing Uranium's requirements. A ductile-iron pipe with a cement mortar-lined inner wall and spigot and socket joints was chosen for all of the new water pipelines. The pipes are to be coated with zinc and bitumen externally to withstand the harsh corrosive environment. No internal epoxy coating is required as the water to be conveyed is potable.

The pipes will be strapped to concrete pedestals (cast in-situ typically), while special fittings will allow for thermal expansion and contraction of the pipe without the need for special expansion fittings.

The approved water supply pipeline to the Heap Leach area will be 400mm in diameter and 1.5km in length. The Heap Leach instantaneous demand at the extraction point will not be satisfied at gravity flow pressure due to the topography of the area. A pump station has therefore been added to the end of the line to supply the necessary flow at the required pressure. A water supply pipeline to the Acid Plant will be 500mm in diameter and 30m in length.

5.2.2.7 Diesel Supply

The fuel demand requirements of the proposed Z20 mining operations would require approximately 200m^3 per day. The design of the fuel supply and storage will be such that there is sufficient capacity for a five day period at any given time.

The diesel pipeline will be attached to the roof of the RopeCon/ RailCon conveyor structure. The diesel pipe will be 75mm in diameter and will be constructed out of FlexSteel pipe which is a flexible pipe with steel reinforcement. This will be installed within a 100mm in diameter flexible sleeve pipe. The pipe will be covered with an Ultra Violet (UV) resistant finish as shown in Figure 22.

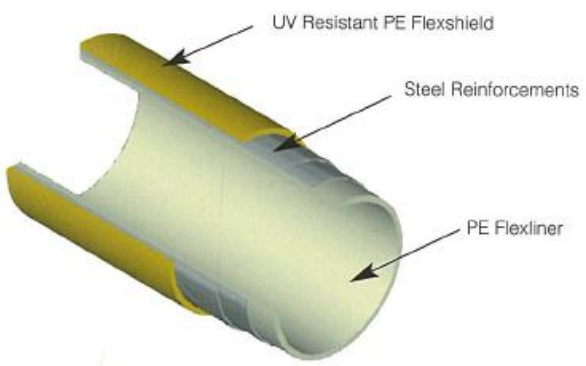

Figure 22: Double layer diesel pipe

The double layer piping allows for condition monitoring instrumentation and monitoring focussing on early indication of failure will be in place. The system will detect pipe failures by monitoring the flow, pressure and temperature at various intervals along the pipeline. Four flow monitoring stations will be installed at even intervals together with three shutoff valves. Shutoff valves will be located at the lowest positions on the pipe route in order to minimise the fluid to be drained in the event of pipe replacement. Any of the following will shut the system off and close sectional isolation valves:

- A deviation in flow detected upstream;
- A pressure drop below the standard operating pressure; and
- A variation in fluid temperature.

Any leak will result in a temperature rise of the fluid downstream whereby the temperature detection system will detect temperature variations of 0.001°C. In addition a secondary leak detection system will be installed between the two piping systems that will detect any fuel between the sleeve pipe and the main pipe. Spill from the leak will be contained by the sleeve pipe whilst any leak is repaired. All sleeve pipes and main pipe sections will have drain valves between the tower positions to collect and drain fuel if required. The pipe will be designed, manufactured and installed according to South African National Standard relating to storage and distribution of petroleum products (SANS 10089).

5.2.2.8 Power Distribution and Supply

The supply to the Z20 uranium deposit site will be from the NamPower 220kV line as per current configuration, stepped down to 11kV at the NamPower Rössing substation. The on-site distribution will be at 11kV with the following areas to be stepped up to 33kV from 11kV. A new 11kV indoor substation will be provided for the distribution to the new areas which will be interconnected to the existing main substation. Transformer yards and associated electrical equipment with protection and communication is to be allowed for at the new 11kV substations as well as at the Acid Plant and Heap Leach. The transformer yards will be provided with step-up step-down voltage transformation. The transformers will be sized to maintain 80% load capacity. Substation buildings will be based on standard designs with all panels, breakers and busbars sized according to load and current requirements.

Feeder cables will be standardised 11kV type-A power cable. However, where load limits are significant, larger sized cables will be allowed for in order to maintain an average of 4 parallel feeder cables per panel.

The electrical phase to phase and phase to ground clearances as well as overhead structure loading will comply with the South African National Standard regulations for overhead power lines (SANS 10280) and the requirements of IEC 60826 (design criteria of overhead transmission lines) respectively.

Electrical power supply for the Acid Plant (6MW demand with backup generation of 23.3MW) and Heap Leach (22MW demand) will be transmitted via overhead transmission lines utilising Rössing Uranium standard H-Pole structures. All overhead lines will be designed according to IEC 60826 loads and electrical clearances are maintained according to SANS 10280. Standard 14m eucalyptus wood poles are to be used for all H-Poles and eucalyptus wood poles (18m in length) will be used where overhead lines cross roads.

A new 33kV overhead transmission line will be established within the infrastructure corridor to provide electricity to the proposed Z20 mining operations. The proposed power line route is in line with the recommendation by MME (2010) as it will follow existing infrastructure routes. The proposed route will run parallel to the existing transmission line for the approximately 1km. The route will follow the conveyor routing for approximately 6km after which the transmission line run parallel to the access road. The line generally follows a route between 45m and 90m from the centre of the road. The last 1.5km of the transmission route runs parallel to the conveyor belt up to the Z20 uranium deposit.

The current Rössing capacity is 40MVA and the proposed mining of the Z20 pit and associated infrastructure would require an additional 20MVA (i.e. an increase of 50%) as indicated in Table 16.

Table 16: Electricity requirements for the Rössing Uranium Limited site and Z20 site

	RUL Site	Z20 Site
Rössing Uranium Limited and Mine	28 MW	
Z20 Mine	22 MW	10 MW
Total	50 MW	10 MW
Transformer capacity	50 MVA	10 MVA

5.2.3 Production of sulfuric acid

An Environmental Clearance Certificate, authorising the construction of a sulphur burning acid plant with the associated sulphur storage and handling facilities, was issued to Rössing Uranium. In order to process the additional ore generated from the Z20 ore body, the planned production capacity of the acid plant would need to be increased to 2000t/d (from the already approved 1200 t/d).

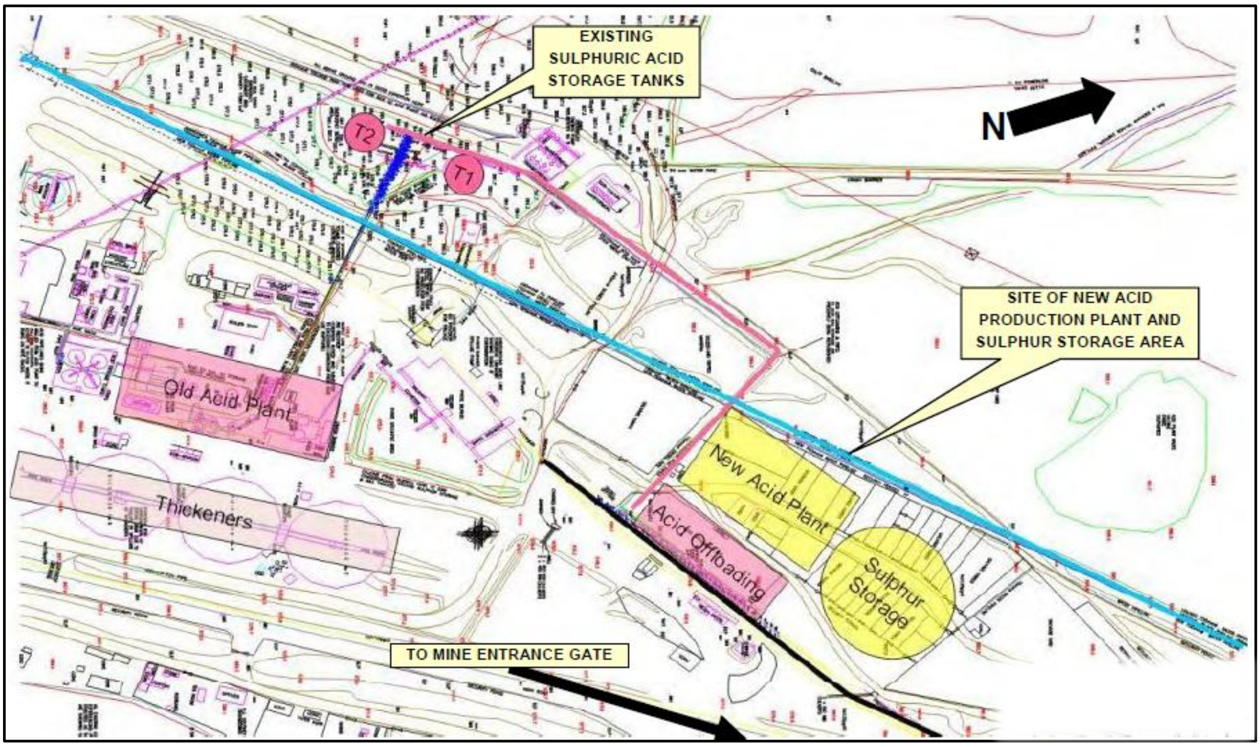

Figure 23: Proposed acid plant and sulphur storage locations on site

In essence, the sulfuric acid produced will be converted from elemental sulphur feedstock that will be shipped to Walvis Bay harbour and railed to the proposed acid plant on the mine. The sulfuric acid production process, as proposed for Rössing Uranium, is generally favoured as the most stable process with the highest yield of product. This correlates well with a preferred environmental option as this efficient and more stable combustion is associated with more manageable, predictable and measurable atmospheric outputs. The exothermic nature of the process also provides the opportunity for electricity generation by utilising the waste heat in the form of steam to drive a turbine generator.

A generic description of the process is now provided below:
The manufacture of sulfuric acid at Rössing Uranium would be done via a two-step oxidation process of elemental sulphur (S) to sulphur trioxide (SO_3) which would be absorbed into a 98.5% sulfuric acid solution (H_2SO_4).

From the sulphur storage the sulphur would be conveyed to the sulphur melting tank, where the solid sulphur would be melted at a temperature of approximately 145°C with 700kPa steam. The molten sulphur would then be filtered to remove any solid particles and transferred into the clean sulphur storage tank where the sulphur would be kept molten at approximately 145°C. The molten sulphur would flow by gravity to the clean sulphur pit from where it would be pumped to the sulphur burner. In the sulphur burner, the molten sulphur would be combusted with dry air to form sulphur dioxide according to the chemical equation below:

$$S + O_2 \rightarrow SO_2 \quad \Delta H_{rxn}\ \text{-ve}$$

The reaction is exothermic and the exit SO_2 gas at 1131°C and 48kPa would be cooled to 420°C in a waste heat boiler prior to entering the converter. The function of the converter is to oxidise the SO_2 to SO_3 using a vanadium pentoxide catalyst according to the equation below:

$$SO_2 + \tfrac{1}{2} O_2 \rightarrow SO_3 \quad \Delta Hrxn\ \text{-ve}$$

The SO_3 formed in the converter is absorbed into 98.5% sulfuric acid via a two stage absorption system according to the equation below:

$$SO_3 + H_2O \rightarrow H_2SO_4 \quad \Delta Hrxn\ \text{-ve}$$

The gas leaving the final absorption column, containing 250 parts per million (ppm) of SO_2 under routine operating conditions, would be vented to atmosphere via a stack. The stack would be a self-supported steel stack 50m tall and would have a diameter of about 2m.

5.2.4 Processing plant modifications

The Rössing Uranium processing plant modifications include a number of new green- and brownfield installations as well as upgrades to the existing plant. A second coarse ore stockpile and a new milling area are new designs and are new additions in the area.

The upgrades include modifications to the existing thickener circuit to handle the increased ore throughput. Tailings from the thickener circuit will initially be pumped to the existing tailings storage facility and once the existing storage capacity is exhausted, tailings will be pumped to the new tailings area at the Dome area (See Section 5.2.5).

Changes would be made to the coarse ore stockpile and milling circuit. The existing Rössing Uranium leach circuit would be modified to allow for the processing of the additional ore. The modification to the leach circuit includes the construction of a new train of leach tanks. The new leach train would be identical to the existing two trains. A new slurry transfer pipeline will be constructed. The existing thickener circuit will be upgraded. The modifications to the piping and pumps will not require any additional land to be used.

The area to the south of the existing CIX plant will be used to locate new plant facilities. The existing Rössing SX circuit will be modified to allow for the processing of liquors from the new process. The modification requires the installation of a single train of four extract mixer settlers, which will be of a reverse-flow design. The existing raffinate settlers will be re-used, with potentially one new raffinate settler required. In addition, a loaded solvent tank will be installed to facilitate distribution of loaded solvent to the downstream sections.

5.2.5 Changes to Tailings Storage Facility and Establishment of New High Density Tailings Storage Facility

Tailings from the additional Z20 processing will initially be disposed at the existing tailings storage facility after which it is envisaged that tailings would be disposed at the new high density tailings storage facility to be established on the Rössing Dome from 2017 (see Table 17 for storage capacities). The Ripios dump will receive waste from 2015 and is expected to reach maximum capacity by 2029. The storage capacities of the existing TSF, new TSF and Ripios Dump are indicated in Table 17 and the layout are indicated in Figure 24.

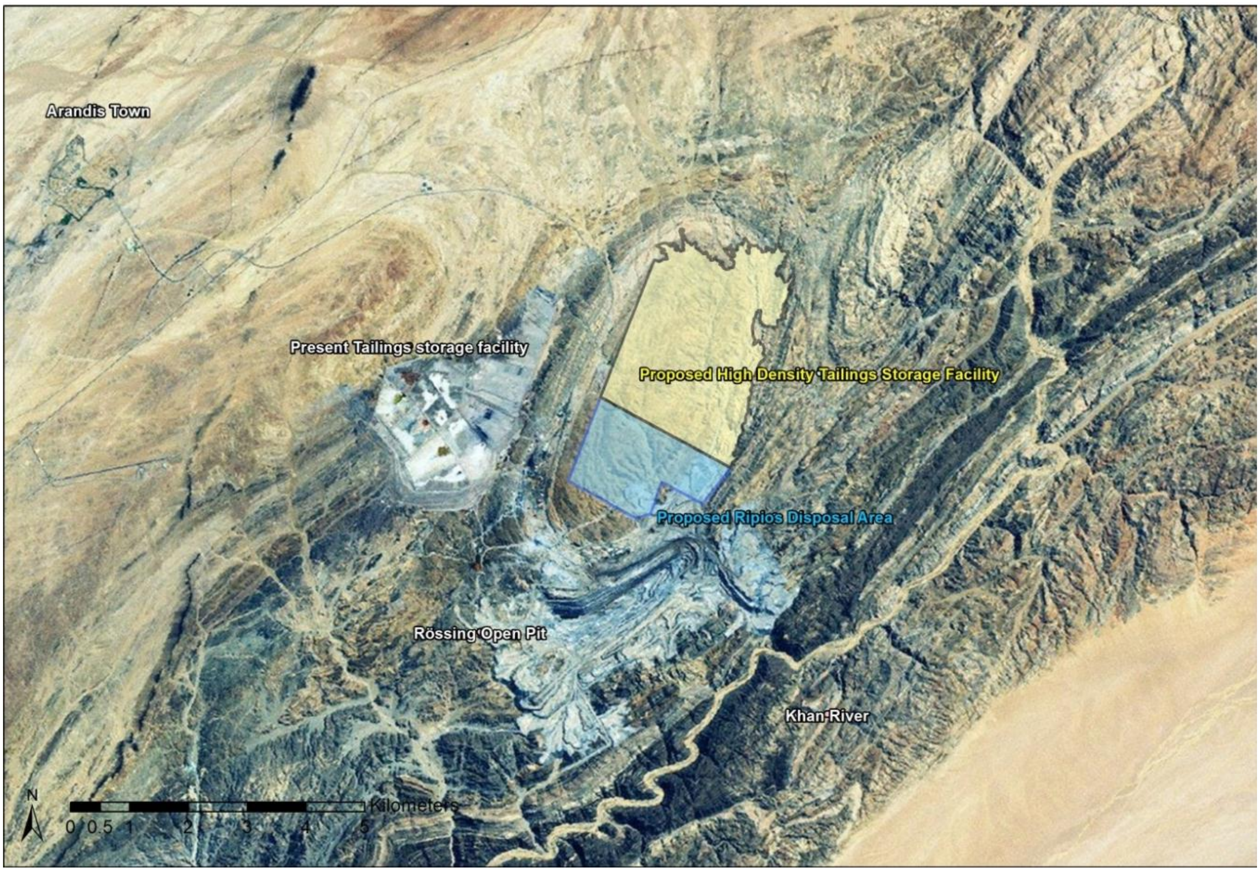

Figure 24: Tailings disposal sites at Rössing

An Environmental Clearance Certificate authorising the establishment of a mineral waste site on the Rössing Dome was issued in July 2012. However, the Environmental Clearance Certificate was given to dispose of Heap Leach spend ore (ripios) and not for tailings material. Z20 tailings will be pumped to a central distribution point. A thickening plant to produce high density tailings is proposed for construction at the Dome storage facility. Adequate protection of the surface and groundwater environment will be provided for by a combination of engineered, mined and natural systems to contain surface water and intercept groundwater for reuse in the processing plant.

Closure measures will be developed to provide long term stability of the facilities. Surface seepage and stormwater management facilities will be considered in the design of the HD TSF.

Table 17: Storage capacity for tailings

Facility	Storage requirement (Mt)	Storage Capacity	
		Mt	Mm^3
Existing TSF- Phase 1	400	12.9	18
Existing TSF- Phase 2		18.6	26.1
New high density TSF		415	259.4
Ripios Dump	300	17.2	10.1
		278.3	163.7

As tailings slurry is deposited, the areas will be covered with material to prevent wind erosion. The material will most likely be ripios which will be disposed at the southern portion of the Rössing Dome. At the time of closure, the entire disposal area will be covered.

5.2.5.1 Ripios dump design

Ripios (dry and courser waste material from the heap leach operation) would be disposed on an on-going basis at a currently planned rate of 20Mt/year. The ripios dump will form the southern impounding embankment for the HD TSF. Ripios will be transported from the heap leach pads to the ripios dump on conveyors where a large stacker will be used for development of the ripios dump. The ripios dump will be constructed in a series of 20m to 30m high lifts over the area indicated.

6 ALTERNATIVES

The purpose of this section is to identify feasible project alternatives. The identification of potential impacts of the infrastructure corridor is included in Section 9. The remaining project components, namely the mining of the Z20 ore body will be assessed in the next phase of this SEIA process.

The identification and consideration of alternatives is recognised as required practice in environmental assessment procedures globally. Regulatory requirements in Namibia comply with this requirement, as reflected in the Environmental Management Act and the Environmental Assessment Policy, namely as a step in the earliest proposal development stage.

Alternatives are typically considered at various stages in the formulation of proposed developmental policies, plans and projects. With reference to development policies and plans, these are usually addressed at the higher level of national and regional strategy and forward-planning, and are termed strategic alternatives. Assessment of project alternatives is limited to the level or site of the particular project. The examination of alternatives for Rössing Uranium's proposed project is thus mainly concerned with the assessment of project-level alternatives, although strategic and cumulative implications will be addressed as far as possible (see section 7.2). Unless there is valid and logical justification to screen certain alternatives out, all feasible alternatives should be considered in the SEIA Report stage. Part of the Scoping process is to screen out those alternatives that will not be considered in the SEIA Report stage.

Various alternatives were considered for the components of the infrastructure corridor including layout and technology alternatives and are described in the Section.

6.1 PRODUCT TRANSPORT

Four options were investigated comprehensively to determine the best option to transport ore from south of the Khan River to the Rössing Uranium site namely hauling, conventional conveying, conventional conveying through a tunnel and ore slurry pumping. The investigation took into account the cost, impact on the environment, reliability and availability.

The hauling option was discounted mainly due to the capital cost required for road and periodical truck replacements. Haul roads are typically 40m wide and require a maximum gradient of 10% to allow traffic in two directions. Compared to the access road for people transport and maintenance vehicles which is 10m wide, extensive blasting through the Khan River Mountains would have to take place. The potential for ore spillage from the haultrucks would be higher than that from other transport systems. The use of diesel and associated maintenance of trucks compared to the minimal energy consumption and maintenance activity of mechanical conveyors made this alternative unfeasible.

The tunnelling option to house a conveyor was screened out as waterproofing sections in order to prevent water ingress increases costs significantly and introduce significant stability risks due to the crossing of the Khan River aquifer and its fracture system. The time required for blasting or boring the tunnel, and the associated stability risk which would be caused by production blasting in the area made this alternative unfeasible. Maintaining a conventional conveyor in a tunnel is being done in many other operations, but would require significantly more resources than the maintenance along an above ground system.

Slurry pumping was an alternative which would require crushing and milling to take place at the Z20 site to produce ore slurry. Whereas this would be feasible, the slurry pumps and piping would have to be established as a dual system having one line on standby in the case of pipe chokes on the alternate system. Although production interruptions could be prevented in such a way, the clearing of pipechokes over the 13km distance could present environmental problems. Specifically the potential for ore slurry spillage during cleaning of chokes along the route and required clean-up operations would make this alternative unfeasible.

The mechanical conveying option was deemed the best alternative as it would have the lowest cost, the least impact on the environment, would be the most reliable and it is widely available and successfully implemented.

Rössing Uranium thus proceeded with an extensive investigation of three conveying systems namely:

- Conventional troughed aerial conveyor;
- Tube or pipe conveyor; and
- Aerial ropeway system.

As the conveying system would need to cross the Khan River, all infrastructures would have to be constructed above the flood line. A specification was drafted inviting proposals from various conveyor suppliers, one of which related to the Doppelmayr RopeCon/ RailCon system.

An extensive review process of this system provided sufficient information to conclude that the RopeCon/ RailCon system offers the best solution to Rössing Uranium for conveying crushed ore over difficult terrain in terms of cost per tonne transported, environmental impact and the highest availability and reliability of all the other conveying systems considered. It also offered the least environmental impact potential and highest availability and reliability compared to the other options considered. The ease of installation was also taken into consideration given the terrain and the experience of Doppelmayr in constructing similar systems in similar or even more difficult terrain.

6.2 ACCESS ROAD

The following alternative access routes were investigated:

- B2 to the Z20 uranium deposit (16km in length);
- C21 to Z20 uranium deposit (22.5km in length);
- New road from Rössing Uranium Mine to the Z20 uranium deposit (14.4km in length);
- Access from the B2 via the Valencia road; and
- Access via the Zhonghe Resources access road.

The first alternative from the existing B2 Road to the Z20 was screened out as this option was not visitor and goods friendly. The second alternative was along an existing track and even though this is the closest direct access route from the Z20 to the Port, it was screened out due to the environmental sensitive area that would be impacted on by the dust. This road would also require frequent maintenance. The third alternative would connect the mine directly with the Z20 area along the shortest route. The forth alternative would have required construction of road sections along the Khan River and would therefore be prone to flooding and operational interruptions. The last alternative would be using an existing road which would have to be extended from east to west for a considerable distance to reach the Z20 site. This was unfeasible from the perspective of travel time required between the Z20 and Rössing.

Therefore the third alternative was chosen as the preferred alternative as this private road could be totally controlled by security as it would have security points at both ends and no other entrance. Therefore the construction of a new access road from Rössing Uranium Mine to the Z20 uranium deposit is the sole access road alternative that will be assessed in this Scoping Study.

6.3 WATER SUPPLY PIPELINE

Three options were considered for the water supply pipeline:

- On top of the RopeCon/ RailCon roof.
  - This option was not considered because the water pipeline is too heavy to be placed on top of the roof structure of the aerial conveyor.
- Below ground.
  - This option was not considered due to the inherent difficulties in construction and operational maintenance and repair.
- Above ground.
  - This option was considered the preferred option since it is easy to construct and allows quick access to the pipeline for maintenance and repairs. The above ground option, its entire length, will, however, potentially affect the ability of a number of large mammal species as well as the Common Ostrich to use the Khan River and its tributaries as movement corridors. This potential impact needs to be assessed in more detail (Refer to Sections 8 and 9 of this report).

6.4 DIESEL SUPPLY

Two alternatives to supply fuel to the Z20 were considered namely:

- Attaching the diesel supply line to the RopeCon / RailCon;
- Below ground diesel supply line along the access road route; and
- Transportation of fuel by road tanker.

All three of these alternatives had positive and negative aspects. Easy accessibility for the maintenance team was positive aspects of the first two alternatives. The alternative of constructing the pipeline below ground was screened out as flood damage to the road could also damage the fuel supply. By attaching the diesel supply line to the RopeCon / RailCon there is a potential risk that a leakage could directly affect the environment if not maintained and repaired properly. Therefore various leak prevention systems must be put in place. Transportation by road tanker would require frequent trips at high cost due to equipment and maintenance. The potential for spillage would be low, but would be difficult to clean up.

6.5 RÖSSING PLANT MODIFICATIONS

6.5.1 Coarse Ore Stockpile and Milling Circuit

The creation of a new stockpile and milling circuit including a semi autogenous mill and ball mill is an alternative to the currently applied milling system. Compared to the current system it offers operational and environmental advantages. Whereas the current crushing, screening and milling in place at the mine consists of four dry crushing stages, the new system would consist of two wet milling systems only. This would reduce the potential for dust emissions, the creation of noise and vibration, and the consumption of energy and the use of wash down water. From this perspective it is the preferred alternative and will be assessed in the second phase of the SEIA.

6.6 Z20 MINING OPTIONS

The mining of the Z20 ore body by open pit mining methods would be the only alternative which would make ore extraction viable. The avoidance and no go alternative are not being considered.
This situation is different in respect of alternatives to dispose of mineral wastes resulting from the mining activities.

6.7 WASTE ROCK DUMP SCENARIOS

6.7.1.1 Backfilling

Unlike for strip mining operations, for example conducted at the Langer Heinrich and Trekkopje mines, backfilling as mining moves forward in a shallow paleo river and leaving a mining void behind is not possible. Open pit mines exploiting granitic ore bodies (like for example Rössing and Husab) will deepen the pits until the final depths are reached. Similarly rock disposal areas will grow until mining is completed. Subsequent backfilling is economically unfeasible and would not be successful in restoring ecosystems.

6.7.1.2 Rock disposal at the Rössing waste rock dumps

The transportation of waste rock across the river would make mining of the Z20 ore body unfeasible due to high transport costs.

6.7.1.3 Disposal close to the Z20 open pit within ML28

This alternative is the one which would be applied in most mining ventures in order to minimise mining costs. This would impact the areas directly surrounding the mining area regardless of the sensitivity of the environment. Dump height could be restricted to remain below the level of the Welwitschia Plains and render the mining site invisible from the distance after mine closure.

6.7.1.4 Disposal within and outside the ML28 area

In case rock dumping would be allowed outside the ML28 mining license area, the dump footprints could be located in less sensitive environments. This would require the dumps to be developed to greater heights in order to maintain disposal capacity. This would create a new feature in the landscape which would be visible from the distance after mine closure.

Alternatives to prevent potential changes to the groundwater depend on the geochemical characteristics of the mineral waste. These characteristics would consider the potential for acid mine drainage and the creation of rainwater leachates contain radionuclides. Once the mineral waste is sufficiently characterised groundwater protection alternatives will be developed and assessed during the next phase of the Z20 SEIA.

Alternative locations for future waste rock dump(s) associated with the Z20 mining are being considered. The related selection criteria parameters to be applied may include:

- ecological;
- archaeology/heritage;
- groundwater;
- surface water;
- land use;
- land capability;
- long term visual impact;
- carbon footprint considerations;
- air quality management;
- emergency management;
- agreements with neighbouring landowners;
- sterilisation of mineral resources; and
- technical and financial considerations.

6.8 TAILINGS DISPOSAL

A number of tailings disposal options have been evaluated during the prefeasibility studies for expanded tailings disposal and are contained in the Phase II SEIA for Rössing's expansion projects. They consider various alternatives to fully utilise the full capacity of the current tailings storage facility. The alternatives of establishing a new tailings storage facility on the Rössing Dome include the deposition of conventional tailings, high density tailings, co-disposal with ripios, different disposal areas and wall building alternatives. These will be described in detail in the next phase of this SEIA considering the mining of Z20 and associated tailings disposal.

6.9 NO-GO ALTERNATIVE

The assessment of the no-go option requires a comparison between the options of proceeding with the project with that of not proceeding with the project. The assessment of this option requires input from the investigations described in Section 10 of this report so that the full extent of social, economic and environmental considerations can be taken into account.

The no-go alternative relating to the proposed infrastructure corridor, would mean that Rössing Uranium will be unable to process the Uranium mined in the Z20 area, which is located on the other side (south) of the Khan River from the existing Rössing processing plant. The overarching (positive) socio-economic implications for this option can only be assessed as part of the next phase of the SEIA (as mentioned above).

However, taking the cumulative impact assessment findings (Section 9 of this report), relating to the following aspects into consideration, the no-go option is more favourable:

- Biodiversity;
- Visual; and

- Archaeology.

With mitigation, some of the potential negative impacts on the environment can be avoided or minimised to acceptable levels. However, certain aspects, specifically from a biodiversity point of view cannot be mitigated and the potential impacts cannot be avoided.

Also, the proposed infrastructure corridor will run to a certain extent parallel to the proposed (already approved) linear infrastructure for the Husab mine. The two proposed “infrastructure corridors” cross the Khan River approximately 5km from each other. This contradicts the recommendation provided in the SEMP for mines to develop infrastructure corridors together, so that lines for road, power and water are clustered together to reduce to total area of disturbance.

In this regard, the collaboration between different mines (in this case between Rössing Uranium and Swakop Uranium) must be considered as a preferred option should the proposed Z20 mining and associated activities be approved.

7 ASSESSMENT METHODOLOGY

The purpose of this section is to describe the assessment methodology utilised in determining the significance of the construction, operational and closure impacts associated with the proposed to the existing mining activities on the socio-economic and biophysical environment. It also addresses the challenge of subjectivity and the means of assessing cumulative impacts.

The methodology applied during this SEIA uses a tabulated rating system, where each impact is described according to its extent (spatial scale), magnitude (size or degree scale, related to the relevant standard where applicable), and duration (time scale). These criteria are used to ascertain the significance of the impact, with and without mitigation. Once the significance of an impact has been determined, the probability of this impact occurring as well as the confidence in the assessment of the impact is determined. Lastly, the reversibility of the impact is estimated.

The following Table 18 provides a summary of the significance of the social and environmental impacts associated with this proposed project. In recognising the extent of the information available at this stage of the project planning cycle, the confidence in the assessment undertaken is regarded as acceptable for informed decision making.

For each impact, the EXTENT (spatial scale), MAGNITUDE (size or degree scale) and DURATION (time scale) will be described. These criteria are used to ascertain the SIGNIFICANCE of the impact, firstly in the case of no mitigation and then with the most effective mitigation measure(s) in place. The mitigation described in the SEIA Report will represent the full range of plausible and pragmatic measures but does not necessarily imply that they should or will all be implemented. The decision as to which combination of alternatives and mitigation measures to apply for will lie with Rössing Uranium as the proponent, and their acceptance and approval ultimately with MET:DEA and MME. The tables on the following pages show the scales used to assess these variables and define each of the rating categories.

The SIGNIFICANCE of an impact is derived by taking into account the temporal and spatial scales and magnitude. The means of arriving at the different significance ratings is explained in Table19, developed by Ninham Shand in 1995 as a means of minimising subjectivity in such evaluations, i.e. to allow for standardisation in the determination of significance.

Table 18: Assessment criteria for the evaluation of impacts

Criteria	Category	Description
Extent or spatial influence of impact	National	Within Namibia
	Regional	Within the Erongo Region
	Local	On site or within 100 m of the impact site
Magnitude of impact (at the indicated spatial scale)	High	Social and/or natural functions and/ or processes are *severely* altered
	Medium	Social and/or natural functions and/ or processes are *notably* altered
	Low	Social and/or natural functions and/ or processes are *slightly* altered
	Very Low	Social and/or natural functions and/ or processes are *negligibly* altered
	Zero	Social and/or natural functions and/ or processes remain *unaltered*
Duration of impact	Short term	Up to 3 years
	Medium Term	4 to 10 years
	Long Term	More than 10 years

Table19: Definition of significance ratings

Significance ratings	
High	• High magnitude with a regional extent and long term duration • High magnitude with either a regional extent and medium term duration or a local extent and long term duration • Medium magnitude with a regional extent and • long term duration
Medium	• High magnitude with a local extent and medium term duration • High magnitude with a regional extent and construction period or a site specific extent and long term duration • High magnitude with either a local extent and construction period duration or a site specific extent and medium term duration • Medium magnitude with any combination of extent and duration except site specific and construction period or regional and long term • Low magnitude with a regional extent and long term duration
Low	• High magnitude with a site specific extent and construction period duration • Medium magnitude with a site specific extent and construction period duration • Low magnitude with any combination of extent and duration except site specific and construction period or regional and long term • Very low magnitude with a regional extent and long term duration
Very low	• Low magnitude with a site specific extent and construction period duration • Very low magnitude with any combination of extent and duration except regional and long term
Neutral	• Zero magnitude with any combination of extent and duration

Once the significance of an impact has been determined, the PROBABILITY of this impact occurring as well as the CONFIDENCE in the assessment of the impact would be determined using the rating systems outlined in Table 20 and Table 21. It is important to note that the significance of an impact should always be considered in concert with the probability of that impact occurring.

Lastly, the REVERSIBILITY of the impact is estimated using the rating system outlined in Table 22.

Table 20: Definition of probability ratings

Probability ratings	Criteria
Definite	Estimated greater than 95% chance of the impact occurring.
Probable	Estimated 5 to 95% chance of the impact occurring.
Unlikely	Estimated less than 5% chance of the impact occurring.

Table 21: Definition of confidence ratings

Confidence ratings	Criteria
Certain	Wealth of information on and sound understanding of the environmental factors potentially influencing the impact.
Sure	Reasonable amount of useful information on and relatively sound understanding of the environmental factors potentially influencing the impact.
Unsure	Limited useful information on and understanding of the environmental factors potentially influencing this impact.

Table 22: Definition of reversibility ratings

Reversibility ratings	Criteria
Irreversible	The activity will lead to an impact that is permanent.
Reversible	The impact is reversible, within a period of 10 years.

7.1 SUBJECTIVITY IN ASSIGNING SIGNIFICANCE

Despite attempts at providing a completely objective and impartial assessment of the environmental implications of development activities, environmental assessment processes can never escape the subjectivity inherent in attempting to define significance. The determination of the significance of an impact depends on both the context (spatial scale and temporal duration) and intensity of such an impact. Since the rationalisation of context and intensity will ultimately be prejudiced by the observer, there can be no wholly objective measure by which to judge the components of significance, let alone how they are integrated into a single comparable measure.

This notwithstanding, in order to facilitate informed decision-making, environmental assessments should endeavour to come to terms with the significance of the potential environmental impacts associated with particular development activities. Recognising this, Aurecon has attempted to address potential subjectivity in the current SEIA process as follows:

- Being explicit about the difficulty of being completely objective in the determination of significance, as outlined above;
- Developing an explicit methodology for assigning significance to impacts and outlining this methodology in detail;
- Having an explicit methodology not only forces the assessor to come to terms with the various facets contributing towards the determination of significance, thereby avoiding arbitrary assignment, but also provides the reader of the SEIA Report with a clear summary of how the assessor derived the assigned significance;

- Wherever possible, differentiating between the likely significance of potential environmental impacts as experienced by the various affected parties; and
- Utilising a team approach and internal review of the assessment to facilitate a more rigorous and defendable system.

Although these measures may not totally eliminate subjectivity, they provide an explicit context within which to review the assessment of impacts.

7.2 CONSIDERATION OF CUMULATIVE IMPACTS

Namibia's Environmental Assessment Policy requires that, "as far as is practicable", cumulative environmental impacts should be taken into account in all environmental assessment processes. Environmental impact assessments have traditionally, however, failed to come to terms with such impacts, largely as a result of the following considerations:

- Cumulative effects may be local, regional or global in scale and dealing with such impacts requires co-ordinated institutional arrangements; and
- Environmental assessments are typically carried out on specific developments, whereas cumulative impacts result from broader biophysical, social and economic considerations, which typically cannot be addressed at the project level.

Cumulative impacts are difficult to deal with on a project SEIA level, since they may occur outside of the geographical area of the particular project being assessed and thus require the collaboration of other institutions, and involve broader social, economic and biophysical considerations outside the scope of the specific project-level assessment. The fact that several other mining companies have been pursuing uranium interests in the Erongo Region emphasized the need for a holistic approach, by means of a strategic or sectoral level assessment. Such a Strategic Environmental Assessment (SEA) of the so-called "central Namib Uranium Rush" (Uranium Rush) was recently undertaken by the Southern African Institute for Environmental Assessment, commissioned by the Ministry of Mines and Energy of the Government of Namibia. This section provides a summary of the SEA sections applicable to cumulative impacts.

The SEA (MME, 2010) provides a bird's eye view of cumulative environmental impacts in the Erongo Region brought about as a result of the Uranium Rush (and other directly linked developments, and potential developments, such as desalination and chemical plants), and advises on how to avoid negative cumulative impacts and to enhance opportunities for positive impacts, within the uranium sector and between mining and other industries. It should be noted that for some aspects of the environment, available data was lacking, such as for biodiversity, and that attaining a level of comprehensive data would be an undertaking of many years. To wait for such a time before development could continue would be unreasonable, and the SEA therefore proceeded with information at hand. The SEA found that the cumulative impacts resulting from the Uranium Rush are not limited to the Erongo Region, but are wide-ranging and could potentially affect a much greater area.

The second medium-growth mine development scenario, of the four possible scenarios that the SEA developed, has been used as a departure point to describe cumulative impacts that are relevant to this SEIA. This scenario is described as being "in-line with expectations", which is an expected total of 5 to 7 mines operating in the Erongo Region by the year 2020. The four mines that currently possess mining licences, and one or two additional mines, are included and predicted to be operating by 2013 in this scenario. It is also accepted that existing mines will proceed with planned expansion projects and that uranium prices are optimistic. The uranium mines included are Rössing Uranium (with expansions) Langer Heinrich (Stages I, II and III), Trekkopje, Valencia, Rössing South (Husab Project) and the Etango Project. Furthermore, one additional non-uranium mine was considered as part of this growth scenario. The other industrial developments that were considered that are directly linked to the uranium mining industry are the two desalination plants by Trekkopje and NamWater, a 400MW coal-fired or compressed natural gas power station at Walvis Bay and the Gecko mining and chemicals operations.

8 IDENTIFICATION AND DESCRIPTION OF POTENTIAL SOCIAL AND ENVIRONMENTAL ASPECTS AND IMPACTS

This section provides information relating to the potential impacts on the social and biophysical environment associated with all the phases of the proposed project that were identified during the screening and scoping process, in consultation with authorities, IAPs and specialists.

The proposed mining of the Z20 Uranium deposit and associated infrastructure, activities and modifications to the existing Rössing Uranium process plant has the potential to impact on the environment in the construction, operational and decommissioning/closure phases.

As discussed in Section 8 of this report, the SEIA team already commenced with the identification of environmental and social aspects and potential impacts relating to the proposed project during the initiation/screening phase. These were further refined during the public participation (Scoping) process where stakeholders had the opportunity to raise issues and provide comments.

Section 8 of this report further explained that the potential impacts associated with the infrastructure corridor (i.e. overland conveyor and diesel line, road, water pipeline and power line) can already be assessed as part of the scoping phase. For this reason the following section, firstly, provides a summary of the identified aspects and potential impacts associated with the infrastructure corridor (please refer to Table 23). The assessment of these impacts is discussed in Section 9 of this report.

Secondly, this section provides a summary of all the identified aspects and impacts associated with the other project components (refer to Table 24). These other project components including:

- Mining of the Z20 ore body;
- Disposal of Z20 waste rock;
- Amendment of the approved Acid Plant Environmental Clearance;
- Processing plant modifications;
- Changes to the present Tailings Storage Facility (TSF); and
- Establishment of a new High Density TSF on the Rössing Dome.

Section 10 of this report sets out the specific work required to assess each of the identified impacts associated with these other project components.

Table 23: Environmental aspects and potential impacts associates with the proposed infrastructure corridor

ASPECT	POTENTIAL SOCIAL AND BIOPHYSICAL IMPACT	FACILITY/ACTIVITY	PHASE IN WHICH IMPACT(S) MAY OCCUR
1. Socio-economic issues			
Employment	Positive impact resulting from permanent employment creation	All linear infrastructure (infrastructure corridor)	Construction and operation phases
The potential impacts on occupational and public health and safety	Overarching social impact on public health and safety	All linear infrastructure (infrastructure corridor)	Construction, operation and decommission phases
Impact on energy use	Operation of the conveyor would require additional electricity supply impacting on the national power grid	All linear infrastructure (infrastructure corridor)	Construction, operation and decommission phases
Construction-related health, safety and aesthetic impacts	During construction there will be an increased number of heavy vehicles. The vehicles will generate noise and dust that may cause a nuisance to residents/visitors in the area, as well as a danger in terms of traffic safety. Machinery used during construction may be an additional source of nuisance through the creation of dust and noise. There is also a potential risk that community members and/or animals can wander onto the site and get injured. Although the proposed site is very isolated, it borders the NNNP. From a tourism perspective the activities may be regarded as visually intrusive	All linear infrastructure (infrastructure corridor)	Construction phase
Operational-related health, safety and aesthetic impacts	Impacts during the operational phase will be very similar to those experienced during the construction phase. There will be additional vehicles on the road that will generate noise and dust and could pose a danger in terms of road safety. The type and activity of the vehicles will be different from the construction phase and the vehicles are more likely to operate according to specific patterns. Machinery used during operations will generate dust and noise that are likely to be cumulative to existing dust and noise sources. The activities on site may be visually intrusive from a tourism perspective. The activities will lead to a change in sense of place for the tourists that visit the area.	All linear infrastructure (infrastructure corridor)	Operation phase
Creation of jobs	The construction and operational activities could create a	All linear infrastructure	Construction and operation phase

and other economic opportunities	number of direct but temporary job opportunities for local residents. Indirect economic opportunities will be created through the need of services such as food, accommodation, etc. by contractors as well as construction workers and new employees.	(infrastructure corridor)	
Negative impacts related to a construction camp	A number of negative impacts are sometimes associated with construction camps, such as social disturbances resulting from noise at night, damage to neighbouring properties caused through negligence, unintended fires, loss of game and livestock through poaching, littering by construction workers and the illegal occupation of the camp by squatters after the construction period. An increase in HIV/AIDS can often be associated with the presence of a construction camp and migrant labour.	All linear infrastructure (infrastructure corridor)	Construction phase
2. Air quality			
Clearing of groundcover	Particle emissions during road construction (resulting from blasting, land clearing, topsoil removal, road grading, material loading and hauling, stockpiling, compaction, etc.) causing a negative impact on air quality and ecosystem functionality.	Construction of the access road	Construction phase
Levelling and grading of surface			
Wind erosion from exposed areas			
Asphalt processes			
Vehicle and construction equipment activity during construction operations		Vehicle activity on-site	Construction phase
Tailpipe emissions from vehicles and construction equipment such as graders, scrapers and dozers	Release of gases and particles into the air causing a negative impact on air quality and ecosystem functionality.	Vehicle and construction equipment activity	Construction phase
Wind-blown dust from conveyor	Particle emissions resulting from ore transport from Z20 to Rössing Mine via the RopeCon conveyor causing a negative	Ore transport via conveyor	Operation phase

	impact on air quality and ecosystem functionality.		
Dust generation from tipping	Particle emissions resulting from ore transport at transfer points from Z20 to Rössing Mine via the RopeCon conveyor causing a negative impact on air quality and ecosystem functionality.	Material transfer points	Operation phase
Vehicle activity on the access road	Particle emissions resulting from vehicle activity (vehicle-entrained dust from unpaved and paved roads) causing a negative impact on air quality and ecosystem functionality.	Access road	Operation phase
Tailpipe emissions from vehicle activity on the access road	Gases and particle emissions as a result of vehicle activity, causing a negative impact on air quality and ecosystem functionality.	Vehicle activity	Operation phase
Demolition of asphalt road surface	Particulates released into the atmosphere as a result of rehabilitation activities, causing a negative impact on air quality and ecosystem functionality.	Rehabilitation access road and conveyor support systems	Decommission phase
Removal of surface material			Decommission phase
Exposed cleared areas and exposed topsoil during rehabilitation		Wind erosion	Decommission phase
Truck activity at site during rehabilitation		Vehicle activity on unpaved roads and on-site	Decommission phase
Tailpipe emissions from trucks and equipment used for rehabilitation	Gases and particle emissions as a result of rehabilitation activities, causing a negative impact on air quality and ecosystem functionality.	Vehicle activity	Decommission phase
3. Visual			
Visual impact on surrounding receptors.	Visual impact caused by landscape changes brought about by construction of the road, power line, water pipes, bridge over the Khan River and the RopeCon conveyor. The infrastructure may be visible from receptors utilising the Khan River as a 4x4 recreation route. Impact on sense of place.	Access road, power line and RopeCon aerial conveyor	Construction, operation and decommission phase

	Impact on landscape character.		
4. Noise			
Noise pollution resulting from blasting activities	Blasting events will result in large increase in ambient noise levels with the possibility that the noise will be propagated by the valleys and gorges within the study area. The blasting noise could negatively affect tourists who visit the region or cause a nuisance to nearby residents. The blast noise could potentially negatively affect the fauna population living in the vicinity of the proposed road.	Blasting	Construction phase
Noise pollution resulting from land clearing and bulk earthworks activities, using large mobile equipment	The noise could negatively affect tourists who visit the region or cause a nuisance to nearby residents. The noise could potentially negatively affect the fauna population living in the vicinity of the proposed activities.	Operation of machinery	Construction and decommission phase
Noise pollution as a result of helicopter operations		RopeCon aerial conveyor	Construction and decommission phase
Nuisance factor caused to local residents and tourists due to increased noise	Disruption of the sense of place to local residents and tourists.	Access road and RopeCon aerial conveyor	Construction and operation phase
5. Radiation			
Fugitive radioactive dust emissions from the ore transport	Fugitive radioactive dust emissions resulting in an increased exposure risk of radiation to third parties.	Ore transport via conveyor	Operation phase
Spillage of ore from aerial conveyor	Surface water contamination resulting in radiological impacts.	Ore transport via conveyor	Operation phase
6. Biodiversity (natural vegetation and animals)			

Physical destruction and/or general disturbance of biodiversity	Loss of mountainous habitats.	Construction activities associated with the RopeCon pylons, as well as the area covered by access tracks	Construction phase
	Loss of water course habitat and aquatic habitat (specific reference to the springs located south of the Khan River).	Access road, power supply, water supply pipeline	Construction, operation and decommission phase
	Potential loss of rare and threatened species.		
	Impact on animal movement (loss of natural migration corridors).	Road and water pipeline	Construction, operation and decommission phase
	Impact bird populations due to bird collisions.	Overland conveyor and power line	Operation phase
	Impact on susceptible vertebrate populations.	Traffic on the road	Operation phase
7. Archaeology			
Altering of sensitive archaeological and/or heritage sites	Disturbance and/or destruction of sensitive archaeological sites.	Access road, power line, water pipeline, RopeCon aerial conveyor	Construction phase
8. Surface water			
Spillage of ore and leakage of diesel from aerial conveyor and diesel line	Surface water contamination as a result of material falling from the conveyor system or diesel leakage into the Khan River. Contamination of surface water and transport of contaminated materials due to floods.	Ore transport via conveyor and diesel pumping through pipeline	Operation phase

Table 24: Potential environmental aspects and impacts associated with the other project components

ASPECT	POTENTIAL SOCIAL AND BIOPHYSICAL IMPACT	FACILITY/ACTIVITY	PHASE IN WHICH IMPACT(S) MAY OCCUR
1. Socio-economic issues			
Impact on the economic sustainability of Arandis	Arandis would be vulnerable to the consequences of the eventual termination of Rössing Uranium and its employees	Rössing Mine	Construction, operation and decommission phase
Employment	Positive impact resulting from temporary and permanent employment creation	Expansion of Rössing Mine	Construction and operational
The potential impacts on occupational and public health and safety	Overarching social impact on public health and safety	Z20 Mine pit Disposal of waste rock Processing plant New HD TSF	Construction, operation and decommission phase
Impact on housing and accommodation	Additional accommodation units will be required to house the projected increased workforce	Expanded Rössing Mine	Construction and operation phase
Impact on local economies	Large scale mining operations are typically economic drivers of considerable importance and their influence is felt well beyond the mine site.	Expanded Rössing Mine	Construction, operation and decommission phase
Impact on the availability of schooling	The provision of social services in the form of health care and schooling in the Erongo Region is generally high, although some disparities exist with regard to health services. The capacity of schools in Swakopmund and Walvis Bay is under pressure as a result of the perception that schools in the towns offer a better education than those in rural areas and the demand to accommodate learners from other areas is high.	Expanded Rössing Mine	Construction and operation phase
Impact on service infrastructure	Water supply and reticulation, and the provision of electricity and transportation facilities could all be impacted on.	Expanded Rössing Mine	Construction, operation and decommission phase
Impact on energy use	Operation of the plant would require additional electricity supply impacting on the national power grid.	Expanded Rössing Mine	Construction, operation and decommission phase
Impact on human	Accidental releases of the three extremely hazardous	Acid plant	Construction, operation and

health	compounds in use during the acid burning process, namely sulfuric acid, SO_2 and sulphur trioxide		decommission phase
Construction-related health, safety and aesthetic impacts	During construction there will be an increased number of heavy vehicles. The vehicles will generate noise and dust that may cause a nuisance to visitors to the area, as well as a danger in terms of traffic safety. Machinery used during construction may be an additional source of nuisance through the creation of dust and noise. There is also a potential risk that community members and/or animals can wander onto the site and get injured. Although the proposed site is very isolated, it borders the NNNP. From a tourism perspective the activities may be regarded as intrusive.	Road, water supply, fuel supply, Z20 mining operations, modified plant, heap leach, tailings construction	Construction phase
Operational-related health, safety and aesthetic impacts	Impacts during the operational phase will be very similar to those experienced during the construction phase. There will be additional vehicles on the road that will generate noise and dust and could pose a danger in terms of road safety. The type and activity of the vehicles will be different from the construction phase and the vehicles are more likely to operate according to specific patterns. Machinery used during operations will generate dust and noise that are likely to be cumulative to existing dust and noise sources. The activities on site may be intrusive from a tourism perspective. The activities will lead to a change in sense of place for the tourists that visit the area.	Road, water supply, fuel supply, Z20 mining operations, modified plant, heap leach, tailings	Operational phase
Influx of people	The proposed project may attract a number of opportunistic jobseekers to the area. These individuals are likely to put additional pressure on local infrastructure and services such as housing, water, sanitation, electricity, health care and education. The jobseekers that are unsuccessful usually do not have the means to return to areas where they came from. An influx of people can also lead to possible social disintegration and cultural differentiation. There are a number of projects being proposed in the area. It has not been proven that the proposed project by itself would be responsible for an influx of people. It would, however, contribute to an influx of people together with all the other projects planned in the area.	Expanded Rössing Mine	Construction and operation phase

Increase in social pathologies	An influx of people in the area that are unemployed may lead to an increase in social problems that are often associated with poverty, such as drug/alcohol abuse, abuse of women, incidence of Sexually Transmitted Diseases, increase in HIV/AIDS, unwanted pregnancies, violence and an increase in opportunistic crime. The proposed project is likely to have a cumulative effect on the increase in social pathologies together with all the other projects planned in the area.	Expanded Rössing Mine	Construction and operation phase
Creation of jobs and other economic opportunities	The construction and operational activities could create a number of direct job opportunities for local residents. Indirect economic opportunities will be created through the need of services such as provision of food, accommodation, etc. by contractors as well as construction workers and new employees.	Expanded Rössing Mine	Construction and operation phase
Negative impacts related to a construction camp	A number of negative impacts are sometimes associated with construction camps, such as social disturbances resulting from noise at night, damage to neighbouring properties caused through negligence, unintended fires, loss of game and livestock through poaching, littering by construction workers and the illegal occupation of the camp by squatters after the construction period. An increase in HIV/AIDS can often be associated with the presence of a construction camp and migrant labour.	Expanded Rössing Mine	Construction phase
2. Air quality			
Air emissions and occupational and public health and safety	The increase of production of the proposed acid plant could result in elevated emissions of SO_2 and/ or sulfuric acid (SO_3/H_2SO_4) causing a negative impact on air quality.	Acid plant	Operation phase
Dust	Potential increase in PM_{10} and TSP causing a negative impact on air quality, public health and ecosystem functionality.	Z20 Mine pit Disposal of waste rock Expansion of acid plant Processing plant modifications Changes to existing TSF New HD TSF	Construction, operation and decommission phase
Gaseous emissions	Potential increase in SO_2, Nitrogen dioxide (NO_2) and carbon monoxide (CO) causing a negative impact on air quality.		
Blasting Activities	Blasting could release CO and hydrogen sulphide (H_2S) that may impact on residentia.	Z20 Mine pit	Construction and operation phase

	Increased dust accumulation around the mining operations may reduce the productivity of plants, and reduce the abundance and diversity of soil crust organisms and small invertebrates.	Z20 Mine pit	Construction and operation phase
	Ground vibrations and tremors, air blast and fly rock (caused by blasting) could have a physical impact on neighbouring private property and industrial areas.	Z20 Mine pit	Construction and operation phase
	Fumes caused by blasting operations during the mine expansion could result in nuisance to residents of neighbouring private property in the town of Arandis and neighbouring mining and industrial areas.	Z20 Mine pit	Construction and operation phase
3. Visual			
Visual impact on surrounding receptors.	Visual impacts resulting from mining the Z20 Uranium deposit, when viewed from surrounding tourist attractions. Impact on sense of place. Impact on landscape character.	Z20 Mine pit Disposal of waste rock	Construction and operation phase
	Increased visual impact from the B2 and Arandis Expansion of the TSF	Expansion of acid plant (stack) Changes to existing TSF New HD TSF	Construction and operation phase
4. Noise & vibrations			
Blasting noise and vibration resultant from mining activities	Noise disturbance and/ or noise nuisance: • Impact on surrounding areas • Impact on fauna • Impact on the wilderness experience that people expect when visiting the area (i.e. eco-tourism and recreation)	Z20 Mine pit Disposal of waste rock	Construction and operation phase
	Vibration impacts on surrounding areas and neighbouring mining and industrial sites	Z20 Mine pit	Construction and operation phase
5. Radiation			
Additional sources of radioactive dust emissions.	Potential contamination of the environment with radionuclides. Dust could be radioactive and pose a potential radiological inhalation hazard to members of the public.	Z20 Mine pit Disposal of waste rock	Construction, operation and decommission phase
Fugitive radioactive dust emissions from the		Clearing of the groundcover at Z20, Levelling and grading of the surface, Wind erosion from	Construction phase

Construction		exposed areas of ore	
Increased emission of radon gas	Potential health impacts as a result of the release of radon gas, which pose a potential radiological hazard to members of the public.	Z20 Mine pit Disposal of waste rock Changes to existing TSF New HD TSF	Construction, operation and decommission phase
Exposure to radiation though surface water and groundwater pathways	Radiation exposure of third parties through the drinking of contaminated water, eating of food grown on contaminated land, or eating of animals (contaminated through drinking contaminated water or eating contaminated plants).	Z20 Mine pit Disposal of waste rock Processing plant New HD TSF	Construction, operation and decommission phase
6. Biodiversity (natural vegetation and animals)			
Physical destruction and/or general disturbance of biodiversity	Loss of habitat.	Z20 Mine pit Disposal of waste rock Processing plant Changes to existing TSF New HD TSF	Construction, operational and decommission phase
	Potential loss of rare and threatened species		
	Impact on animal movement (loss of natural migration corridors).		
	Loss of soil resources through removal, compaction and/or erosion.	Z20 Mine pit Disposal of waste rock New HD TSF	Construction, operational and decommission phase
7. Archaeology			
Mining impacts on archaeological sites	Potential disturbance/destruction of archaeological sites and landscapes.	Z20 Mine pit Disposal of waste rock New HD TSF	Construction and operation phase
8. Surface water			
Contamination of surface water	Pollution sources that can have a negative impact on surface water quality. Pollution sources include amongst others fuel and lubricant spillage, sewerage, tailings solution, mineralised rock waste, process chemical spillage, non-mineralised waste, etc.	Acid plant, mining operations, waste rock disposal, process plant, TSF and new HD TSF	Construction, operational and decommission phase
Water usage	Increased water consumption impacting on the Omdel aquifer.	Acid plant Processing plant	Operation
	The supply, storage, application, runoff and reuse of water necessitated by the mining of the Z20 Uranium deposit.	Z20 Mine pit	Construction and operation phase
	Increase in water use for dust suppression	Z20 Mine pit	Construction and operation phase
Altering drainage	Changing surface water flow through impeding existing	Z20 Mine pit	Construction and operation phase

patterns	drainage patterns.	Disposal of waste rock New HD TSF	
Erosion	Erosion of soil from exposed areas may result in siltation of streams.	Z20 Mine pit Disposal of waste rock Changes to existing TSF New HD TSF	Construction and operation phase
9. Groundwater			
Pollution of groundwater	Groundwater could become contaminated from a number of pollution sources. Pollution sources include amongst others fuel and lubricant spillage, sewerage, tailings seepage, mineralised waste, process chemical spillage, non-mineralised waste.	Z20 Mine pit Disposal of waste rock, process plant Changes to existing TSF New HD TSF	Construction, operational and decommission phase
Dewatering	Dewatering the Z20 mine pit will lower the existing ground water levels.	Z20 mine pit	Late construction, operation and decommission phase
10. Traffic			
Traffic volumes	Increase in traffic volumes to the mine impacting on the B2 and the B2 intersection to Arandis.	Expanded Rössing Mine	Construction and operation phase

9 IMPACT ASSESSMENT AND MANAGEMENT AND MITIGATION MEASURES RELATING TO THE Z20 INFRASTRUCTURE CORRIDOR

This section forms the focus of this SEIA process. It contains a detailed assessment of the construction, operations and decommissioning/closure impacts associated with the linear infrastructure corridor on the affected socio-economic and biophysical environment, using the methodology described in Section 7.

The potential social and environmental impacts associated with the construction, operation and decommissioning/closure phases of the linear infrastructure that were identified in Section 8 of this report, were assessed by a team of specialists. The methodology presented in Section 7 was followed for each of the identified aspects and assessed on this basis, taking the existing environment (as described in Section 4) into consideration.

Management and mitigation measures to address the identified impacts are discussed in this section and included in more detail in the SEMP that is attached in Annexure D.

9.1 SOCIO ECONOMIC

With reference to Table 23 in Chapter 8, a number of socio-economic aspects and potential impacts have been identified. Most of the identified issues were covered by other specialist investigations later on in this section of the report. Therefore, apart from the identification of overarching issues, a detailed socio economic impact assessment has not been conducted for the construction and operations of the linear infrastructure. The overarching issues relating to the proposed infrastructure corridor are presented in the table below.

Table 25: Potential social impacts

Potential socio-economic impact	Comment
Overarching social impact on public health and safety	Assessed as part of the air quality- and radiation specialist studies.
Operation of the conveyor would require additional electricity supply impacting on the national power grid	The power draw from the conveyor system will be minimal and will not have an effect on national power supply.
During construction there will be an increased number of heavy vehicles. The vehicles will generate noise and dust that may cause a nuisance to residents/visitors in the area, as well as a danger in terms of traffic safety. Machinery used during construction may be an additional source of nuisance through the creation of dust and noise. There is also a potential risk that community members and/or animals can wander onto the site and get injured. Although the proposed site is very isolated, it borders the NNNP. From a tourism perspective the activities may be regarded as visually	Assessed as part of the following specialist studies: • Air quality; • noise; • biodiversity; and • visual Other safety issues relating unauthorised access are addressed in the SEMP.

intrusive	
Impacts during the operational phase will be very similar to those experienced during the construction phase. There will be additional vehicles on the road that will generate noise and dust and could pose a danger in terms of road safety. The type and activity of the vehicles will be different from the construction phase and the vehicles are more likely to operate according to specific patterns. Machinery used during operations will generate dust and noise that are likely to be cumulative to existing dust and noise sources. The activities on site may be visually intrusive from a tourism perspective. The activities will lead to a change in sense of place for the tourists that visit the area.	Refer to above mentioned.
Positive impact resulting from permanent employment creation	During the peak of the construction phase there will be approximately 2500 (temporary) employees.
The construction and operational activities could create a number of direct but temporary job opportunities for local residents. Indirect economic opportunities will be created through the need of services such as food, accommodation, etc. by contractors as well as construction workers and new employees.	The number of permanent employees still needs to be determined, but compared to the existing Rossing Uranium workforce, the increase will be very marginal. The associated (positive) indirect economic opportunities will possibly increase marginally.
A number of negative impacts are sometimes associated with construction camps, such as social disturbances resulting from noise at night, damage to neighbouring properties caused through negligence, unintended fires, loss of game and livestock through poaching, littering by construction workers and the illegal occupation of the camp by squatters after the construction period. An increase in HIV/AIDS can often be associated with the presence of a construction camp and migrant labour.	These issues are addressed in the SEMP.

A detailed socio-economic specialist study will however be conducted as part of the next phase of the SEIA process (refer to the Terms of Reference in section 10.2.1 of this report) addressing the entire Z20 project.

9.2 AIR QUALITY

An air quality impact assessment was undertaken to assess the environmental aspects and potential impacts of the proposed Z20 linear infrastructure corridor. Please refer to Annexure C for the complete air quality impact assessment undertaken by Airshed Planning Professionals.

9.2.1 PM_{10} Ground Level Concentrations

9.2.1.1 Impact statement

A number of the activities associated with the proposed project have the potential to impact on the air quality. Particle emissions from various construction activities (blasting, land clearing, topsoil removal, road grading, material loading and hauling, stockpiling, compaction) during the road construction could cause a negative impact on air quality and ecosystem functionality, as well as the release of gases from vehicles and machinery. Particle emissions from ore transport via the RopeCon conveyor and at the transfer points may cause a negative impact on air quality and ecosystem functionality.

9.2.1.2 Discussion

Without any mitigation measures, modelling shows that the PM_{10} air quality limit (75µg/m³) is exceeded for a distance of up to 850m from the material transfer points with no exceedances along the conveyor system. The infrastructure corridor results in low PM_{10} concentrations that are well below the daily and annual air quality limits. Figure 25 indicates the area of highest predicted daily PM_{10} ground level concentrations with no mitigation in place, assuming a conventional conveyor system which is more conservative.

With mitigation in place at the material transfer points, and on the conveyor (roof cover and sidewalls resulting in 70% overall control efficiency) the predicted incremental impacts reduce over a daily average to only exceed the air quality limit (75 µg/m³) for a small area around the two transfer points. This results in low ground level concentrations off-site. The annual average footprint as shown in Figure 28 also reduces significantly.

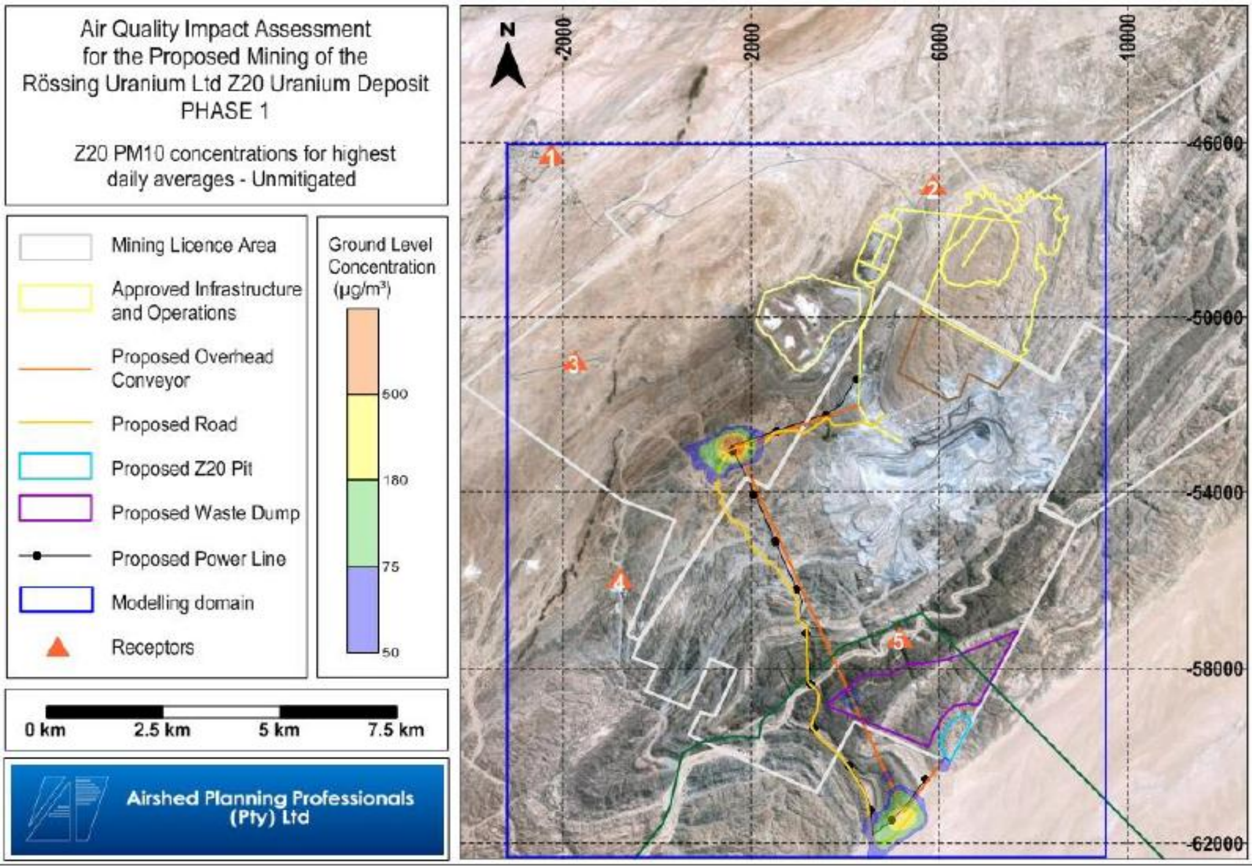

Figure 25: Unmitigated Highest daily PM10 ground level concentrations from Z20 Infrastructure Corridor

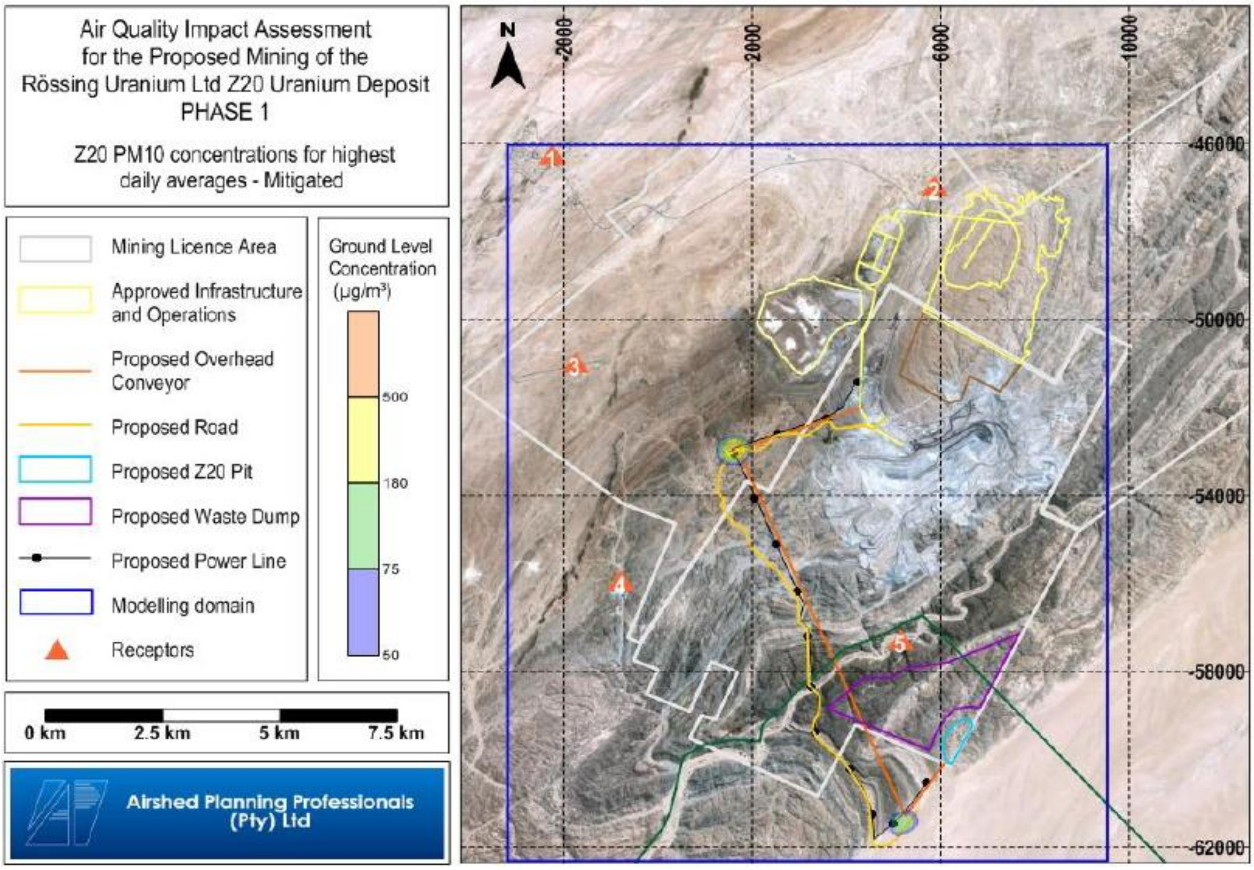

Figure 26: Mitigated Highest daily PM10 ground level concentrations from Z20 Infrastructure Corridor

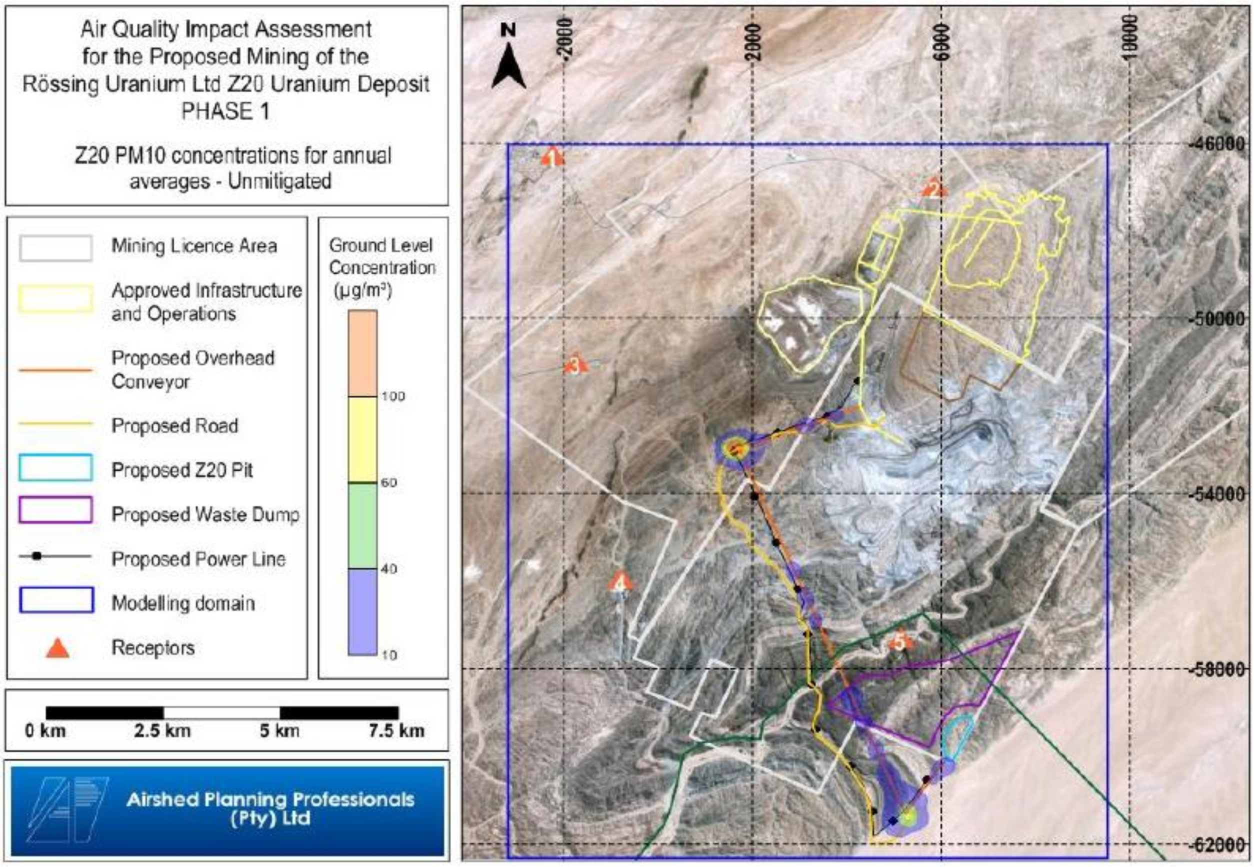

Figure 27: Unmitigated Annual average PM10 ground level concentrations from Z20 Infrastructure Corridor

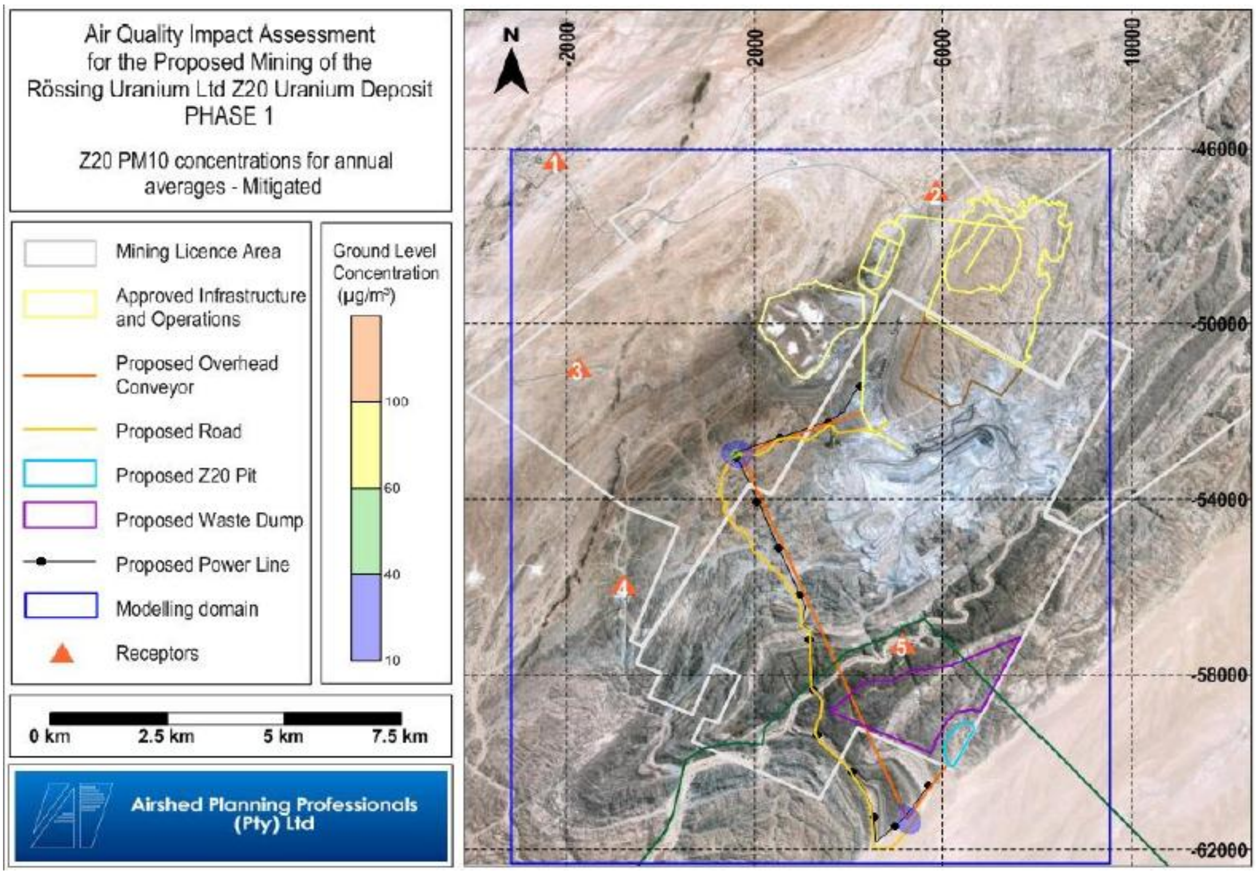

Figure 28: Mitigated Annual average PM10 ground level concentrations from Z20 Infrastructure Corridor

9.2.1.3 Impact rating

Construction phase

For the unmitigated scenario the dust generation during access road construction will result in additional inhalable particulate concentrations. The impact is expected to be localised.

For the mitigated scenario the dust generation during access road construction will result in additional inhalable particulate concentrations. The impact is expected to be very localised if mitigated with water sprays.

The table below provided the impact rating for the PM_{10} impact during the construction phase.

Table 26: Impact rating of PM10 during construction phase

	Before Mitigation	**After Mitigation**
Extent	Local (On- or near site, not at any communities)	Local (On- or near site, not at any communities)
Magnitude	Low (Slightly below the Air Quality Limits, cumulatively)	Low (Slightly below the Air Quality Limits, cumulatively)
Duration	Short term (Up to 3 years)	Short term (Up to 3 years)
SIGNIFICANCE	Low (-)	Low (-)
Probability	Probable (Considered the appropriate probability rating for predicted air quality impacts)	Probable (Considered the appropriate probability rating for predicted air quality impacts)
Confidence	Unsure (Considered the appropriate confidence rating for predicted construction phase air	Unsure (Considered the appropriate confidence rating for predicted construction phase air

	quality impacts)	quality impacts)
Reversibility	Reversible (Only consider impacts on vegetation where the dust fallout rate is above the limit)	Reversible (Only consider impacts on vegetation where the dust fallout rate is above the limit)

Operational phase

For the unmitigated scenario there will be an increase in inhalable particulate concentrations to the existing baseline air quality in the region.

For the mitigated scenario, with enclosed transfer points and conveyor, there will be an insignificant increase in inhalable particulate concentrations to the existing baseline air quality in the region.

The table below provided the impact rating for the PM_{10} impact during the operational phase.

Table 27: Impact rating of PM_{10} during operational phase

	Before Mitigation	**After Mitigation**
Extent	Regional (Outside the Mining Licence Area but within the Erongo Region)	Local (On- or near site, not at any communities)
Magnitude	Medium (Exceedances of the Air Quality Limits, where this project does not cause cumulative impacts to exceed - baseline already in exceedance)	Low (Slightly below the Air Quality Limits, cumulatively)
Duration	Long term (More than 10 years)	Long term (More than 10 years)
SIGNIFICANCE	High (-)	Low (-)
Probability	Probable (Considered the appropriate probability rating for predicted air quality impacts)	Probable (Considered the appropriate probability rating for predicted air quality impacts)
Confidence	Sure (Considered the appropriate confidence rating for predicted operational phase air quality impacts)	Sure (Considered the appropriate confidence rating for predicted operational phase air quality impacts)
Reversibility	Reversible (Only consider impacts on vegetation where the dust fallout rate is above the limit)	Reversible (Only consider impacts on vegetation where the dust fallout rate is above the limit)

Decommissioning phase

For the unmitigated scenario there will be an increase in dust generation due to the demolition of existing infrastructure. The impact is expected to be localised.
For the mitigated scenario there will be an increase in dust generation due to the demolition of existing infrastructure. The impact is expected to be localised.

The table below provided the impact rating for the PM_{10} impact during the decommissioning phase.

Table 28: Impact rating of PM_{10} during decommissioning phase

	Before Mitigation	**After Mitigation**
Extent	Local (On- or near site, not at any communities)	Local (On- or near site, not at any communities)
Magnitude	Low (Slightly below the Air Quality	Very low (Well below the Air

	Limits, cumulatively)	Quality Limits, cumulatively)
Duration	Short term (Up to 3 years)	Short term (Up to 3 years)
SIGNIFICANCE	Low (-)	Very low (-)
Probability	Probable (Considered the appropriate probability rating for predicted air quality impacts)	Probable (Considered the appropriate probability rating for predicted air quality impacts)
Confidence	Unsure (Considered the appropriate confidence rating for predicted construction phase air quality impacts)	Sure (Considered the appropriate confidence rating for predicted operational phase air quality impacts)
Reversibility	Reversible (Only consider impacts on vegetation where the dust fallout rate is above the limit)	Reversible (Only consider impacts on vegetation where the dust fallout rate is above the limit)

9.2.2 Dust fallout

9.2.2.1 Impact statement

A number of the activities associated with the proposed project have the potential to impact on the air quality. Particle emissions from ore transport from the Z20 area to the Rössing Mine via the RopeCon conveyor and at the transfer points, as well as particle emissions resulting from vehicle activity (vehicle-entrained dust from unpaved and paved roads) could cause a negative impact on air quality and ecosystem functionality.

9.2.2.2 Discussion

Without mitigation the majority of dust fallout will occur within the ML28 site boundary. The area around the conveyor has higher dust fallout. The predicted dust fallout rate above the 600mg/m²/day stretches up to about 600m from the conveyor. Cumulative impacts do not exceed the residential dust fallout limit of 600mg/m²/day with a maximum of 400mg/m²/day (European vegetation limit) at the Khan River.

With mitigation in place on the material transfer points and the conveyor, the predicted dust fallout rates reduce to only have impact areas at the transfer points. Cumulatively the dust fallout rates remain similar to the baseline situation with no exceedances of either the residential limit (600mg/m²/day) or the European vegetation limit (400mg/m²/day).

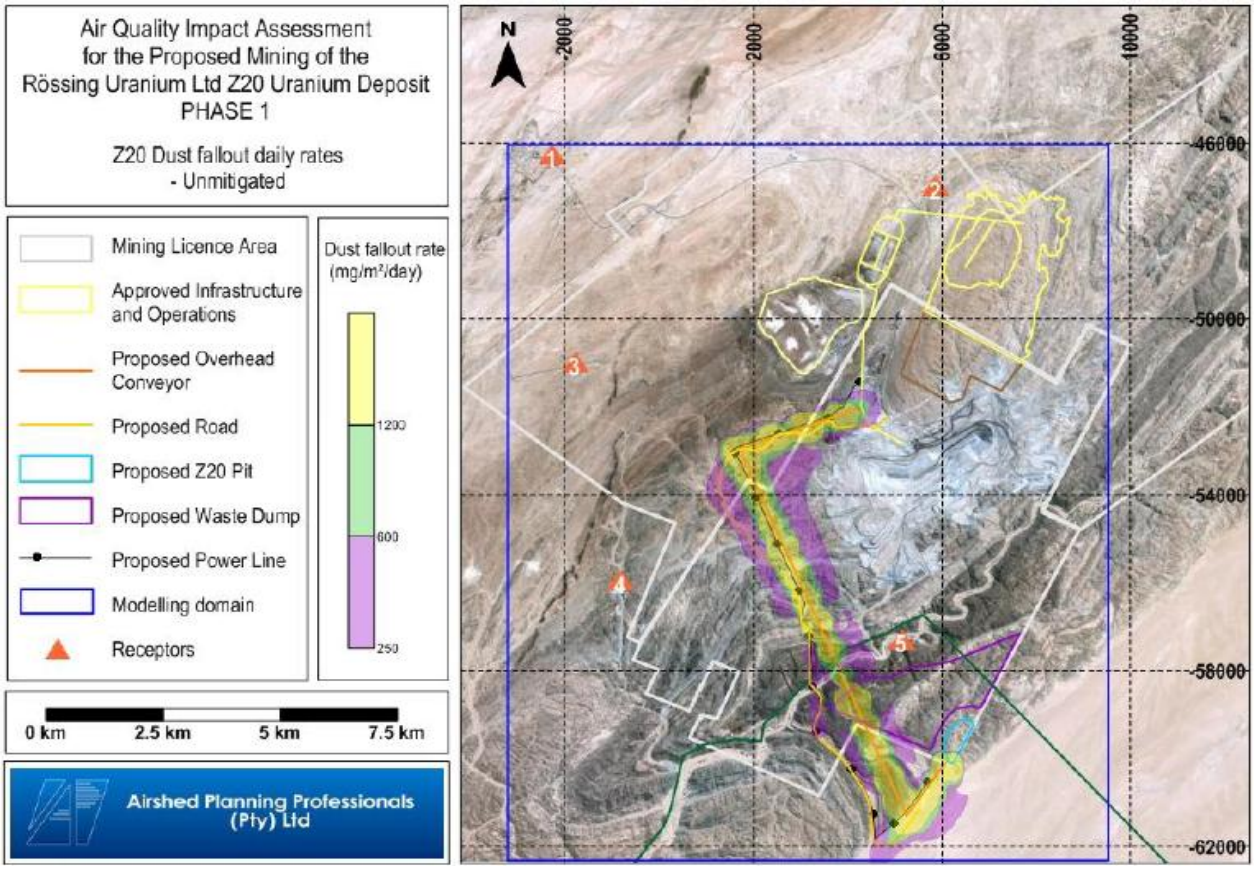

Figure 29: Unmitigated Maximum daily dust fallout rates from Z20 Infrastructure Corridor

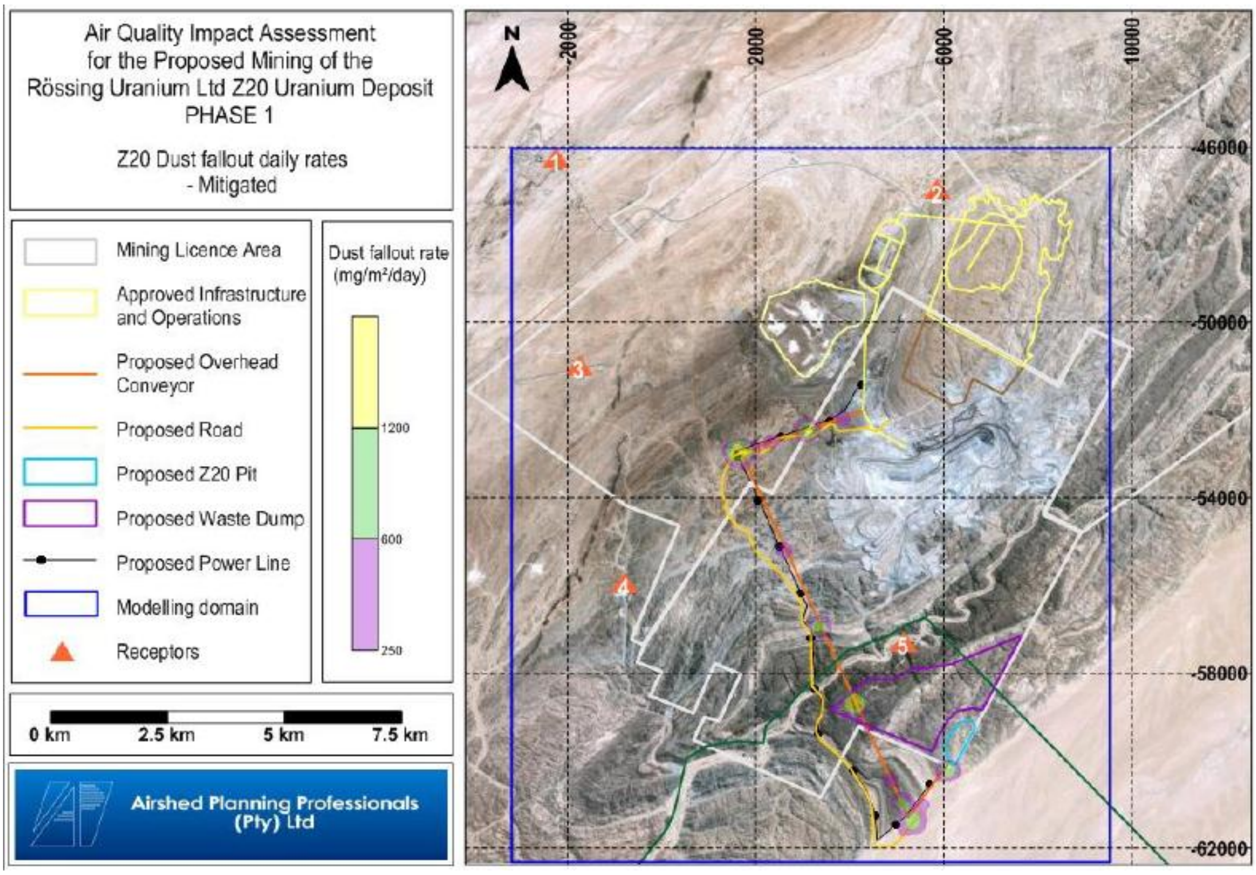

Figure 30: Mitigated Maximum daily dust fallout rates from Z20 Infrastructure Corridor

9.2.2.3 Impact rating

Construction phase

For the unmitigated scenario the dust generation during access road construction is expected to be localised. For the mitigated scenario the dust generation during access road construction will result in dust fallout that is expected to be localised, if mitigated with water sprays.

The table below provided the impact rating for the dust fallout impact during the construction phase.

Table 29: Impact rating of dust fall out during construction phase

	Before Mitigation	**After Mitigation**
Extent	Local (On- or near site, not at any communities)	Local (On- or near site, not at any communities)
Magnitude	Low (Slightly below the Air Quality Limits, cumulatively)	Low (Slightly below the Air Quality Limits, cumulatively)
Duration	Short term (Up to 3 years)	Short term (Up to 3 years)
SIGNIFICANCE	Low (-)	Low (-)
Probability	Probable (Considered the appropriate probability rating for predicted air quality impacts)	Probable (Considered the appropriate probability rating for predicted air quality impacts)
Confidence	Unsure (Considered the appropriate confidence rating for predicted construction phase air quality impacts)	Unsure (Considered the appropriate confidence rating for predicted construction phase air quality impacts)
Reversibility	Irreversible (Only consider impacts on human health where the annual air quality limits is exceeded)	Irreversible (Only consider impacts on human health where the annual air quality limits is exceeded)

Operational phase

For the unmitigated scenario the increase in dust fallout concentrations to the existing baseline air quality will marginally exceed the European vegetation limit at the Khan River. An insignificant increase in dust fallout rates to the existing baseline will be observed if the transfer points and conveyor are enclosed.

The table below provided the impact rating for the dust fallout impact during the operational phase.

Table 30: Impact rating of dust fall out during operational phase

	Before Mitigation	**After Mitigation**
Extent	Regional (Outside the Mining Licence Area but within the Erongo Region)	Local (On- or near site, not at any communities)
Magnitude	High (Exceedances of the Air Quality Limits, where this project causes cumulative impacts to exceed)	Low (Slightly below the Air Quality Limits, cumulatively)
Duration	Long term (More than 10 years)	Long term (More than 10 years)
SIGNIFICANCE	High (-)	Low (-)
Probability	Probable (Considered the appropriate probability rating for predicted air quality impacts)	Probable (Considered the appropriate probability rating for predicted air quality impacts)

Confidence	Sure (Considered the appropriate confidence rating for predicted operational phase air quality impacts)	Sure (Considered the appropriate confidence rating for predicted operational phase air quality impacts)
Reversibility	Reversible (Only consider impacts on vegetation where the dust fallout rate is above the limit)	Reversible (Only consider impacts on vegetation where the dust fallout rate is above the limit)

Decommissioning phase

The demolition of existing infrastructure will result in an increase in dust generation during the decommissioning phase and the impact is expected to be localised with no mitigation measures in place. For the mitigated scenario an increase in dust generation, due to the demolition of existing infrastructure, is expected to have localised impacts.

The table below provides the impact rating for the dust fallout impact during the decommissioning phase.

Table 31: Impact rating of dust fall out during decommissioning phase

	Before Mitigation	**After Mitigation**
Extent	Local (On- or near site, not at any communities)	Local (On- or near site, not at any communities)
Magnitude	Low (Slightly below the Air Quality Limits, cumulatively)	Very low (Well below the Air Quality Limits, cumulatively)
Duration	Short term (Up to 3 years)	Short term (Up to 3 years)
SIGNIFICANCE	Low (-)	Very low (-)
Probability	Probable (Considered the appropriate probability rating for predicted air quality impacts)	Probable (Considered the appropriate probability rating for predicted air quality impacts)
Confidence	Unsure (Considered the appropriate confidence rating for predicted construction phase air quality impacts)	Sure (Considered the appropriate confidence rating for predicted operational phase air quality impacts)
Reversibility	Reversible (Only consider impacts on vegetation where the dust fallout rate is above the limit)	Reversible (Only consider impacts on vegetation where the dust fallout rate is above the limit)

9.2.3 Cumulative impacts

9.2.3.1 PM_{10} Ground Level Concentrations

Without mitigation the cumulative predicted impact zone is similar to the baseline scenario, with only a slight increase in cumulative ground level concentrations of between 1% (at the Khan River) and 14% (at Husab Mine) when compared to the baseline scenario. Over an annual average there are only exceedances of the air quality limit at the Khan River.

With mitigation in place on the infrastructure corridor material transfer points and on the conveyor, the predicted cumulative impacts remain similar to the baseline scenario. Annual concentrations remain low.

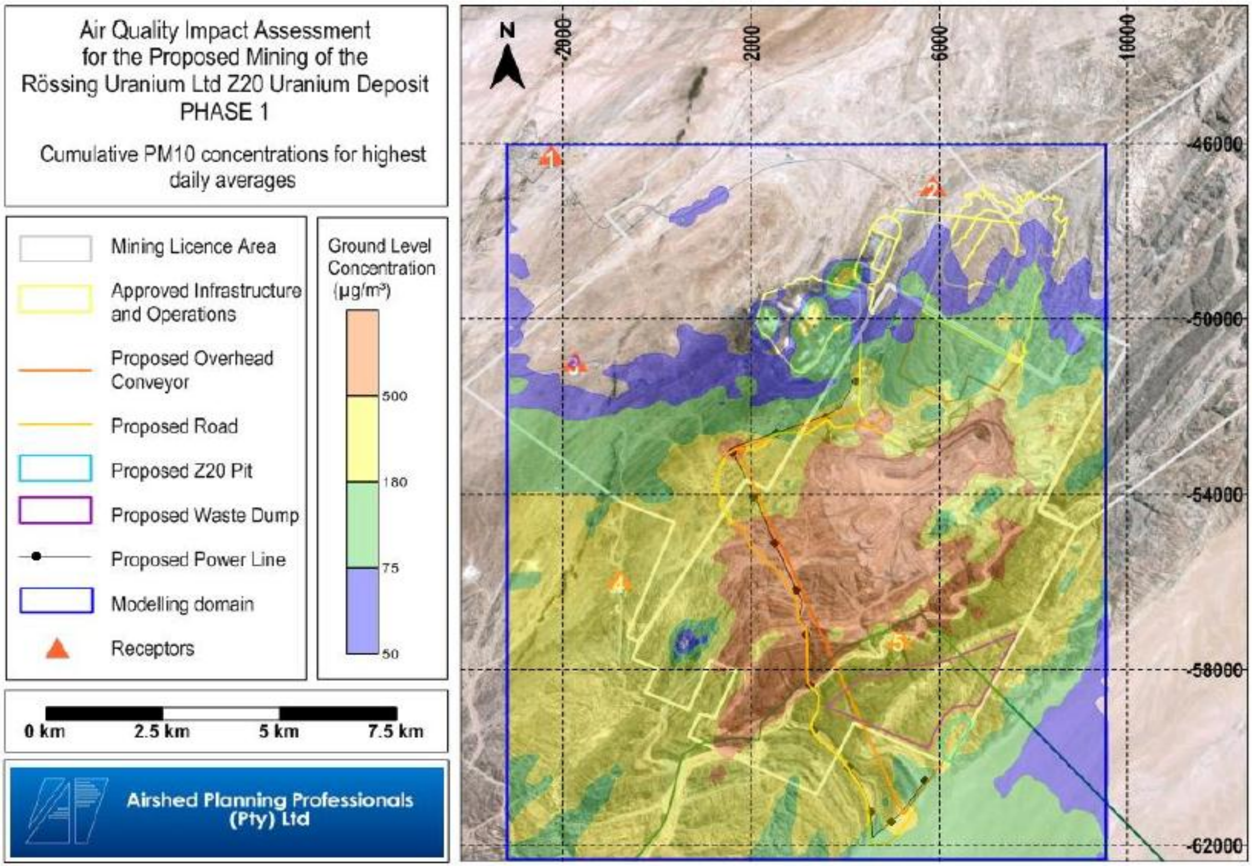

Figure 31: Unmitigated Highest daily PM10 ground level concentrations from all Rössing sources

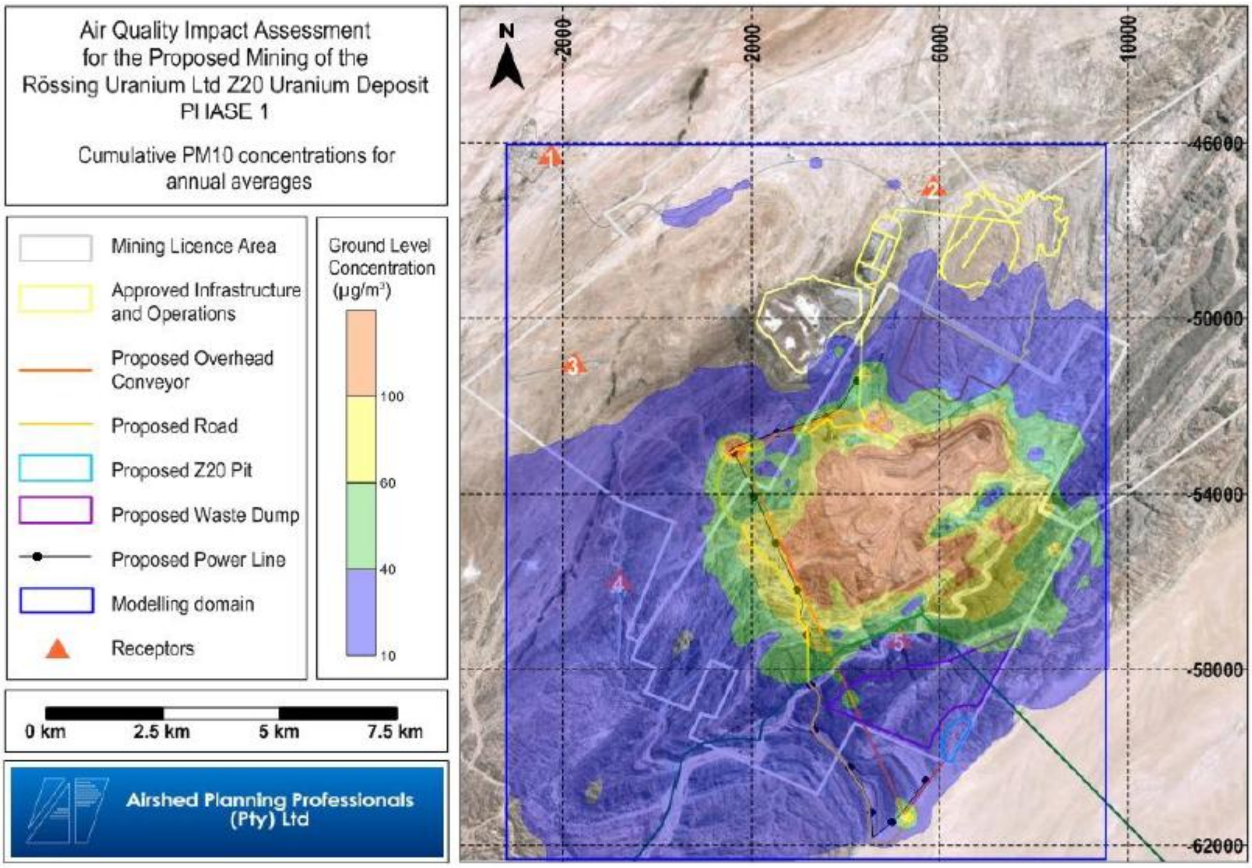

Figure 32: Mitigated Annual average PM10 ground level concentrations from all Rössing sources

Dust fallout can be high around the conveyor with no mitigation in place, exceeding the vegetation limit of 400mg/m²/day. With mitigation in place, the dust fallout rates decrease significantly to be well below the vegetation and residential limits.

Impacts from the decommissioning phase were assessed qualitatively. These impacts would depend on the extent of demolition activities, but are expected to be localised and cease once rehabilitation starts.

9.2.4 Mitigation measures

The air quality management plan provides options on the control of dust and gases at the main sources with the monitoring network designed as such to track the effectiveness of the mitigation measures.

Table 32: Air quality mitigation measures

Aspect	Mitigation measure	Phase
Ambient monitoring	• It is recommended that the proposed conveyor system be designed as per the RopCon description, ensuring a roof cover. It is further recommended that the transfer points be enclosed with an extraction system and bag filter attached. This will ensure more than 95% control efficiency in comparison to the 70% from enclosure only. • It is recommended that four single dust fallout buckets be installed along the conveyor system in order to monitor the impacts from this source. The buckets locations are indicated in the specialist study (Annexure C). • It is further recommended that a passive diffusive sampling campaign be conducted during the access road building phase to sample concentrations of SO_2 and VOCs.	Design phase
Land clearing activities such as bulldozing and scraping of road and blasting	• Water sprays at area to be cleared. • Moist topsoil will reduce the potential for dust generation when tipped onto stockpiles. • Ensure travel distance between clearing area and topsoil piles to be at a minimum.	Pre- and during construction
Road construction activities such as road grading and asphalt mixing and application	• Water sprays at area to be graded. • Freshly graded areas to be kept to a minimum. • Dust fallout bucket to be placed in the Khan River downwind of the bridge construction with monthly dust fallout rates not exceeding 400mg/m²/day(a) • Asphalt production and application to be monitored with passive diffusive tubes for SOx and VOCs	Pre- and during construction
Wind erosion from conveyor system	• Ensure RopeCon has sides of 200mm high and a roof covering the entire conveyor length. • Visual monthly inspections to ensure the conveyor are operational according to design specifications. • Dust fallout bucket to be placed downwind in the Khan River with monthly dust fallout rates not exceeding 400mg/m²/day	On-going during operational phase
Material transfer points	• Ensure all transfer points are enclosed with dust extraction system and fitted with a bag filter. • Visual monthly inspections to ensure no visual dust generation from the enclosed transfer points. • Dust fallout buckets to be placed downwind (south) of all	On-going during operational phase

	three transfer points with monthly dust fallout rates not exceeding 400mg/m²/day(a) at Transfer points 1 and 2 and 600mg/m²/day at final transfer point on-site.	

9.3 RADIATION

A radiological public dose impact assessment was undertaken to assess the environmental aspects and potential impacts of radioactive sources at the proposed infrastructure corridor on the surrounding public and other interests. The assessment relates mostly to the construction and operational phases of the infrastructure corridor.

The water pathway (i.e. surface water and groundwater) was not included as it was not expected to be a radiological concern. The reason being the following: deposited dust may fall out onto the dry Khan River bed and a fraction thereof may be transported in the event of rain or a flood. However, the dust would not become soluble and as a result settles out in the river sediments. The dust is therefore not present in the surface water, nor can it reach the ground water in this form. The complete public dose impact assessment is attached in Annexure C.

9.3.1 External exposure (direct radiation due to gamma rays) pathway

External exposure occurs when soil is contaminated either through the deposition of airborne radioactivity (in the form of dust) or through the irrigation of soil with contaminated water. In the case of deposited material, the activity is initially present as a thin cover layer.

9.3.1.1 Impact statement

The calculated incremental external exposure at each of the critical groups for the infrastructure corridor operations are summarised in Table 33. All the doses are trivial (i.e. below 10μSv.a-1) for both unmitigated and mitigated operations, with a maximum of 5μSv.a-1 at the Khan Mine during unmitigated operations.

Table 33: Calculated incremental dust deposition doses at each of the critical groups for the unmitigated and mitigated infrastructure corridor operations

Critical Group	Period Outdoors ($h.a^{-1}$)	Period Indoors ($h.a^{-1}$)	Dose (μSv/a)	
			Unmitigated	Mitigated
Arandis Town	4380	4380	< 1	< 1
E-Camp	2000	0	< 1	< 1
Arandis Airport	4380	4380	1	< 1
Khan Mine	4380	4380	5	< 1
Khan River	96	0	< 1	< 1
Husab Mine	2000	0	1	< 1

For the construction phase similar dust fallout rates as those derived for the unmitigated operational phase are expected. This implies that similar or lower doses than those mentioned in Table 33 are expected during the construction phase at the respective critical groups.

Isopleth plots depicting the incremental five unmitigated and mitigated dust deposition doses for an adult exposed for 4380 hours outdoors are presented in Figure 33 and Figure 34 respectively.

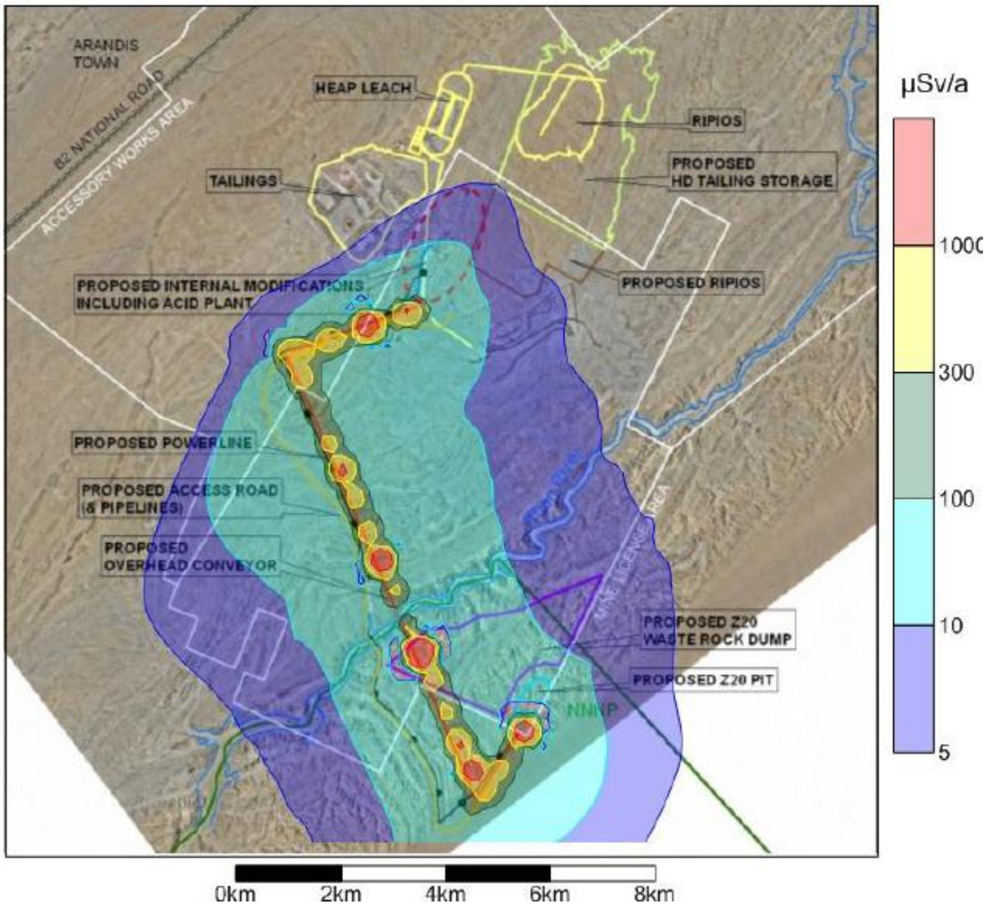

Figure 33: Unmitigated incremental external exposures (μSv/a) for an adult exposed for 4380 hours outdoors and 4380 hours indoors

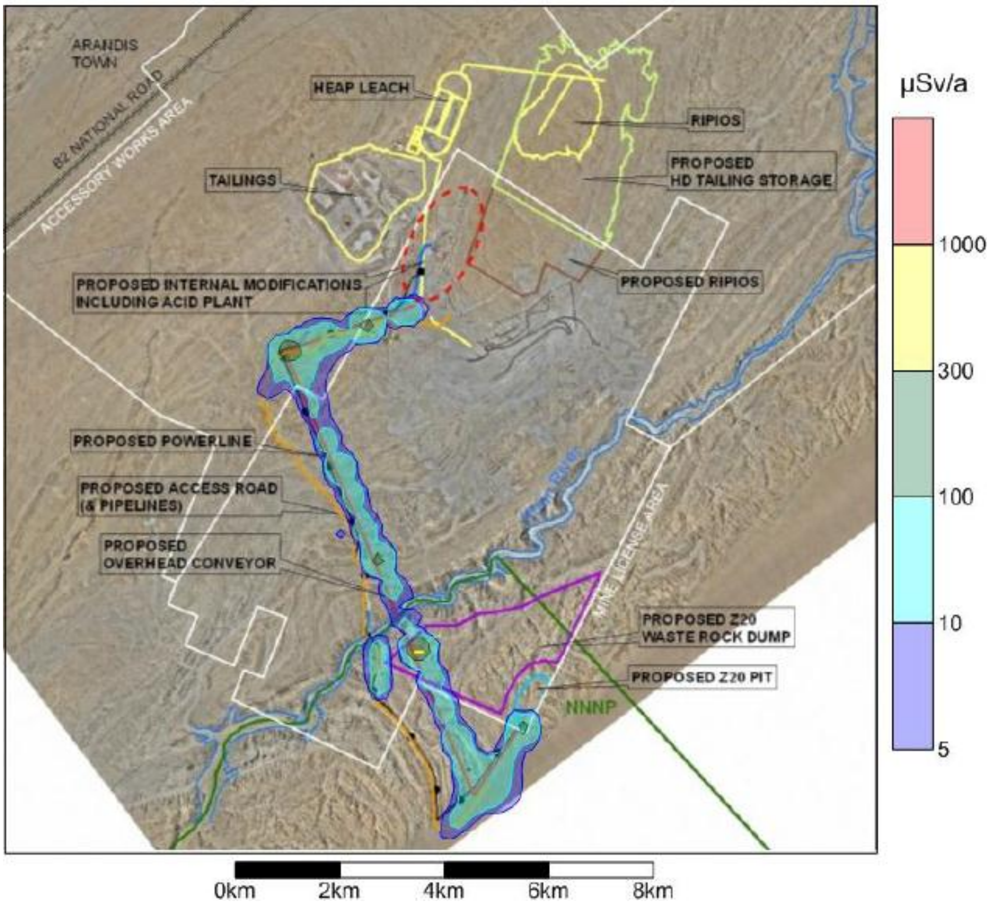

Figure 34: Mitigated incremental external exposures (μSv/a) for an adult exposed for 4380 hours outdoors and 4380 hours indoors

9.3.2 Dust inhalation

Dust from the infrastructure corridor operations can be inhaled and as a result people are exposed to the radioactivity within the dust.

9.3.2.1 Impact statement

The calculated incremental dust inhalation doses at each of the critical groups for the infrastructure corridor operations are summarised in Table 34. All the doses are trivial (i.e. below 10μSv/a) for both unmitigated and mitigated conditions.

Table 34: Calculated incremental dust inhalation doses at each of the critical groups for the unmitigated and mitigated infrastructure corridor operations

Critical Group	Period Outdoors ($h.a^{-1}$)	Period Indoors ($h.a^{-1}$)	Dose (μSv/a)	
			Unmitigated	Mitigated
Arandis Town	4380	4380	< 1	< 1
E-Camp	2000	0	< 1	< 1
Arandis Airport	4380	4380	< 1	< 1
Khan Mine	4380	4380	2	< 1
Khan River	96	0	< 1	< 1
Husab Mine	2000	0	< 1	< 1

For the construction phase similar dust concentrations as those derived for the unmitigated operational phase are expected. This implies that similar or lower doses than those mentioned in Table 34 are expected during the construction phase at the respective critical groups.

Isopleth plots depicting the incremental unmitigated-, incremental mitigated-, cumulative unmitigated- and cumulative mitigated dust inhalation doses for an adult exposed for 4380 hours outdoors and 4380 hours indoors are presented in Figure 35, Figure 36, Figure 37 and Figure 38 respectively.

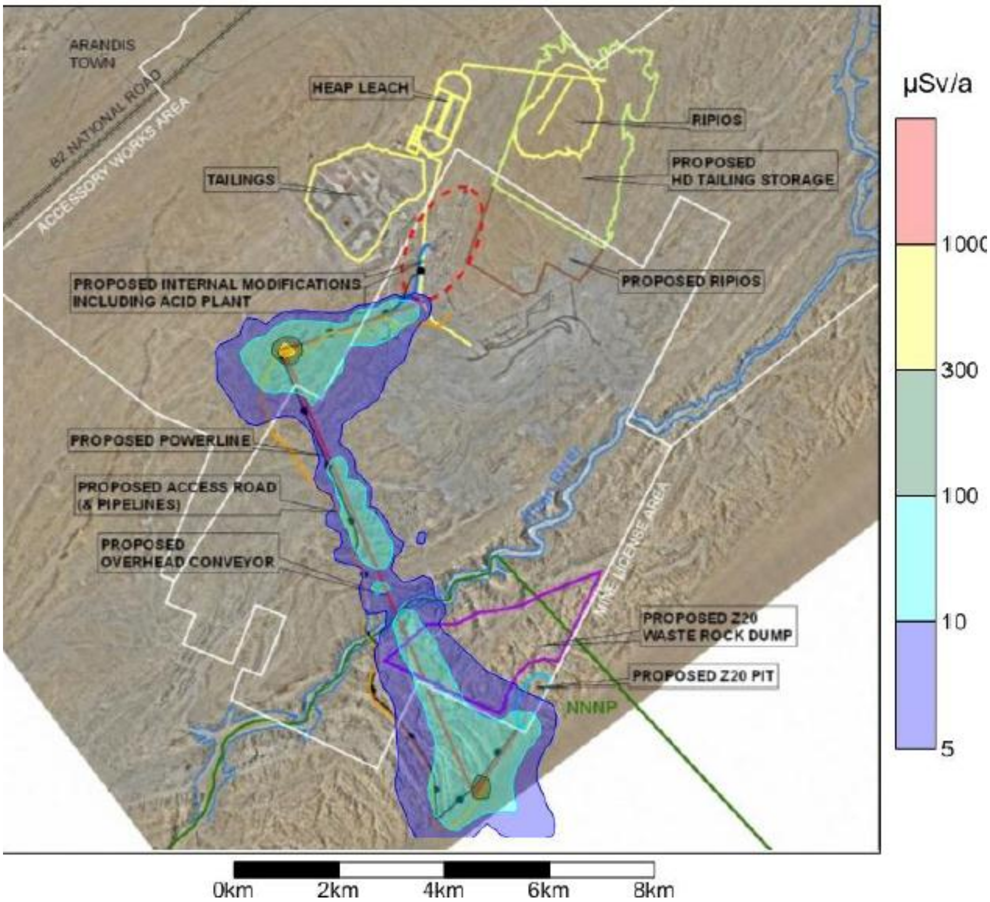

Figure 35: Unmitigated incremental doses (μSv/a) for dust inhalation for an adult exposed for 4380 hours outdoors and 4380 hours indoors

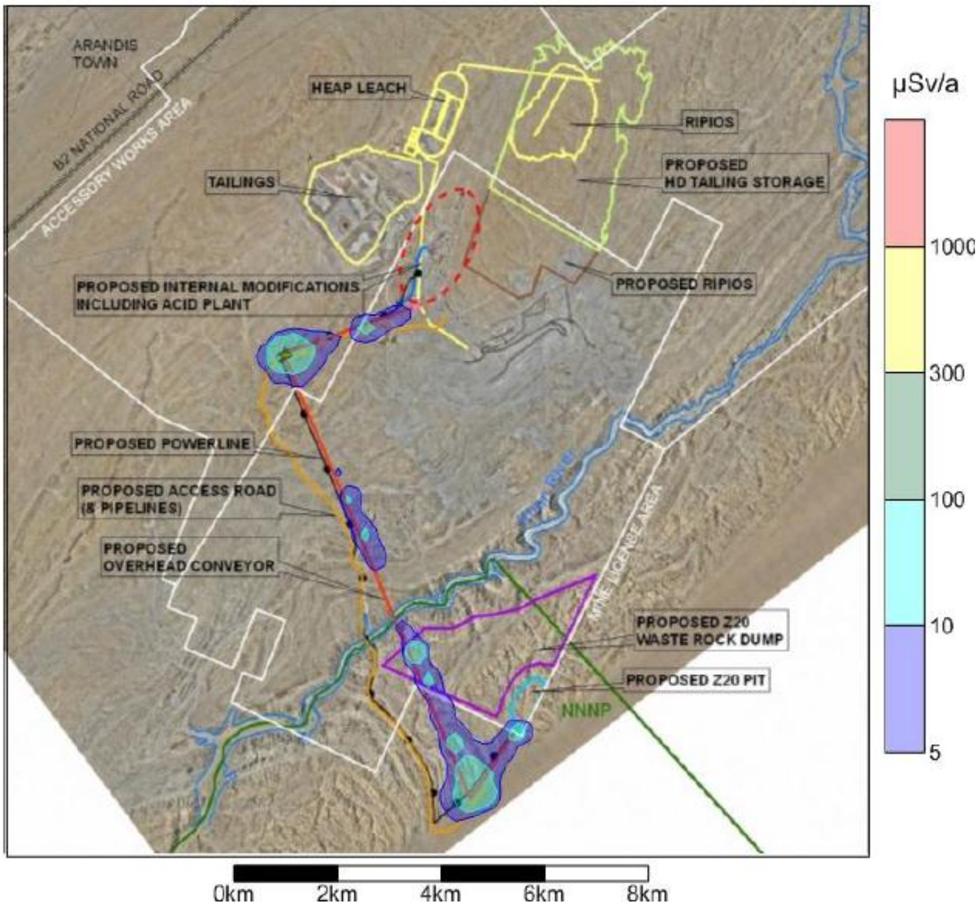

Figure 36: Mitigated incremental doses (μSv/a) for dust inhalation for an adult exposed for 4380 hours outdoors and 4380 hours indoors

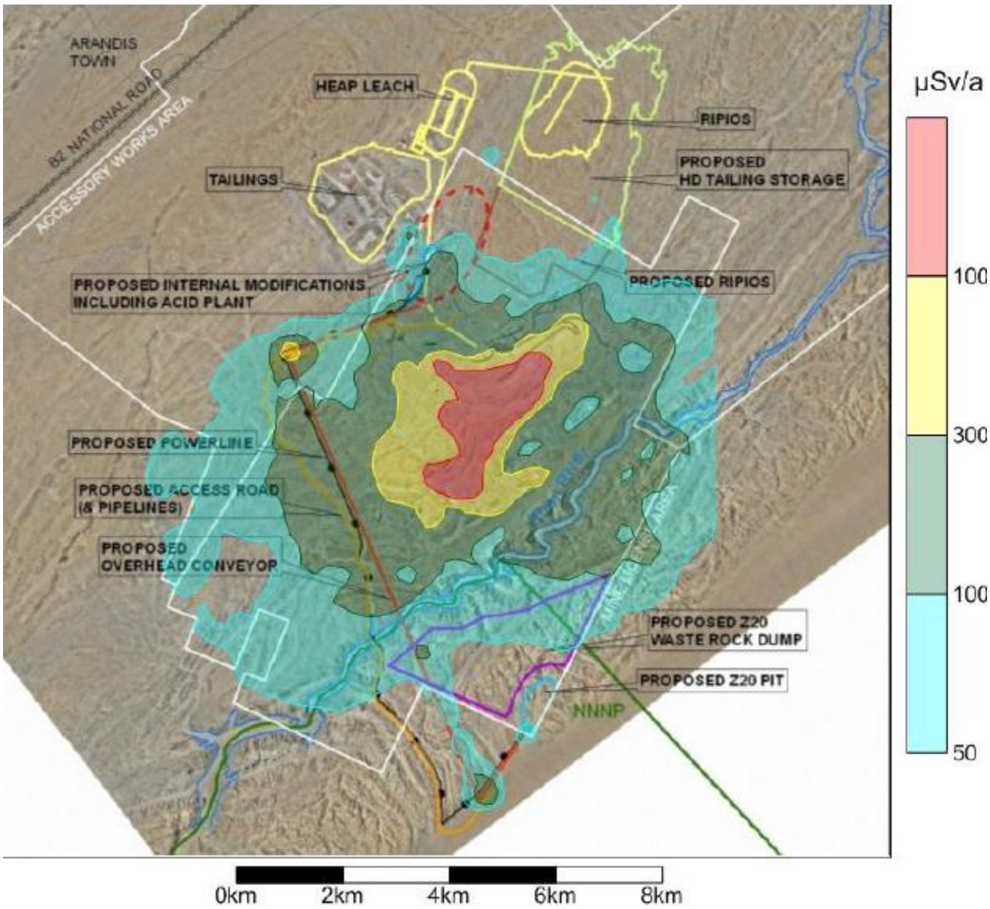

Figure 37: Unmitigated cumulative doses (μSv/a) for dust inhalation for an adult exposed for 4380 hours outdoors and 4380 hours indoors

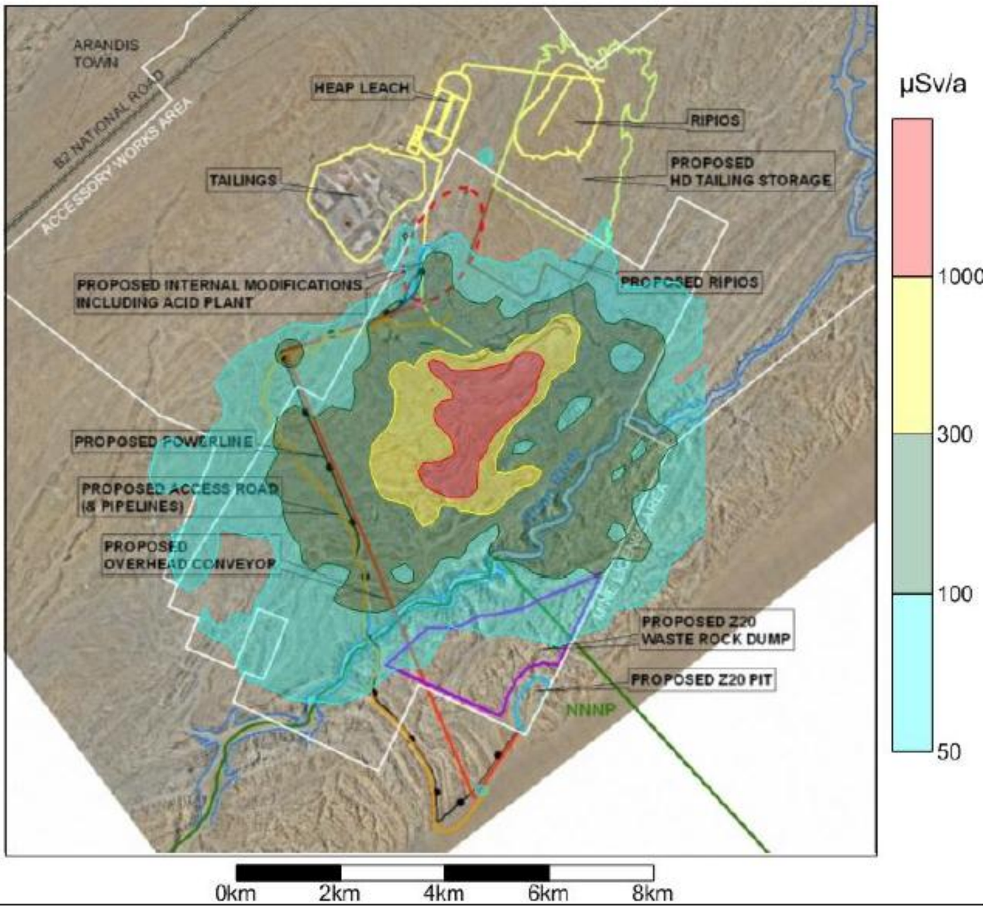

Figure 38: Mitigated cumulative doses (μSv/a) for dust inhalation for an adult exposed for 4380 hours outdoors and 4380 hours indoors

9.3.3 Radiation Doses from Radon Inhalation

9.3.3.1 Impact statement

The calculated incremental radon inhalation doses at each of the critical groups for the infrastructure corridor operations are summarised in Table 35. All the doses are trivial (i.e. below 10μSv/a) for both unmitigated and mitigated conditions.

Table 35: Calculated incremental radon inhalation doses at each of the critical groups for the unmitigated and mitigated infrastructure corridor operations

Critical Group	Period Outdoors ($h.a^{-1}$)	Period Indoors ($h.a^{-1}$)	Dose (μSv/a)	
			Unmitigated	Mitigated
Arandis Town	4380	4380	< 1	< 1
E-Camp	2000	0	< 1	< 1
Arandis Airport	4380	4380	< 1	< 1
Khan Mine	4380	4380	< 1	< 1
Khan River	96	0	< 1	< 1
Husab Mine	2000	0	< 1	< 1

Isopleth plots depicting the incremental unmitigated- and mitigated radon inhalation doses for an adult exposed for 4380 hours outdoors and 4380 hours indoors are presented in Figure 39 and Figure 40 respectively.

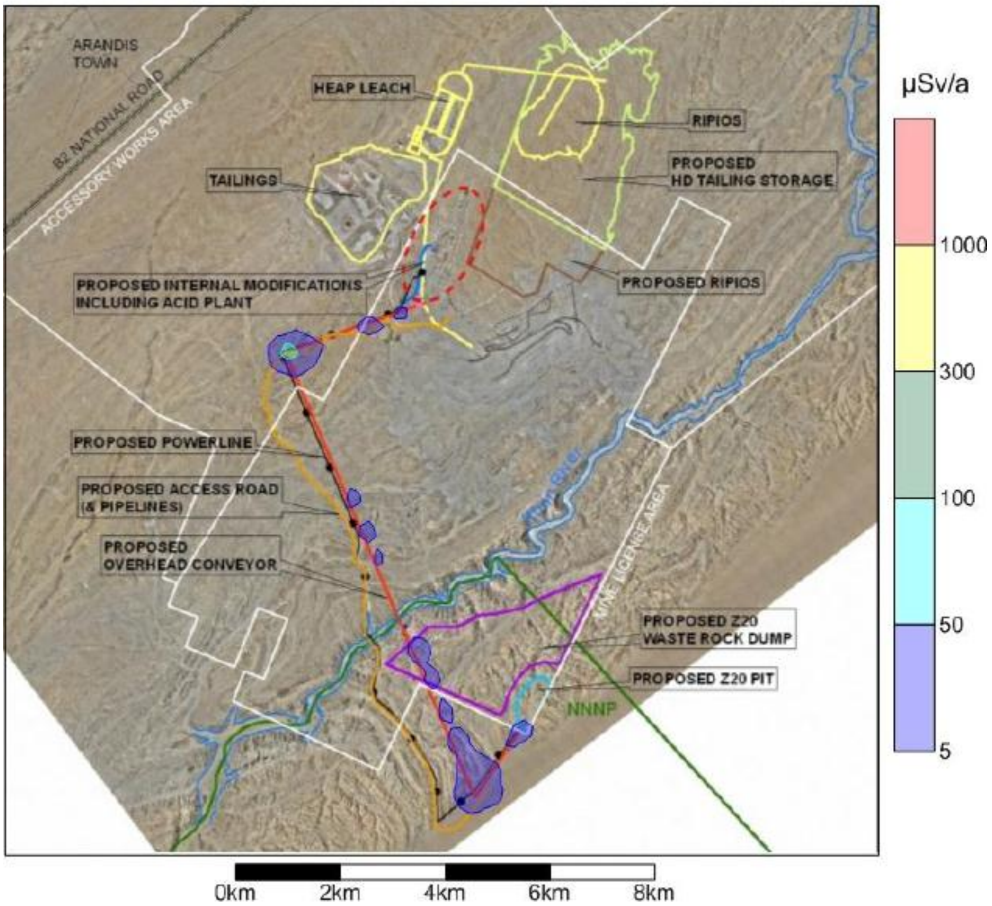

Figure 39: Unmitigated doses (μSv/a) for radon inhalation for an adult exposed for 4380 hours outdoors and 4380 hours indoors

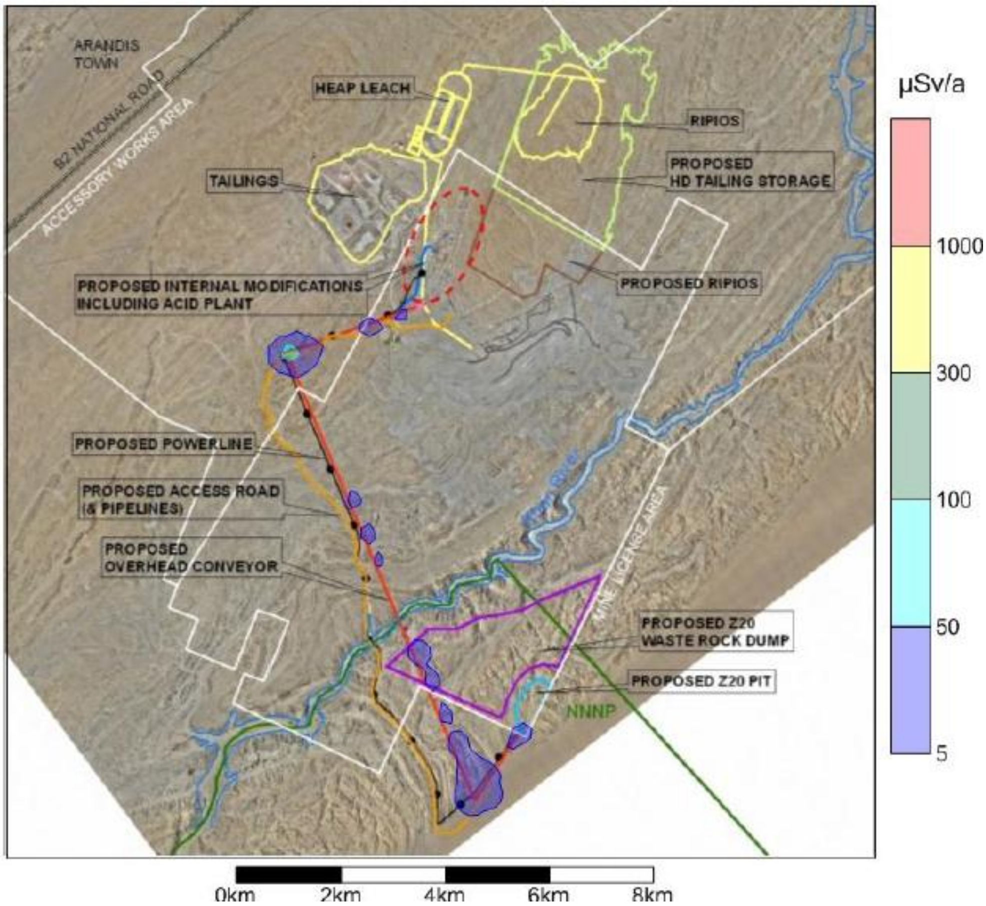

Figure 40: Mitigated doses (µSv/a) for radon inhalation for an adult exposed for 4380 hours outdoors and 4380 hours indoors

9.3.4 Overall radiation

9.3.4.1 Impact statement

The total doses (incremental and cumulative) to the critical groups in each Exposure Scenario due to external exposure, dust inhalation and radon inhalation are summarised in Table 36.

Table 36: Total calculated doses from the atmospheric pathways for different Exposure Scenarios

Critical Group	Period Outdoors ($h.a^{-1}$)	Period Indoors ($h.a^{-1}$)	Dose (µSv/a)					
			Baseline	Incremental		Cumulative		
				Unmitigated	Mitigated	Unmitigated	Mitigated	
Arandis Town	4380	4380	27	< 3	< 3	< 30	<30	
E-Camp	2000	0	11	< 3	< 3	< 14	< 14	
Arandis Airport	4380	4380	57	< 3	< 3	< 60	< 60	
Khan Mine	4380	4380	81	< 8	< 3	< 89	< 89	
Khan River	96	0	<3	< 3	< 3	< 6	< 6	
Husab Mine	2000	0	<8	< 3	< 3	< 11	< 11	

9.3.5 Dust inhalation, external exposure and radon inhalation

9.3.5.1 Impact statement

The SEIA impact significance of external exposure, dust inhalation and radon inhalation is Very Low (-) for both unmitigated and mitigated operations as indicated in Table 37.

Table 37: Impact assessment of dust inhalation, external exposure and radon inhalation during construction and operational

	Before Mitigation	After Mitigation
Extent	Regional	Regional
Magnitude	Very low	Very low
Duration	Long term	Long term
SIGNIFICANCE	Very low (-)	Very low (-)
Probability	Unlikely	Unlikely
Confidence	Certain	Certain
Reversibility	Irreversible	Irreversible

Mitigation options, as described by Liebenberg-Enslin (2012) will reduce the mentioned doses but not by an ample amount, thus the SEIA impact significance rating will not change.

9.3.6 Mitigation measures

Since the radiation impact is strongly related to the air quality, it is advised that the Air Quality Management Plan (Liebenberg-Enslin, 2012) be followed.

With the above-mentioned in mind, it should be noted that the Environmental Manager should ensure that during the rehabilitation activities the site is also restored to pre-mining conditions. This means that the dose from the rehabilitated site should not be significantly more than the background dose before mining commenced. Actions to accomplish this are explained by De Beer (see De Villiers, 2012).

No measures, except the application of "As Low As Reasonably Achievable" (ALARA) principles, are therefore recommended to safeguard the critical groups from dust deposition, dust inhalation or radon inhalation considering the proposed construction and operations of the infrastructure corridor.

9.4 BIODIVERSITY

With reference to Table 8 in Chapter 8, there are a number of activities/facilities in all project phases that have the potential to impact on the biodiversity in the area. A biodiversity impact assessment was undertaken by African Wilderness Restoration and Biodata Consultancy cc to assess these possible impacts of the proposed Z20 linear infrastructure corridor on the surrounding environment. The findings of this assessment are summarised below.

The complete biodiversity impact assessment is attached in Annexure C.

9.4.1 Impact of watercourse habitat loss due to road construction

9.4.1.1 Impact statement

The proposed road will replace natural habitat with an artificial surface, reducing the amount of available habitat. The disturbance of traffic and movement will extend the affected area beyond the actual road into a surrounding envelope of sub-optimally functioning habitat. Because this road will be additional to the developing access road for Husab Mine somewhat further west, it will have a cumulative effect. If both roads go ahead, much of this type of habitat (i.e. woody vegetation) in the area will be removed.

The watercourse habitat is important for its ecological support role. Most vegetation in the area is confined to watercourses. Vegetation is a source of food and shelter. The loss of relatively small areas of vegetation, even individual large trees like *Acacia erioloba*, can have a knock-on effect on the viability of animal populations in a wide surrounding area. Trees are also important as nesting sites for e.g. the threatened Lappet-faced vulture. The proposed road route goes straight over and through large trees. The growth of Namib *Acacia erioloba* is very slow, therefore the current trees in Panner Gorge will not regenerate on human timescales following decommissioning. The damage is likely to be permanent.

Given the impossibility of regenerating trees at sensible time scales and the absence of similar habitats elsewhere that could be conserved, no potential offsets are immediately apparent.

Of relevance here is also the Forest Act 12 of 2001 that prohibits the cutting, destruction or removal of vegetation within 100m of a watercourse, on any land which is not part of a surveyed erven in a local authority area, without a permit.

The impact commences during the construction phase, persists during operation, and persists post-decommissioning.

9.4.1.2 Impact rating

Table 38: Impact assessment of watercourse habitat loss due to road construction

	Before Mitigation	After Mitigation
Extent	Regional. The impact of vegetation loss will affect the surrounding areas as well. There are other Khan tributaries in the area with significant tree growth, but none as extensive as Panner Gorge.	Local.
Magnitude	High. Natural processes will be severely altered in that parts of the habitat will become unsuitable for taxa that currently depend on the presence of large woody vegetation for survival.	Low.
Duration	Long term, on a century scale as indicated above.	Long Term.
SIGNIFICANCE	High Negative	Low Negative. This assessment is based on the assumption that most large woody vegetation remains unaffected, but that

		it is not possible to avoid all damage.
Probability	Probable.	Probable.
Confidence	Sure.	Sure.
Reversibility	Irreversible, trees will not regenerate within 10 years.	

9.4.1.3 Mitigation

Adapt the routing of the road to miss all *Acacia erioloba* and to avoid as much other significant vegetation as possible. Based on a qualitative assessment (with reference to Table 32) of the amount of food and shelter provided to animals by particular tree species, their known or assumed regrowth rates and their relative abundance in Panner Gorge can be used to evaluate the comparative impact of alternative route alignments. In cases where the route cannot be aligned to avoid all large vegetation, trees towards the top of this list should be preferentially avoided.

Table 48: Tree value assessment for Panner Gorge watercourse habitat, with higher valued trees towards the top.

Tree	Food source	Shelter value	Regrowth rate	Abundance
Acacia erioloba	High	High	Very slow	Medium
Salvadora persica	High	High	Slow	Medium
Boscia foetida	High	High	Slow	Medium
Acacia reficiens	Medium	Medium	Medium	Medium
Parkinsonia africana	Low	Low	Medium	Low
Tamarix usneoides	Low	Low	Fast	Low

A study to assess the use of all tributary valleys by wildlife by means of a single survey counting spoor density and a monitoring plan to follow up at frequent intervals are further required.

9.4.1.4 Cumulative impacts

The only Khan tributary in the area with comparable, albeit much less, woody vegetation is the old railway route through which the Husab Mine access road is planned to be taken. If both roads go ahead, much of this type of habitat in the area will be removed.

9.4.2 Impact of road construction and operation on animal movement

9.4.2.1 Impact statement

The watercourses are widely used as corridors for movement and as grazing, browsing and hunting areas by a number of species such as Common Ostrich, oryx, springbok, possibly zebra and cheetah. Construction of a road here will significantly affect their ability to access resources, which is potentially exacerbated by the cumulative nature of this impact. The construction of a bridge over the Khan River will have unknown effects on the rate of movement along the river. Although it appears that the design prescribes a sufficient size bridge to allow even species such as kudu to move underneath it, it is not certain to what extent kudu will learn to adapt to move through what is effectively a broad tunnel (from their perspective). Limiting the ability to move freely is perhaps the most important long-term negative effect that roads can have on gene flow and local population dynamics.

The impact commences during the construction phase, persists during operation and may persist post-decommissioning.

9.4.2.2 Impact rating

Table 39: Impact assessment of road construction and operation on animal movement

	Before Mitigation	After Mitigation
Extent	Regional. The impact of movement limitation will affect other sub-populations as well and remove potential seasonal refugia for species moving from further inland.	Regional.
Magnitude	Medium. Natural processes may be altered for specific large animal species.	Low to Medium.
Duration	Medium term.	Medium Term.
SIGNIFICANCE	Medium Negative.	Low to Medium Negative. The potential for mitigation to decrease expected impacts on animal movement is unknown and the assessment of Low to Medium Negative (with mitigation) might even be Low or Very Low. This is dependent on adequately demonstrating the extent of use of the tributaries and the bridge underpass by animals, to put the impact into its proper regional context.
Probability	Probable.	Unlikely.
Confidence	Sure.	Sure.
Reversibility	Reversible.	Reversible.

9.4.2.3 Mitigation

Allow enough space below bridge and where bridge berm starts for easy animal access during design (avoid the creation of narrow traversing points). Bury water pipe for stretches along the route, to allow as many opportunities for unhindered animal movement as possible.
Monitor use of river and tributary corridors by large animals.

9.4.2.4 Cumulative impacts

The proposed road and pipeline will affect the ability of a number of large mammal species as well as the Common Ostrich to use the Khan River and its tributaries as movement corridors. Because this road will be additional to the developing access road for Husab Mine somewhat further west, it will have a cumulative effect. If both roads go ahead, the potential for obstruction of free movement is much higher than with only one road.

9.4.3 Impact of road construction and operation on Husab Sand Lizard

9.4.3.1 Impact statement

The movement by individual Husab sand lizards between sub-populations may be affected by the road on the south of the Khan, which will cut between two marble ridges, which is the presumed ideal habitat for this species in this area. The occurrence of the species on the ridges north of the

Khan has not been documented in detail yet, so it is uncertain to what extent the road here will be a barrier to movement between sub-populations.

Because this road will have an impact that is additional to those caused by the infrastructure of the developing Husab Mine, it will have a cumulative effect.

Population viability of the endemic, restricted range Husab Sand Lizard can be affected through a decline in gene flow among sub-populations. Given their short generation times, such an effect can theoretically occur very quickly.

The impact commences during the construction phase, persists during operation and may persist post-decommissioning.

9.4.3.2 Impact rating

Table 40: Impact assessment road construction and operation on Husab Sand Lizard

	Before Mitigation	After Mitigation
Extent	Regional. The impact of movement limitation will affect other sub-populations as well and remove potential seasonal refugia for species moving from further inland.	Local.
Magnitude	High negative.	Low.
Duration	Medium term.	Medium Term.
SIGNIFICANCE	High Negative	Low Negative. The potential for mitigation to decrease expected impacts is unknown. Overall too little is yet known about the biology and ecology of this species to be confident about the significance ratings of this potential impact.
Probability	Probable.	Unlikely.
Confidence	Unsure.	Unsure.
Reversibility	Reversible.	Reversible.

9.4.3.3 Mitigation

If road does affect movement of significant numbers of individuals, careful translocations of individuals among sub-populations, guided by a species management plan, could mitigate the effect of loss of gene flow.

Efforts by Gobabeb are currently underway to understand the biology and ecology of this species better. These studies should be supported materially and philosophically to extend the knowledge of their dynamics into areas that have not yet been studied, such as around the Rössing MLA.

Given the nature of the expected impact, no potential offsets are immediately apparent.

9.4.3.4 Cumulative impacts

Other projects may also affect the movement of individuals among sub-populations.

9.4.4 Impact of aquatic habitat loss due to road construction

9.4.4.1 Impact statement

There are three springs in the immediate vicinity of the proposed road route. The two springs south of the Khan River are located right under the proposed footprint of the road. The narrowness of the valley precludes realignment to avoid them, and the extensive filling proposed for this section will cover the habitats and render them non-functional.

Water points in the desert are essential resources that ensure the survival of many vertebrate species. They are rare and widely spaced to begin with as is. The removal of one or more will render a surrounding area less suitable or unsuitable as habitat for a variety of more or less water-dependent species. Apart from their resource value, water points are also aquatic habitats for a variety of drought, salinity and heat-tolerant invertebrates that are almost unstudied in Namibia, but can be expected to show high levels of range-restricted endemism due to specialization for an extreme habitat. It is not known how many other similar water points occur in the area, since the only way to locate them is on foot: none of these three are recognisable recognizable as such on available aerial imagery. One of the others that is known is located under the currently proposed footprint of the Z20 waste rock dump. The proposed road route therefore has the potential of destroying a significant proportion of the currently known natural springs in the area.

The loss of these particular (apparently perennial) springs may thus have a significant multiplicative negative impact on the ability of a range of water-dependent large mammals to persist in the area.

Of relevance here is also the Inland Fisheries Resources Act 1 of 2003 that applies to any freshwater body that is not situated on private property, and that requires Ministerial consultation prior to the erection or installation of any structure in a river or stream.

It is expected that other planned or already approved developments in the area will further block access to springs in other tributaries south of the Khan River as well. The removal of waterpoints will exacerbate the reduction of habitat viability caused by concomitant habitat loss, vegetation removal and habitat fragmentation.

It should be noted that the magnitude of this impact on large mammals and birds is essentially unknown because there is little data available on their use of springs in the region. It is therefore necessary to 1) establish the number and spatial distribution of water points; and 2) to quantify their use over time by different species. Such a study will help to quantify the risks posed by this impact to ecosystem integrity in the region.

Impact commences during construction, persists during operation and post-decommissioning as well.

9.4.4.2 Impact rating

Table 41: Impact assessment of aquatic habitat loss due to road construction

	Before Mitigation	After Mitigation
Extent	Regional. Given that the loss of a water point affects the fauna of a surrounding area beyond the 100 m limit for a local impact extent.	

Magnitude	High. The springs are expected to be severely altered, probably to cease functioning, after a road is built over them.	
Duration	Long term. Given the projected lifetime of the mine, the road will remain and the effect will persist longer than 10 years.	
SIGNIFICANCE	High Negative	High negative. Absence of viable mitigation measures.
Probability	Definite.	
Confidence	Sure.	
Reversibility	Potentially reversible by removal of road post-decommissioning, but in practice this will depend on the extent to which mining had altered the current geohydrological processes which give rise to the springs, or not.	

9.4.4.3 Mitigation

Given the narrowness of the valley, simple re-routing within the valley does not seem possible, nor do there seem to be obvious alternative springless valleys available.
Conduct a survey (study) to quantify the risks posed by this impact to ecosystem integrity in the region taking the following into consideration:

- Establish the number and spatial distribution of water points, and
- Quantify their use over time by different species.

Natural water points cannot be recreated once lost. The establishment of replacement artificial water points has been suggested. The excessive provision of water in previously waterless areas (which is usually what happens when artificial water is provided) may lead to local overexploitation of resources, defeating the planned objectives. In addition, the long term maintenance of such water points beyond decommissioning is problematic. Artificial provision of water should therefore be seen as a last resort.

9.4.4.4 Cumulative impacts

It is expected that other planned or already approved developments in the area will further block access to springs in other tributaries south of the Khan River as well. The removal of waterpoints will exacerbate the reduction of habitat viability caused by concomitant habitat loss, vegetation removal and habitat fragmentation.

It should be noted that the magnitude of this impact on large mammals and birds is essentially unknown because there is little data available on their use of springs in the region. It is therefore necessary to 1) establish the number and spatial distribution of water points, and 2) to quantify their use over time by different species. Such a study will help to quantify the risks posed by this impact to ecosystem integrity in the region.

9.4.5 Impact of Hillslope habitat loss due to conveyor construction

9.4.5.1 Impact statement

The conveyor system will cross the Hillslope habitat (animals) and Western Granite Hills, South-western Hills, Khan River Mountains and Khan Marble Ridges (vegetation habitats), all of which have been identified as either sensitive or very sensitive (the “critical” Khan River Mountains biotope) in their respective previous studies. The footprints of pylons represent direct physical loss of habitat. It is expected that an area surrounding the pylon as well as the area covered by access tracks will also be disturbed during construction. Where the conveyor runs close to the ground (far northern and southern sections), the constant movement might disturb more skittish animals and render the habitat unusable for them. Footprint effects are of particular concern in the Western Granite Hills area where populations of *Lithops ruschiorum* have been identified.

Most of the conveyor system is located in the Western Granite Hills and Khan River Mountains/Hillslope habitat that have all been identified as of particular biodiversity concern.

Impact commences during construction, persists during operation and, may partially disappear after decommissioning, depending on extent of rehabilitation possible.

9.4.5.2 Impact rating

Table 42: Impact assessment of conveyor construction on Hillslope habitat loss

	Before Mitigation	**After Mitigation**
Extent	Local. Expected to be confined to immediate vicinity of pylon footprints only.	Local.
Magnitude	Very low. Negligible ecosystem function alteration expected.	Very low.
Duration	Long term. Given the uncertain rehabilitation potential of rocky hillslopes.	Long term.
SIGNIFICANCE	Very low negative	Very low negative, since mitigation measures are already included in construction planning.
Probability	Definite.	Definite.
Confidence	Sure.	Sure.
Reversibility	Irreversible, again pending more study of the rehabilitation potential of rocky hillslopes.	

9.4.5.3 Mitigation

Use a helicopter for the transport of materials, equipment and personnel to pylon sites as suggested in planning, and do not build a construction access track along the conveyor route, as that would extend habitat loss far beyond the pylon footprints. For the same reason, use the conveyor's inspection gondola for maintenance activities as suggested and do not build a service track along the conveyor route.

Rehabilitate all disturbances around construction footprints.

9.4.6 Impact of conveyor and power line on bird populations due to bird collisions

9.4.6.1 Impact statement

Due to the placement of their eyes some bird species have a blind spot that renders them prone to collision with power lines, even in daytime. They die from impact, not electrocution. Night-migrating birds, like flamingo, do not see power lines in time to prevent collision, and the effect is multiplied because flocks fly head to tail and one collision tends to kill many birds.

It is possible that the RopeCon conveyor can have a similar effect, but it is unknown whether this will indeed be so. The larger profile size of the conveyor relative to a power cable might render it less of a collision risk, while the expected noise and movement might also help to alert birds to its presence, but whether this will indeed be so and be sufficient to prevent night collisions as well would need to be determined.

Collision risk is not expected to be the same along the entire route. Where the power line or conveyor runs parallel to bird movement corridors (like in Panner Gorge), the risk is lower than where they run across such corridors (like in the Khan valley). The Khan Valley is therefore considered the highest risk area, and should be the focus of mitigation efforts. Study will be needed to determine whether other sections also carry higher collision risk and need to be targeted by mitigation measures as well.

Some species that occur in the area, like Rüppell's Korhaan, Ludwig's Bustard and various large raptors, are known to be particularly collision-prone. In the case of Ludwig's Bustard, studies in South Africa have correlated population declines with power line collisions, leading to a change in its conservation status from previous Vulnerable to current Endangered in late 2011.

Impact commences during construction phase, persists during operational phase and disappears after decommissioning.

9.4.6.2 Impact rating

Table 43: Impact assessment of conveyor and power line on bird populations due to bird collisions

	Before Mitigation	After Mitigation
Extent	Regional. The potential exists for affecting birds from outside the area migrating through it. As an example, flamingos migrate between coastal feeding and inland breeding sites, like Etosha, Bushmanland or Makarikari. Their migration routes are largely unknown, because they fly at night, but there is reason to believe that birds leaving the Central Namib coast follow river valleys, like the Swakop or Khan, on their way inland.	Local.
Magnitude	Expected to be Low, but might change when results of suggested monitoring are available.	Very Low.
Duration	Long term. Will persist for as long as the infrastructure stands, presumed more than 10 years.	Short Term.
SIGNIFICANCE	Low Negative.	Very Low Negative.
Probability	Probable.	Probable.
Confidence	Sure. Collision prone species will certainly collide with the power line. What is uncertain is whether this will happen regularly enough to be significant, and whether there will be collisions with the conveyor as well.	Sure.
Reversibility	Potentially reversible by removing infrastructure at decommissioning.	

9.4.6.3 Mitigation

Implement bird collision avoidance mitigation measures at the Khan River crossing. The NamPower/NNF Strategic Partnership is studying the effectiveness of different mitigation methods in Namibia, and it would be premature to suggest a specific measure at this time. Rössing Uranium should liaise with them as part of the detail design stage.

Following construction, monitor both power line and conveyor for bird strikes for the first two years of operation and then re-address mitigation in the light of real data, as needed.

9.4.6.4 Cumulative impacts

There are already many power lines in place intraversing the Central Namib, and more will be added if a power station is built at Arandis as planned. However, because the powerline in this case is relatively small, and the conveyor system is probably fairly visible to most birds, it is expected that the incremental effect of the current project will be minor.

9.4.7 Impact of road operation on susceptible vertebrate populations due to road kills

9.4.7.1 Impact statement

Some animals in the area are prone to vehicle collisions, particularly at night. This might be due to instinctive threat-avoidance behaviour that works for predators but is fatal when practiced against a vehicle (bat-eared foxes, Cape foxes, aardwolf), headlight-blinding that renders usual escape flight ineffective (owls, other night birds) or movement that is too slow to avoid vehicles (Namaqua Chameleon).

Over time, and because of the linear shape (and thus extensive nature) of roads, repeated road kills can drain populations of collision prone animals. If they occur in low numbers to begin with, the relative effects are exacerbated. Occasionally, when the collision is with a large animal (e.g. gemsbok) there is a possibility of property damage and human fatalities. Again, because this road will be additional to other planned or existing roads, an incremental additive or multiplicative effect could result.

Impact commences during construction, persists during operation and disappears after decommissioning.

9.4.7.2 Impact rating

Table 44: Impact assessment of road operation on susceptible vertebrate populations due to road kills

	Before Mitigation	**After Mitigation**
Extent	Regional. Populations are affected.	Local.
Magnitude	Low Slight alteration of natural processes expected.	Very low.
Duration	Long term. Assuming road in operation for more than 10 years.	Short term.
SIGNIFICANCE	Low Negative.	After, assuming speed limit is effective in reducing road kills

		to zero, impact becomes Neutral.
Probability	Definite.	Definite.
Confidence	Certain.	Certain.
Reversibility	Potentially reversible following decommissioning, assuming viable ecosystem functionality otherwise.	

9.4.7.3 Mitigation

Enforce a speed limit on the road. The planned 60km/h limit is good for daytime. Suggest monitoring to determine whether a different night-time limit is needed.

Monitor road kills to determine effectiveness of speed limit and determine whether a different night-time limit is required.

9.4.7.4 Cumulative impacts

Besides existing roads in the area (B2, Rössing access road, Valencia access road), the Husab Mine access road and the Arandis power station access road are also planned.

9.4.8 Impact of cumulative habitat loss on Khan Hillslope habitat range-restricted endemics

9.4.8.1 Impact statement

Parts of the conveyor route both south and north of the Khan River, and the road and power line mainly south of the Khan River, cross over the Hillslope habitat.

The Hillslope habitat was identified as of particular biodiversity importance in the Rössing Expansion SEIA, with many poorly known, range-restricted and / or Threatened species. The habitat is trophically poorly endowed, resulting in low population densities and hence high vulnerability to habitat disruption. Even small habitat losses have the potential of negatively impacting on vulnerable species.

Examples of range-restricted Hills and Mountains habitat endemics include the Husab Sand Lizard, *Pedioplanis husabensis*, and the spider *Moggridgea eremicola*.

The impact commences during construction, increases during operation, and persists after decommissioning.

9.4.8.2 Impact rating

Table 45: Impact assessment of cumulative habitat loss on Khan Hillslope habitat range-restricted endemics

	Before Mitigation	After Mitigation
Extent	National. The potential exists to negatively impact endemic Namibian species.	National.
Magnitude	Low. The footprint on the actual habitat will be relatively small – the largest footprint south of the Khan,	Low.

	the road, is located more in a watercourse and only partly in the Hills and Mountains habitat.	
Duration	Medium term, because of the relatively small footprint.	Medium term.
SIGNIFICANCE	Medium negative	Medium negative
Probability	Probable.	Probable.
Confidence	Sure.	Sure.
Reversibility	Irreversible. The complexities of hillslope habitats cannot be recreated artificially.	

9.4.8.3 Mitigation

Maintain the small footprint and do not plan additional infrastructure in this habitat.

9.4.8.4 Cumulative impacts

In addition to the current infrastructure corridor, the existing Rössing Mine, the planned Z20 mine and the planned Husab Mine infrastructure corridor already impact on this habitat, or will impact on it in future.

9.4.9 Impact of project on integrity of Namib Naukluft National Park

9.4.9.1 Impact statement

The section of the proposed infrastructure corridor south of the Khan River is located within the NNNP.

Under the Nature Conservation Ordinance, Article 14, the purpose of a protected area is stated to be for the '*propagation, protection, study and propagation therein of the wild animal life, fisheries, wild plant life and object of geological, ethnological, archaeological, historical and other scientific interest and for the benefit and enjoyment of the inhabitants of Namibia and other persons.*' The erection of mining infrastructure is incompatible with the reason for proclamation and intended land use of the NNNP, and runs contrary to the internationally accepted purpose of a National Park.

The NNNP is already the focus of other mining activities, ranging from exploration to operational mining. The cumulative impacts in the NNNP will therefore increase with the implementation of the proposed infrastructure placement in the park.

The impact commences during construction, and persists during operation. Some impacts may disappear after decommissioning if infrastructure is removed (e.g. power lines), but those involving landscape modification (e.g. habitat lost due to cutting and filling for the road) may persist indefinitely.

9.4.9.2 Impact rating

Table 46: Impact assessment of project on integrity of NNNP

	Before Mitigation	After Mitigation
Extent	National. This is due to its impact on a National Park, intended to be	

	preserved for the benefit of all Namibians.	
Magnitude	High. In that part of the corridor within the National Park, natural processes are expected to be severely altered because of habitat loss, compounded by the loss of a water points.	
Duration	Long term, permanent. While some infrastructure could be removed following decommissioning, lost habitat is unlikely to be regained.	
SIGNIFICANCE	High negative.	High negative. Absence of viable mitigation measures.
Probability	Definite. The proposed development is in a National Park.	
Confidence	Certain. The proposed development is in a National Park.	
Reversibility	Irreversible. In some cases, habitat loss will be permanent.	

9.4.9.3 Mitigation

No mitigation possible.

9.4.9.4 Cumulative impacts

The NNNP is already the focus of other mining activities, ranging from exploration to operational. From a developer's viewpoint this is often considered as a validation that the erection of additional infrastructure would be justified, reasoning that if it was allowed before it cannot be disallowed subsequently. From an environmentalist's viewpoint, the existence of prior infrastructure developments, against the background of cumulative impacts, rather argues against allowing additional infrastructure placement in the Park.

9.4.10 Further (generic) mitigation measures

- In accordance with principles as defined in the SEA, coordinate management of specifically potential cumulative impacts with other developing projects to prevent a fragmented management effect.
- Decrease area disturbed through consistent application of environmental management principles in design and careful management of construction teams.
- As far as possible, use only existing tracks for construction and maintenance of infrastructure.
- Control of unnecessary collateral damage due to vehicle activity, particularly during construction will largely dictate the extent of the damage caused.
- Sand and other material for building, topping and compaction should not be sourced from the Khan River.

- Populations and individuals of all protected plants along the route of all linear infrastructure should be identified, marked and studiously avoided as a matter of design principle as well as during construction.
- A permit to remove and/or damage protected plants should be obtained, as should a collecting permit for plant rescue.
- Rehabilitation:
  - All disturbances associated with the construction of the road, power and water lines have to be rehabilitated. Should infrastructure be decommissioned in the future, their footprint areas have to be rehabilitated. Rehabilitation should aim to reinstate a state that is consistent with the main land-use and considering the general principle of ecological sustainability.
  - Rehabilitation should only be conducted within the limits of a properly developed restoration/rehabilitation plan. Such a plan will contain clear objectives, a strategy, a work plan, a monitoring plan and management response guidelines.
  - Construction of all linear infrastructure types will result in disturbance of soil along the line of the route, which for the power and pipelines will be concentrated in areas where the pylons or plinths were erected. For the roads, physical disturbance will be found along the length of the road, as well as where borrow pits are located.
  - Rehabilitation aims should focus on the repair of pre-existing or installation of an analogue topography (meaning that soil heaps must be levelled and raked to smooth over the surface, rocky areas should be re-built).
  - Ensure that water flow is not impeded and that natural flows are re-instated.
  - Assist colonisation of rehabilitation areas. For example, should there be quartz rocks around, seed the rehabilitation area with some of these (they typically contain cyanobacteria, part of the biological soil crust), making sure that the colonised parts of the rocks are placed face down onto the ground.
  - In cases where plants were rescued before construction, reintroduce these under the guidance of a properly qualified horticulturalist.
  - Monitor success of rehabilitation as part of a rehabilitation/restoration plan and instigate management response procedures where appropriate.

9.5 ARCHAEOLOGY

With reference to Table 8 in Chapter 8, there are a number of construction related activities that have the potential to impact on the archaeology in the area. An archaeological impact assessment was undertaken by Quaternary Research Services to assess these possible impacts of the proposed Z20 linear infrastructure corridor on the archaeological resources in the area. The findings of this assessment is summarised in this section.

The complete biodiversity impact assessment is attached in Annexure C.

9.5.1 Disturbance and/or destruction of sensitive archaeological sites

9.5.1.1 Impact statement

The specialist study identified various archaeological sites in close proximity to the proposed overland conveyor system.

A small number of important Pleistocene archaeological sites that are located in a relatively undisturbed physical setting may be affected. The most significant site (a chert quarry and workshop) is showing evidence of late Pleistocene occupation. The site has been documented in considerable detail but it is considered to have a high potential for further research. The site and its local setting are also considered to have some potential for specialized visitor access, and possibly for training of archaeology students. A number of small and relatively insignificant sites may be affected on the southern side of the Khan River.

However, there will be little direct impact from the aerial ropeway other than the footings of the support pylons. The ropeway will have a negative effect on the visual integrity of the area, but it will be removed when the mining operation ceases and is therefore reversible. The other components of the infrastructure corridor will be confined to the Panner Gorge on the northern side of the Khan valley, and the area of possible encroachment on the archaeological sites is easily defined and managed.

The potential impacts are applicable to the construction and decommissioning phases.

9.5.1.2 Impact rating

Table 47: Impact assessment of disturbance and/or destruction of sensitive archaeological sites

	Before Mitigation	**After Mitigation**
Extent	Local.	Local.
Magnitude	High. With reference to the Pleistocene sites.	Medium.
Duration	Long Term.	Long Term.
SIGNIFICANCE	High Negative.	Medium Negative. In the case of the relatively insignificant sites (i.e all except the four Pleistocene sites) the impact rating of the sites could be reduced adopting appropriate mitigation measures such as more detailed site documentation, systematic surface collection and photographic documentation. In the case of the significant sites appropriate mitigation could reduce the impact rating although this would be more detailed, and would probably involve limited excavation.
Probability	Probable.	Probable.
Confidence	Sure.	Sure.
Reversibility	Irreversible.	Irreversible.

The above mentioned environmental assessment methodology is a useful means to outlining a general assessment of impact for the project as a whole, however, it is of limited use as a method of archaeological impact assessment. The archaeological assessment identifies specific sites as having high value and attaches specific vulnerability ratings. This provides a more directed and precise method for identifying possible management actions.

Therefore, considered in terms of the protocol developed for archaeological assessment in Namibia, the sites that would be affected by the proposed development have a low (1) to medium/high (3+) significance, with only the “chert quarry and workshop” considered as a 4 to 5 significance rating. The initial assessment of vulnerability of these sites (before the present development scenario emerged) was uniformly low. However, these are all elevated to a medium/high 3 to 4 in anticipation of the proposed project.

9.5.1.3 Mitigation

Mitigation with a view to possible destruction of the site in the course of infrastructure development will require approval from the National Heritage Council.

The project planning process should prioritize final definition of the infrastructure corridor so that the sites that are likely to be affected can be identified with certainty. Once this is done, the corridor to be developed should be clearly marked on the ground, and contractors informed of their responsibilities under the heritage legislation. Mitigation work should be scheduled as early as possible in the development programme.

9.6 NOISE IMPACTS

A noise impact assessment was undertaken to assess the environmental aspects and potential impacts of the proposed Z20 linear infrastructure corridor. Please refer to Annexure C for the complete noise impact assessment undertaken by Airshed Planning Professionals.

9.6.1 Construction phase

The extent and character of construction noise will be highly variable as different activities with different equipment will take place at different times, over different periods, in different combinations, in different sequences and on different parts of the construction site. As a conservative measure, noise levels as a result of all construction operations were assumed to occur at one location simultaneously.

It is understood that construction activities will be limited to day-time hours.

9.6.1.1 Impact statement

Noise pollution will be generated by the following activities during the construction phase of the project:

- Blasting activities;
- Land clearing and bulk earthworks activities (using large mobile equipment); and
- Helicopter operations.

The above mentioned impacts could be perceived as a nuisance to local residents and tourists due to increased noise.

9.6.1.2 Discussion

Blasting

Air overpressure from blasting is measured at frequencies between 2Hz and 250Hz on a linear decibel scale (dBL) (as opposed to community noise, which is measured on a weighted decibel scale). Factors that influence airblast levels include, amongst others, the charge mass, distance from the blast, topographic shielding, blast hole diameter to overburden ratio and meteorological parameters.

Project specific blast information was not available at the time of this SEIA and was therefore not quantified.

Earthworks and Diesel Mobile Equipment

The noise created by diesel mobile equipment was calculated using the sound power level predictive equations for industrial machinery (Crocker, 1998).

Helicopter Noise

A helicopter will be used for civil works and RopeCon erection during the construction phase. The helicopter will perform approximately 1,400 cycles of 3 to 4 minutes in duration during the construction phase. The type of helicopter that will be used is not known at present. The range of noise level is, however, likely to range from that of a Bell 206/Jet ranger to that of a Chinook. The maximum A-weighted sound pressure levels (LAmax) at a distance of 152m range between 75dBA (small single turbine helicopter i.e. Bell 206/Jet ranger) and 89dBA (large twin rotor helicopter i.e. Chinook) (Nelson, 1987).

For this assessment an average LAmax level of 81dBA at 152m was used.

Noise Propagation Modelling and Predicted Noise Levels

The propagation of noise from the construction of the infrastructure corridor was calculated in accordance with *'The calculation of sound propagation by the Concave method'* (SANS 10357, 2004) and SANS 10210. Meteorological and site specific acoustic parameters, along with source data were applied. The propagation of noise was calculated over a downwind distance of 5km at a resolution of 100m.

Total day and night-time noise levels (LAeq(1 hour)) and the increase in environmental day and night-time noise levels, when compared to existing baseline noise levels over the plains and within the Khan River valley, were calculated to facilitate comparison with IFC guidelines.

The calculated maximum cumulative day-time noise levels and the expected increase in day-time noise levels (over the 45dBA baseline level over the plains and 30dBA within the Khan River valley) is provided in the Figures below.

The extent of construction noise impacts are mostly as a result of the use of the helicopter for the transport of materials and erection of the RopeCon/Railcon system. When the helicopter is not in use the area of exceedance of the IFC day-time 55dBA will range between 500m and 600m. The 3dBA increase will be between 1.1km and 3.2km. The closest communities are located at distances of more than 3km away from construction areas. According to the models the day-time noise impacts at these receptors are considered improbable. Within the Khan River valley, however, the construction activities will be audible over long distances down the valley and may result in strong reaction from visitors to the valley, especially during helicopter operational times.

Cumulatively noise levels, as a result of all construction activities in close proximity to each other, may exceed the IFC guideline of 55dBA up to 1.1km and will result in a 3dBA increase over the baseline day-time level of 45dBA up to 1.9km from construction areas over the plains. Within the Khan River valley, cumulative noise levels may exceed the IFC guideline of 55dBA up to 900m and will result in a 3dBA increase over the baseline day-time level of 30dBA over 5km.

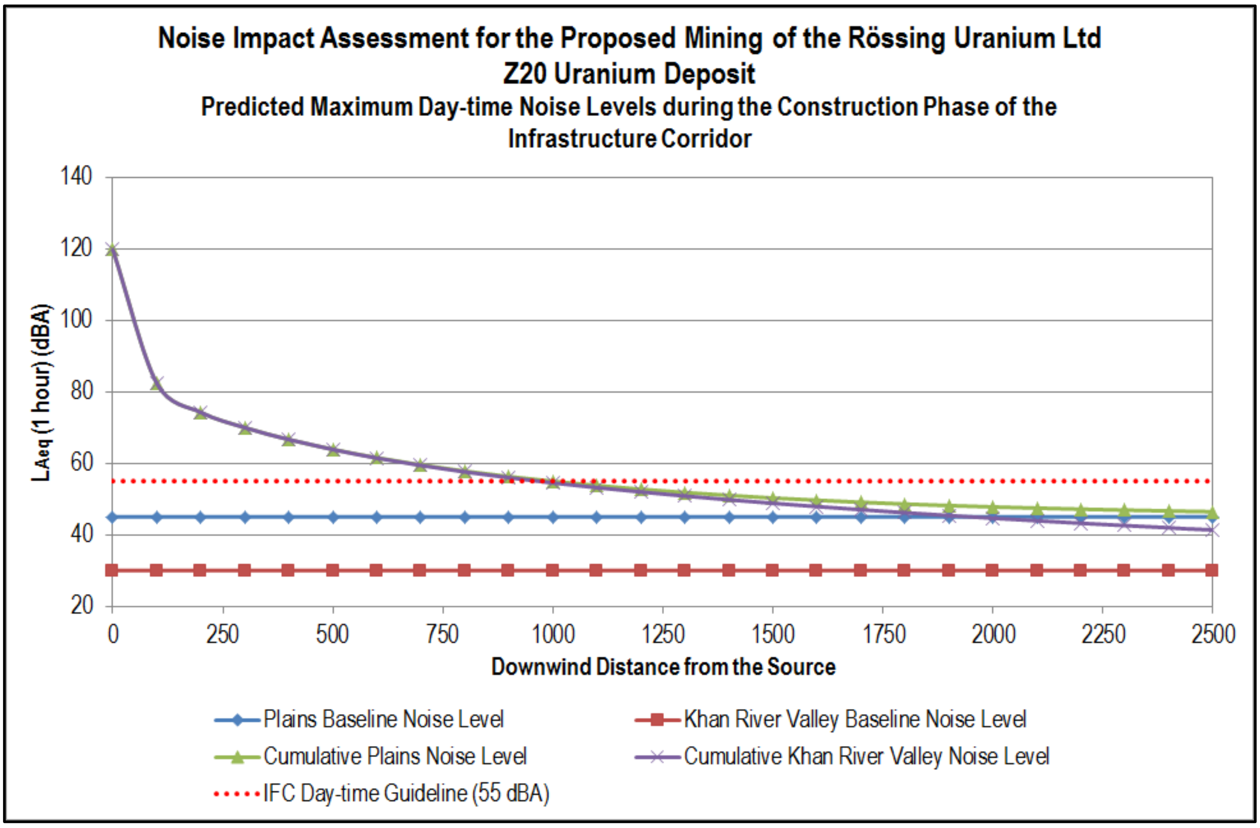

Figure 41: Predicted maximum day-time noise levels

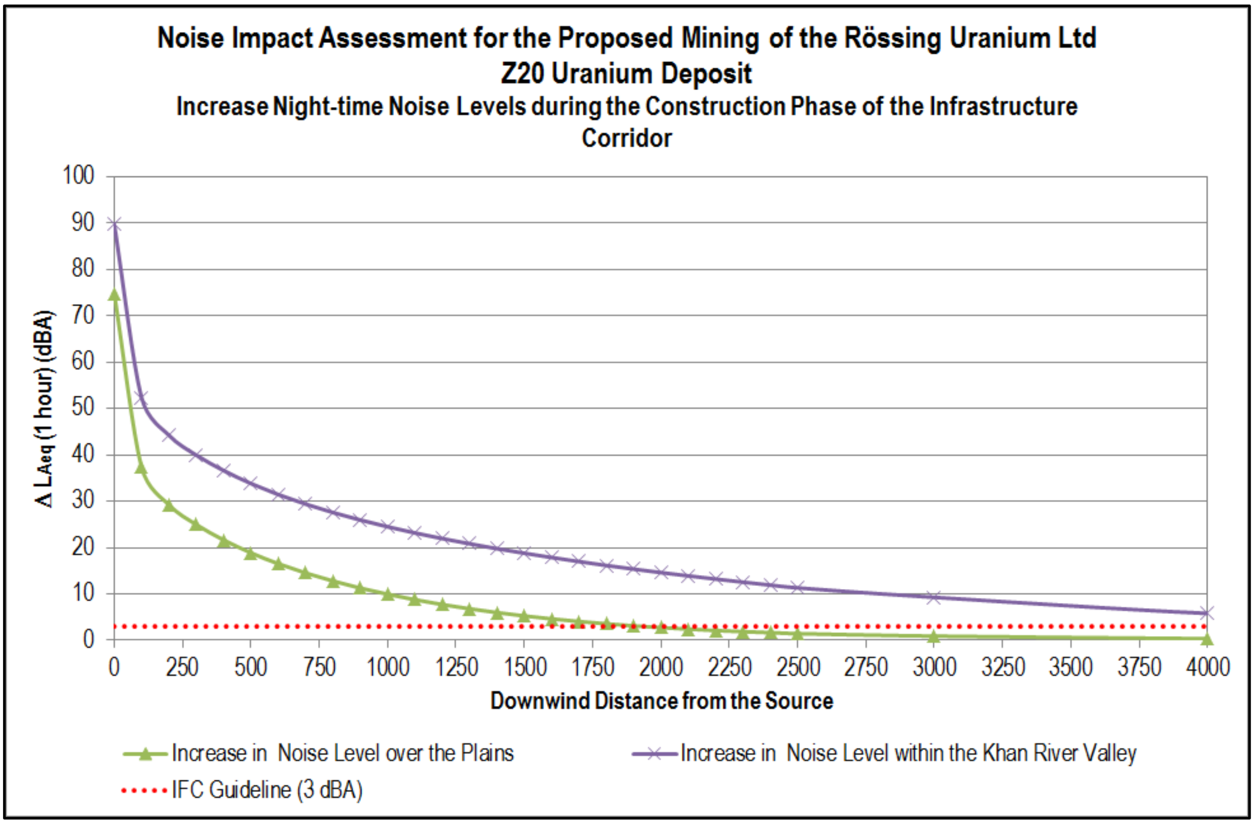

Figure 42: Predicted increase in day-time noise levels

9.6.1.3 Impact rating

The noise impact assessment methodology provides for the assessment of cumulative impacts. As a conservative measure, the significance of noise impacts is assessed based on the predicted increase in noise level above the reported baseline noise level. The IFC guideline of a 3dBA increase is used as the impact indicator since it presents the level at which a person with average hearing acuity will not detect a change in ambient noise levels.

Environmental noise is assessed from an *annoyance perspective* and not a *health impact perspective* since levels and exposure times are generally not enough to cause hearing loss or health effects.

Noise impacts were assessed separately for impacts over the plains and within the Khan River valley where baseline noise levels are very low.

The extent of construction noise impacts are mostly as a result of the use of the helicopter for the transport of materials and erection of the RopeCon/Railcon system.

Table 48: Day time ccumulative noise impact significance at noise sensitive receptors located on the plains as a result of the infrastructure corridor

	Pre Mitigation	**Post Mitigation**
Extent	Local (On- or near site, not at any noise sensitive receptors)	Local (On- or near site, not at any noise sensitive receptors)
Magnitude	Very Low (Less than 3dBA increase in environmental noise level at the nearest noise sensitive receptor)	Very Low (Less than 3dBA increase in environmental noise level at the nearest noise sensitive receptor)
Duration	Short Term (Up to 3 years)	Short Term (Up to 3 years)
SIGNIFICANCE	Very Low (-)	Very Low (-)
Probability	Probable (Considered the appropriate probability rating for predicted noise impacts)	Probable (Considered the appropriate probability rating for predicted noise impacts)
Confidence	Unsure (Considered the appropriate confidence rating for predicted construction phase noise impacts)	Unsure (Considered the appropriate confidence rating for predicted construction phase noise impacts)
Reversibility	Reversible (The impact is reversible, within a period of 10 years)	Reversible (The impact is reversible, within a period of 10 years)

Table 49: Summary of construction phase impact assessment within the Khan River valley

	Pre Mitigation	**Post Mitigation**
Extent	Local (On- or near site, not at any noise sensitive receptors)	Local (On- or near site, not at any noise sensitive receptors)
Magnitude	High (More than 15dBA increase in environmental noise level at the nearest noise sensitive receptor i.e. serious complaints and reaction expected)	Medium (More than 5dBA increase in environmental noise level at the nearest noise sensitive receptor i.e. complains and medium reaction expected)
Duration	Short Term (Up to 3 years)	Short Term (Up to 3 years)
SIGNIFICANCE	Medium (-)	Medium (-)
Probability	Probable (Considered the	Probable (Considered the

	appropriate probability rating for predicted noise impacts)	appropriate probability rating for predicted noise impacts)
Confidence	Unsure (Considered the appropriate confidence rating for predicted construction phase noise impacts)	Unsure (Considered the appropriate confidence rating for predicted construction phase noise impacts)
Reversibility	Reversible (The impact is reversible, within a period of 10 years)	Reversible (The impact is reversible, within a period of 10 years)

9.6.2 Operational phase

9.6.2.1 Impact statement

Noise pollution will be generated by traffic along the access road and as a result of the continuous operation of the RopeCon aerial conveyor system, including the drive units and the transfer station. The noise generated by these activities could be perceived as a nuisance to local residents and tourists due to increased noise.

9.6.2.2 Discussion

Road Traffic Noise

The proposed access road will be an asphalt road with a design traffic speed of 60km/h. The maximum traffic during the day time will be experienced between 16:00 and 17:00.

The road traffic noise was calculated in accordance with SANS 10210 (2004) using the traffic data provided by Rössing Uranium Limited (please refer to the full specialist study report for further details). The night–time traffic will peak at midnight.

The above mentioned information was used to calculate worst-case day-time and night-time LAeq (1 hour) as a function of distance from the road centreline.

RopeCon/RailCon Noise

The following elements of the RopeCon/RailCon will produce noise:

- Wheel and rope or rail contact noise;
- Drive unit noise at the transfer terminal; and
- Materials transfer at the terminal.

Research conducted by Doppelmayr on noise generated by their RopeCon system indicated that a person, at a distance of 1m from the RopeCon system would be exposed to a sound pressure level of between 55dBA and 60dBA (Kessler, et al., 2002). The report did not distinguish between noise along RopeCon and RailCon and this range was assumed to be applicable to both systems.

The sound power level of the system was back calculated from the 60dBA sound pressure level reported at a distance of 1m from the system and by assuming cylindrical divergence. Noise from electrical drives was calculated for continuous operations (not startup) through the application of predictive sound power levels and equations for electrical motors as published by Crocker (1998).

Noise generated by the transfer or ore at the transfer terminal was obtained from a recognised database.

A summary of sound power levels applied in calculations are provided in the full specialist study.

Noise Propagation Modelling and Predicted Noise Levels

The propagation of noise from the operational phase was calculated in accordance with SANS 10103 and SANS 10210. Meteorological and site specific acoustic parameters were applied in the model. The propagation of noise was calculated over a downwind distance of 2.5km at a resolution of 100m.

The total day and night-time noise levels (LAeq(1 hour)) and the increase in environmental day and night-time noise levels, when compared to existing baseline noise levels, were calculated to facilitate comparison with IFC guidelines.

Predicted Day-time Noise Levels

Calculated total day-time noise levels during the operational as well as the expected increase in day-time noise levels over the 45dBA baseline level, over the plains, and 30dBA within the Khan River valley is provided in the Figures below.

Within the Khan River valley, activities will be audible over distances up to 2.5km down the valley. Traffic noise impacts will only occur for a total 5hours of the day. The increase in night-time noise as a result of the RopeCon will be less than 3dBA within 1km. Within the valley the increase will be less than 10dBA directly underneath the RopeCon system.

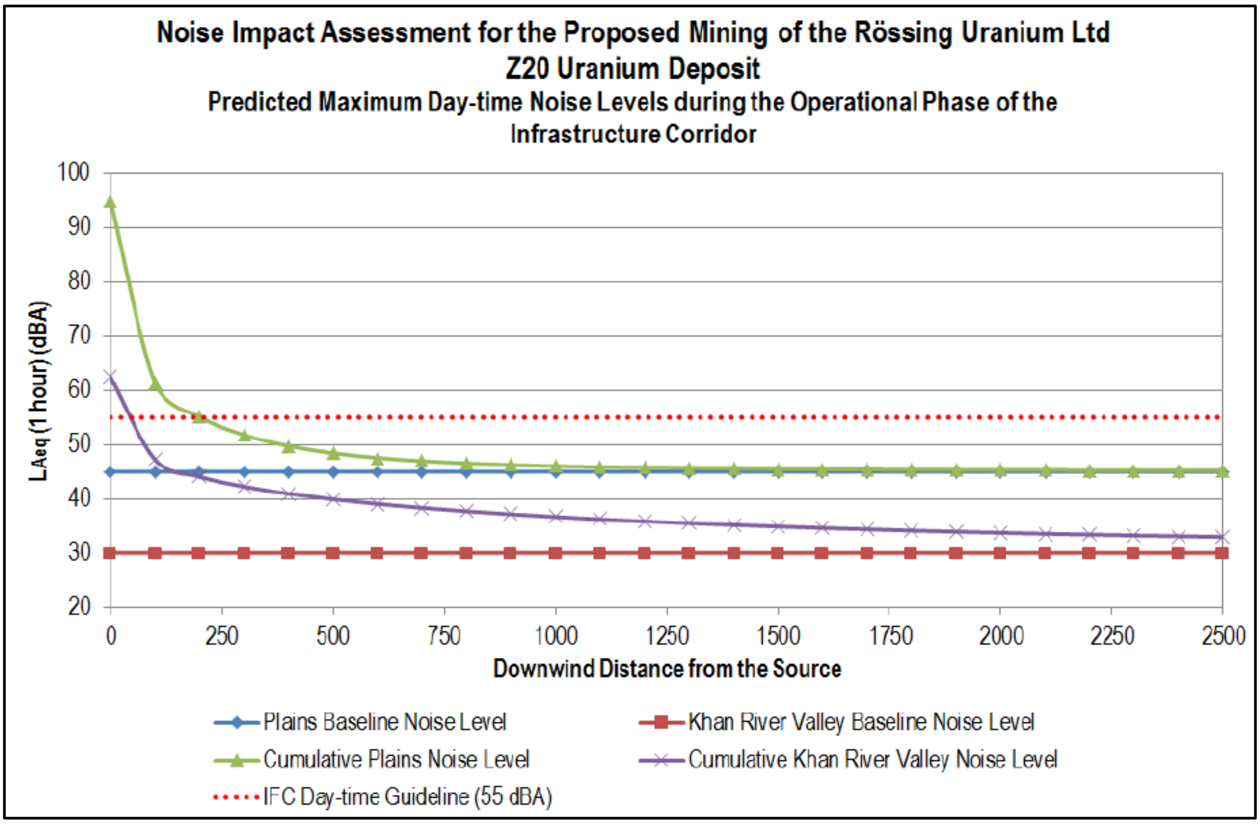

Figure 43: Predicted maximum day-time noise levels

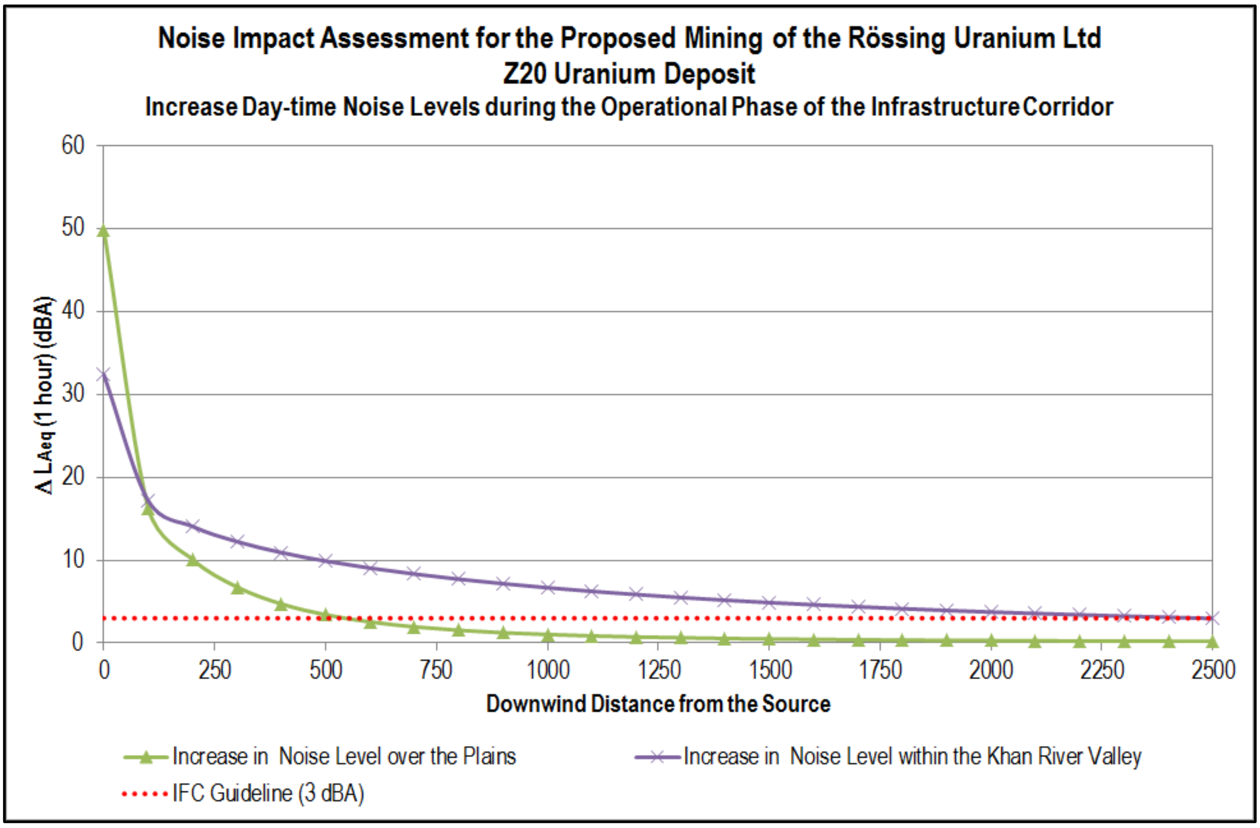

Figure 44: Predicted increase in day-time noise levels

Cumulatively noise levels as a result of the operational phase (transfer terminal, road and RailCon/RopeCon) may exceed the IFC guideline of 55dBA up to 200m and will result in a 3dBA increase over the baseline day-time level of 45dBA up to 500m from the transfer terminal over the plains.

Within the Khan River valley, cumulative noise levels as a result of the road and RailCon exceed the IFC guideline of 55dBA up to 50m and will result in a 3dBA increase over the baseline day-time level of 30dBA up to 2.5km down the valley.

The closest communities are located at distances of more than 3km away from operational areas.

Predicted Night-time Noise Levels

Calculated total night-time noise levels during the operational and the expected increase in night-time noise levels over the 35dBA baseline level over the plains and 30dBA within the Khan River valley is provided in Figure below.

Within the Khan River valley, activities will be audible over distances of up to 1.5km down the valley. Traffic noise impacts will only occur for a total 2 hours of the night. The increase in night-time noise as a result of the RopeCon will be less than 3dBA within 1km. Within the valley the increase will be less than 10dBA directly underneath the RopeCon system.

Cumulatively noise levels as a result of the operational phase (transfer terminal, road and RailCon/RopeCon) may exceed the IFC guideline of 45dBA up to 550m and will result in a 3dBA increase over the baseline night-time level of 35dBA up to 1.4km from the transfer terminal over the plains.

Within the Khan River valley, cumulative noise levels as a result of the road and RailCon exceed the IFC guideline of 45dBA up to 100m and will result in a 3dBA increase over the baseline night-time level of 30dBA up to 1.7km down the valley. Within the Khan River valley, activities will be audible over distances of up to 1.5 km down the valley and may result in strong reaction from visitors to the valley.

The closest receptors are located at distances of more than 3km away from operational areas. Night-time noise impacts at these receptors are considered improbable and community reaction unlikely.

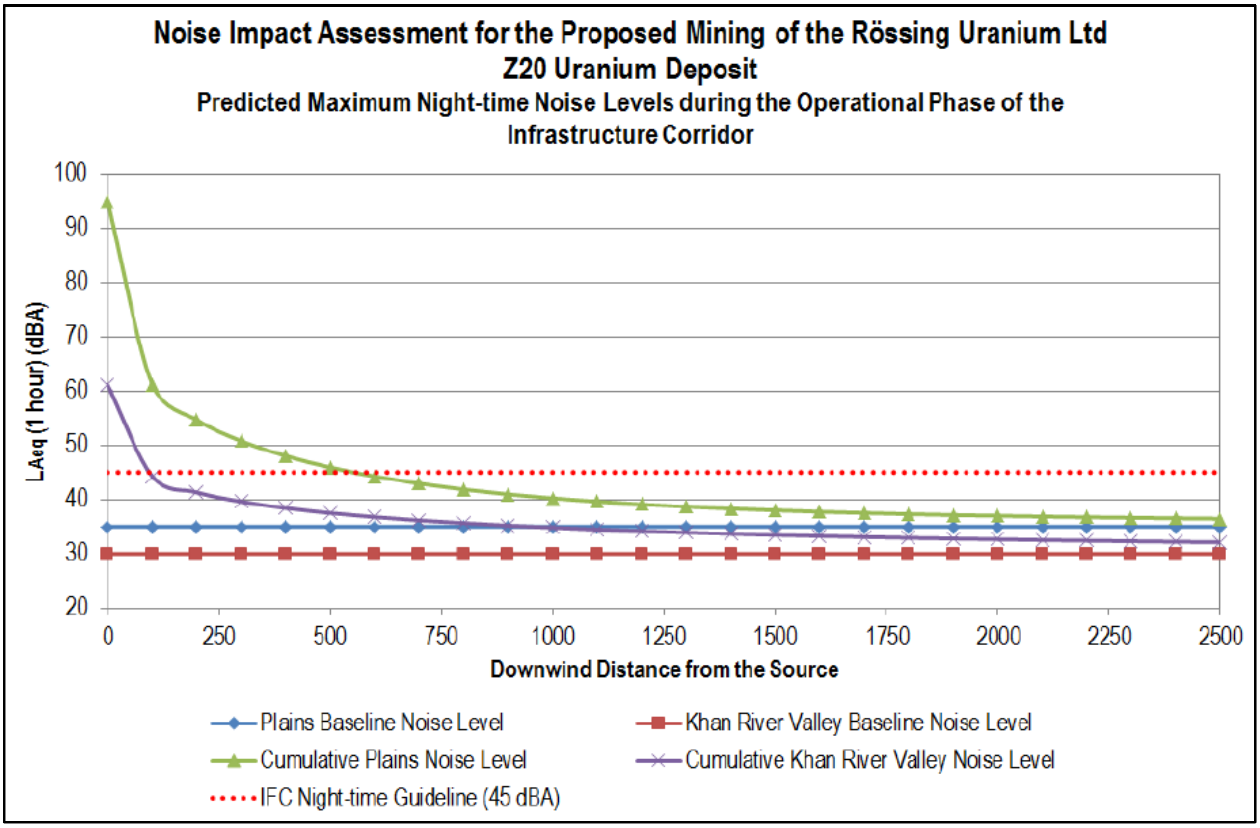

Figure 45: Predicted maximum night-time noise levels

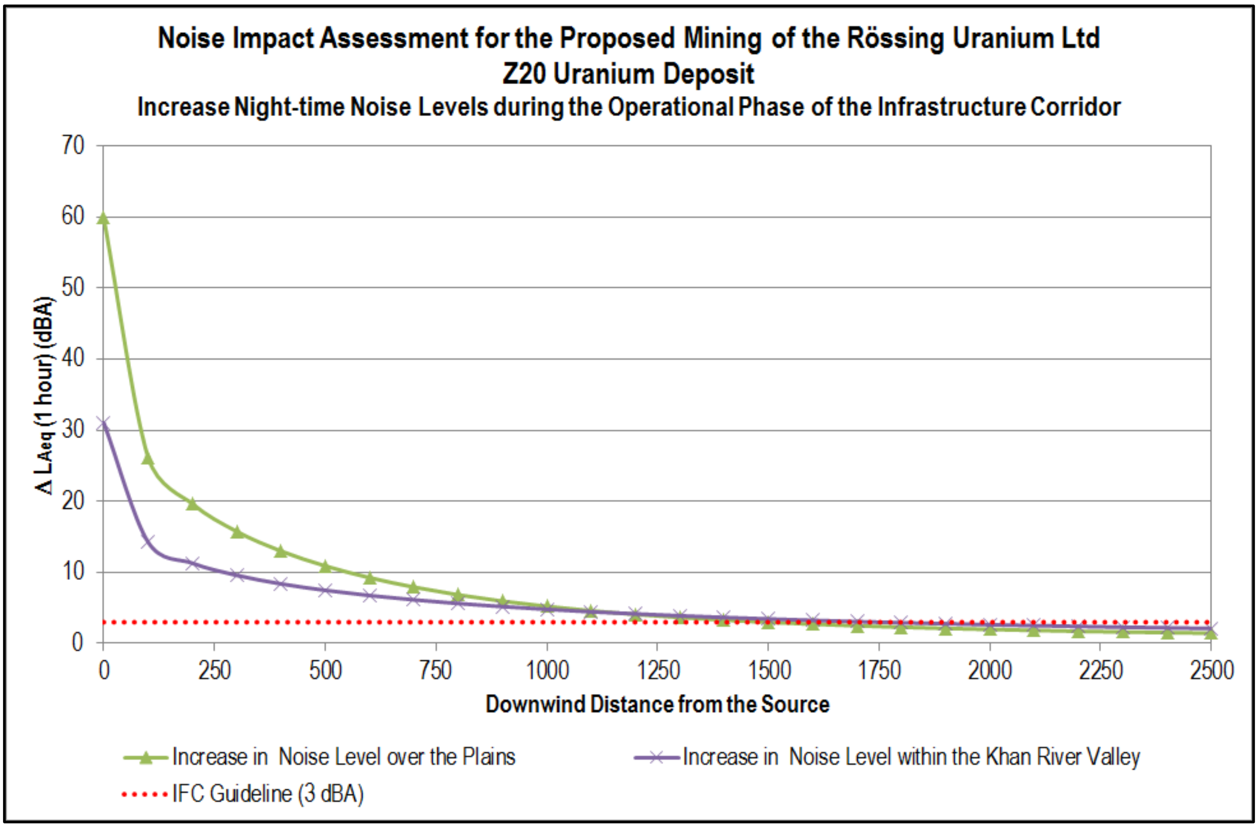

Figure 46: Predicted increase in night-time noise levels

9.6.2.3 Impact rating

Table 50: Day time cumulative noise impact significance at noise sensitive receptors located on the plains as a result of the infrastructure corridor

	Pre Mitigation	Post Mitigation
Extent	Local (On- or near site, not at any noise sensitive receptors)	Local (On- or near site, not at any noise sensitive receptors)
Magnitude	Very Low (Less than 3dBA increase in environmental noise level at the nearest noise sensitive receptor)	Very Low (Less than 3 dBA increase in environmental noise level at the nearest noise sensitive receptor)
Duration	Long Term (More than 10 years)	Long Term (More than 10 years)
SIGNIFICANCE	Very Low (-)	Very Low (-)
Probability	Probable (Considered the appropriate probability rating for predicted noise impacts)	Probable (Considered the appropriate probability rating for predicted noise impacts)
Confidence	Sure (Considered the appropriate confidence rating for predicted operational phase noise impacts)	Sure (Considered the appropriate confidence rating for predicted operational phase noise impacts)
Reversibility	Reversible (The impact is reversible, within a period of 10 years)	Reversible (The impact is reversible, within a period of 10 years)

Table 51: Night time cumulative noise impact significance at noise sensitive receptors located on the plains as a result of the infrastructure corridor

	Pre Mitigation	Post Mitigation
Extent	Local (On- or near site, not at any noise sensitive receptors)	Local (On- or near site, not at any noise sensitive receptors)

Magnitude	Very Low (Less than 3dBA increase in environmental noise level at the nearest noise sensitive receptor)	Very Low (Less than 3 dBA increase in environmental noise level at the nearest noise sensitive receptor)
Duration	Long Term (More than 10 years)	Long Term (More than 10 years)
SIGNIFICANCE	Very Low (-)	Very Low (-)
Probability	Probable (Considered the appropriate probability rating for predicted noise impacts)	Probable (Considered the appropriate probability rating for predicted noise impacts)
Confidence	Sure (Considered the appropriate confidence rating for predicted operational phase noise impacts)	Sure (Considered the appropriate confidence rating for predicted operational phase noise impacts)
Reversibility	Reversible (The impact is reversible, within a period of 10 years)	Reversible (The impact is reversible, within a period of 10 years)

Table 52: Day time cumulative noise impact significance within the Khan River valley as a result of the infrastructure corridor

	Pre Mitigation	**Post Mitigation**
Extent	Local (On- or near site, not at any noise sensitive receptors)	Local (On- or near site, not at any noise sensitive receptors)
Magnitude	High (More than 15dBA increase in environmental noise level at the nearest noise sensitive receptor i.e. serious complains and reaction expected)	Medium (More than 5 dBA increase in environmental noise level at the nearest noise sensitive receptor i.e. complains and medium reaction expected)
Duration	Long Term (More than 10 years)	Long Term (More than 10 years)
SIGNIFICANCE	High (-)	Medium (-)
Probability	Probable (Considered the appropriate probability rating for predicted noise impacts)	Probable (Considered the appropriate probability rating for predicted noise impacts)
Confidence	Sure (Considered the appropriate confidence rating for predicted operational phase noise impacts)	Sure (Considered the appropriate confidence rating for predicted operational phase noise impacts)
Reversibility	Reversible (The impact is reversible, within a period of 10 years)	Reversible (The impact is reversible, within a period of 10 years)

Table 53: Night time cumulative noise impact significance within the Khan River valley as a result of the infrastructure corridor

	Pre Mitigation	**Post Mitigation**
Extent	Local (On- or near site, not at any noise sensitive receptors)	Local (On- or near site, not at any noise sensitive receptors)
Magnitude	High (More than 15dBA increase in environmental noise level at the nearest noise sensitive receptor i.e. serious complains and reaction expected)	Medium (More than 5 dBA increase in environmental noise level at the nearest noise sensitive receptor i.e. complains and medium reaction expected)
Duration	Long Term (More than 10 years)	Long Term (More than 10 years)

SIGNIFICANCE	High (-)	Medium (-)
Probability	Probable (Considered the appropriate probability rating for predicted noise impacts)	Probable (Considered the appropriate probability rating for predicted noise impacts)
Confidence	Sure (Considered the appropriate confidence rating for predicted operational phase noise impacts)	Sure (Considered the appropriate confidence rating for predicted operational phase noise impacts)
Reversibility	Reversible (The impact is reversible, within a period of 10 years)	Reversible (The impact is reversible, within a period of 10 years)

9.6.3 Decommissioning Phase

No information regarding potential noise sources for the decommissioning phase was available at the time of the study and could therefore not be quantified. Noise impacts will depend on the extent of rehabilitation and demolition activities. It is however expected that noise impacts during the decommissioning phase would be comparable to that of the construction phase.

9.6.4 Cumulative Impacts

The potential for cumulative noise impacts within the Khan River valley as a result of the Rössing Z20 Infrastructure Corridor and the Husab Linear Infrastructure exists and is qualitatively discussed. The Husab Linear Infrastructure crosses the Khan River approximately 5km downstream of the Rössing Infrastructure Corridor. The Husab Linear Infrastructure noise assessment concluded that under the most unfavorable meteorological conditions, noise impacts may be expected up to 2.5km from the road. Impact areas may therefor overlap and result in more significant impacts between the Husab Linear Infrastructure crossing and the Rössing Infrastructure Corridor crossing.

The significance of cumulative noise impacts at noise sensitive receptors located on the plains to the north of the Khan River is Very Low (-).

The significance of cumulative noise impacts on visitors to Khan River valley close to the infrastructure corridor crossing is Medium (-) to High (-) due to very quiet surroundings.

9.6.5 Mitigation measures

A discussion of the mitigation measures is provided below. More detail regarding the mitigation measures is provided in the infrastructure corridor SEMP (see Annexure D).

Engineering

- All diesel powered equipment must be regularly maintained and kept at a high level of maintenance. This must particularly include the regular inspection and, if necessary, replacement of intake and exhaust silencers. Any change in the noise emission characteristics of equipment must serve as trigger for withdrawing it for maintenance.
- To minimise noise generation, vendors can be required to guarantee optimised equipment design noise levels for example the RopeCon/RailCon electrical drive motors.
- During the planning and design stages of the project, possibly related noise aspects should always be kept in mind. The enclosure of major sources of noise, such as compressor or pump systems, must be included in the design process, since they represent basic good engineering practice.

- By enclosing the tipper discharge and lowering the conveyor drop height, noise emissions may be reduced. Mechanical and electrical design also influences the amount of noise from stacking and reclaiming operations.
- Re-locate noise sources to less sensitive areas to take advantage of distance and shielding.
- Develop a mechanism to monitor noise levels, record and respond to complaints and mitigate impacts.

Operational hours

- It is recommended that, as far is as practicable, noise generating activities such as maintenance and construction, be limited to day-time hours (considered to be between 07:00 and 22:00) since noise impacts are often most significant during the night.

Blasting

- Predicting the noise caused by blasting events is a highly complex and unreliable process that depends on various factors. Blasting at the surface will be audible over long distances and may cause a startling reaction at receptors in close proximity.
- This can be mitigated by adhering to blast schedules that have been communicated to the affected parties. The best approach to the control of blasting noise is proper blast design. The air overpressure can be controlled trough proper, charge mass, stemming height and type, burden to blast hole ratios and the combined effect of burden, spacing and blast timing control.
- Very little information was available with respect to blasting and noise impacts could not be quantified. It is recommended that blasting be assessed in more detail as an addendum to this report once blast design detail becomes available.

Tourism

It is likely that as activities within the Khan River valley increase, the number of visitors to the area where the infrastructure corridor crosses the valley will reduce. Tourism offsets should be considered to encourage overnight visitors to visit other, less impacted parts of the Khan River valley.

Noise monitoring

It is recommended that, should the project continue, ambient noise measurements be conducted during the construction, operational and decommissioning phases to assess and confirm the impact area. Specific attention should be paid to noise levels at Arandis, the Arandis airport, the Khan Mine and at various locations within the Khan River valley.

The frequency of noise monitoring as well as the parameters that should be determined are summarised in Table 54. The locations as identified by Dracoulides (2010) should be used as points where monitoring should be conducted.

In addition to the measurement of sound pressure levels, the 3rd octave band frequency spectra should also be recorded. Frequency spectrum data can provide useful insight into the nature of recorded sound pressure levels and assist with distinguishing between potential sources of noise that contribute to noise levels at a certain location. Source noise measurements could be conducted to confirm equipment manufacturer sound power data and assumed sound power data used in the current study.

It is recommended that a noise management zone of 2.8km be considered around the proposed operations. This area corresponds to the area over which noise levels may result in annoyance i.e. complaints and occasional community action. Noise levels in this area should be monitored and results communicated to interested and affected parties.

Table 54: Proposed monitoring plan

Proposed Monitoring Plan	
Parameters to be measured	**Frequency**
L_{Aeq} (1 hour) between 07:00 and 22:00	One campaign during construction of the transfer terminal One campaign during the construction of infrastructure within the Khan River valley One campaign per year of operation
L_{Aeq} (1 hour) between 22:00 and 07:00	One campaign per year of operation
L_{Zeq} (T) during a blast event	During as many blast events as possible but at least 2 campaigns
3^{rd} Octave band frequency spectrum	During every campaign

9.7 SURFACE WATER

A surface water impact assessment was undertaken to assess the environmental aspects and potential impacts of the proposed Z20 linear infrastructure corridor. Please refer to Annexure C for the complete surface water impact assessment undertaken by SLR Consulting.

9.7.1 Aerial Conveyor

9.7.1.1 Impact statement

The spillage of ore from the aerial conveyor and/or a leakage of diesel from and diesel line could result in surface water contamination.

9.7.1.2 Discussion

The planned RopeCon conveyor system will cross the Khan River but will be elevated above the river and suspended from towers located on the ridges at the edge of the river valley. No infrastructure will be located in the main channel to restrict flow in the river. The RopeCon conveyor system is designed to significantly reduce the risk of material spillage, with corrugated sides on the belt, a roof over the structure and an extra lower collecting structure at the river crossing to ensure that no material can fall from the conveyor into the river channel. An additional design feature is the monitoring system that continuously checks the height and weight of the loaded belt at the loading point to ensure that overloading does not take place. With these features, plus the likelihood that any unstable material would have fallen from the conveyor, it is assumed that the risk of any contaminating material falling from the conveyor system into the Khan River is very low.

There is not expected to be any contaminated material in the river channel for any flood to transport, so radiation levels will remain at current low background levels. There will be no anticipated impact on the surface water quality due to the elevated conveyor system.

9.7.1.3 Impact rating

The extent of likely impacts from the construction of a high level conveyor system across the Khan River is local. The magnitude of the impact is very low and the duration of the impact is long term (life of mine). This gives a very low significance rating for this impact. However, it should be noted that at the end of the Z20 mine operating life, the risk reduces to zero.

9.7.1.4 Mitigation measures

During the first years of operation it is recommended that regular monitoring of the area below the conveyor system be undertaken to confirm that there was no material accumulating in the river channel due to material falling from the conveyor system. If any material is found then further mitigation would be to have a ‘cleaning team’ carry out regular monitoring and removal of any fallen material, especially during the main flood season of November to April.

9.7.2 Road Bridge

9.7.2.1 Impact statement

The construction of an access bridge across the Khan River could potentially restrict surface water flow and or result in erosion of the river bed surrounding the bridge pedestals.

9.7.2.2 Discussion

The road bridge will be mounted on concrete pedestals which will be spaced at 8m intervals across the river and the main road deck will be approximately 10m wide and will be elevated 3.6m above the river channel. The river channel is approximately 165m wide at the bottom of Panner Gorge, so there will be approximately 18 concrete pedestals across this river section and the planned bridge will cross the river channel in a straight line perpendicular to the flow direction. The river channel at this section is sandy, with no visible rock outcrops, so excavation will be required to ensure that the footing of the pedestals are anchored to bed-rock.

Likely impacts of the proposed road bridge will be the possibility of raised water levels for a short distance upstream of the bridge during extreme flooding and some erosion/scouring of the river bed surrounding the bridge pedestals. The proposed bridge will be located in a fairly straight and uniform width section of river channel, so no impacts are likely to occur beyond 100m from the bridge structure.

9.7.2.3 Impact rating

The extent of likely impacts from the construction of a high level road bridge across the Khan River is local. The magnitude of the impact is low and the duration of the impact is long term. This gives a low significance rating for this impact.

9.7.2.4 Mitigation measures

Possible mitigation measures would be the addition of gabions at the bridge pedestals to reduce erosion/scouring effects.

9.7.3 Mitigation measures

Recommended mitigation strategies to reduce the impact on surface water would include:

- Regular monitoring of the area below the conveyor system, with immediate removal of any identified spill material, especially before and during the main flood season (November to April).
- Regular bridge inspection after flood events to ensure no significant damage to structure has taken place, or erosion around pedestals. Removal of flood debris (vegetation/rocks)

from the upstream side of the bridge should be carried out to prevent restrictions to flow. If erosion of the river bed is noted, then sand and rock material should be brought in to infill any areas of concern.

- The design of the road through the gorges should take care when designing for runoff, as there is little data available on rainfall intensities. The final road structure should ensure that generated runoff is routed so as to prevent wash/erosion of material within the gorges and to minimise the transport of material into the Khan River.

9.8 VISUAL IMPACTS

A visual impact assessment was undertaken to assess the environmental aspects and potential impacts of the proposed Z20 linear infrastructure corridor. Please refer to Annexure C for the complete visual impact assessment undertaken by VRMA.

9.8.1 Construction phase

9.8.1.1 Impact statement

Visual impact on surrounding receptors caused by landscape changes is potentially brought about by construction of the road, powerline, water pipes and bridge over the Khan River and the RopeCon conveyor.

9.8.1.2 Discussion

A visual impact will be caused by landscape changes brought about by construction of the road, powerline, water pipes, bridge over the Khan River and the overhead conveyor. Due to the remoteness of the area where the projects are proposed, the high exposure areas include few receptor locations. The following receptor points are exposed to the proposed infrastructure corridor expansion for the Z20 uranium deposit:

- Khan River
- B2 National Road (eastbound)
- Khan Mine Access Road
- Welwitschia Plains

The northern sections of the project are located adjacent to the existing Rössing Mine and overlap with the existing mine's zone of visual influence (ZVI). The zone of visual influence will result in the Panner Gorge areas being exposed to near views of the project construction and operation. This area is located within the Rössing Mine License Area, and is restricted, and receptors would be limited to Rössing employees only.

Khan River

The Khan River is a known 4x4 route that is utilised by local 'Swakopmunders' and tourists for desert recreation. Visible project activities would be the conveyor, the transmission line and the bridge structure. These proposed project elements lie in the Khan River valley, surrounded by very rugged rocky outcrops which limit visibility to a local extent. The 4x4 users will pass under the proposed bridge, power line and overhead conveyor with clear views at high exposure levels. The scenic quality is high due to the rugged rocky outcrops of the land form, dry river and interesting contrasting colours of the dark rocks and light brown sands of the river bed. Adjacent scenery along the length of the Khan River is of similar value. Cultural modifications are limited to some power lines and pump stations and do not significantly detract from the scenery.

B2 National Road

The B2 eastbound road receptor links the Namibian interior with the coastline and the towns of Swakopmund and Walvis Bay, which is an important tourist route. It is mainly a desert landscape. Possible visible activities would be the edge of the conveyor, which may be visible at a distance of 5.2km. It is within the Foreground (6km) distance however, and it is therefore unlikely that the landscape character associated with the proposed conveyor will influence the landscape character. The scenic quality would be B (moderate) due to the infrastructure associated with the existing well-established Rössing uranium mine, which is clearly visible in the same direction and at a much larger scale. Due to the B2 being a tourist route, receptor sensitivity is moderate.

Khan Mine access road (track)

The other possible tourist route is the road to the old Khan Copper Mine, which is located to the south of the Arandis Airport. This is a 4x4 access route to the Khan River and passes by some interesting structures of the old copper mine which have some heritage value. The route is currently being used by Swakop Uranium for the laying of their temporary water pipe above ground. The landscape character of the route is currently fairly degraded.

Visible Z20 project activities would be the conveyor and transmission line, which would be located 2 km from the receptor location. These lie in the high exposure foreground zone where there is potential for the landscape character to be changed. The scenic quality is low due to the close location to the Rössing tailings storage facility, power lines and stockpiles, which are visible within the 6km radius. The sensitivity for the receptor would therefore be low.

Welwitschia Plains

Located in the background (12km) to the south-east of the proposed site, the Welwitschia Plains is within the NNP and is an important tourist destination in the area. Due to the distance between the site and the receptor location, it is highly unlikely that any of the proposed project components will be visible and contrast generated from the proposed project will be weak. The only impact that may occur is lights at night. As the area is located in the NNNP, mitigation for reducing light spillage should be undertaken.

Visibility of Infrastructures

The overhead conveyor will be visible from two of the four receptors. The Class III visual objectives[6] required to maintain the existing landscape character will be met from the B2 and Khan Mine access roads as the proposed modifications will be visually absorbed into the background context of the existing Rössing Mine. Due to the location of the conveyor in strongly undulating terrain and mainly within the Khan River valley system, there will be no views from eastern receptors in the NNP and Welwitschia Plains area. The Class II visual objective, which requires low levels of landscape change in order to maintain the existing landscape character of the Khan River,

[6] The **Class III** objective is to partially retain the existing character of the landscape, where the level of change to the characteristic landscape should be moderate. Management activities may attract attention, but should not dominate the view of the casual observer, and changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.

will not be met. Due to the close proximity of the receptors, who would pass under the proposed structures, strong levels of landscape change will occur and, should permission be granted for this proposal, it must be recognised that the current landscape character will be degraded. The area where the landscape change will take place is contained within a local geographic zone due to the rugged terrain which limits visibility. With the Husab crossing of the Khan River downstream, cumulative impacts from repeated views of development within the river valley would degrade the area's sense of place and reduce the viability of the Khan River as a tourist attraction.

The pipeline would not be visible from most receptors, except the Khan River, should the pipe be laid above ground. With mitigation, and the incorporation of the pipe into the bridge structure, or being buried, the landscape change would meet the Class II visual objectives[7] .

The power line would not be visible from the B2 or NNNP receptors, but would be visible from the Khan Mine access road and the Khan River receptors. The Class III visual objective, requiring moderate levels of landscape change, would be met as seen from the Khan Mine access route, as higher levels of contrast from the existing 220kVA power line in the foreground, and the Rössing Mine waste rock dump in the background, would visually absorb the proposed tower structures. As seen from the Khan River, if the structures are set back from the river area, it is likely that the views of the power lines would be limited and would meet the Class II visual objective[8] which requires low levels of landscape change.

The proposed access road and bridge structures would only be visible from the Khan River due to the location of this landscape modification within valley areas. As with the overhead conveyor, the Class II visual objective, which requires low levels of landscape change in order to maintain the existing landscape character of the Khan River will not be met. Strong levels of landscape change will occur and, should permission be granted for this proposal, it must be recognised that the current high rating levels of landscape character will be degraded, albeit within a local geographic zone due to the rugged terrain that limits visibility.

Visual objectives for lighting at night would not be met for the Khan receptors should Aircraft warning lights be attached to the conveyor. However the conveyor system is located in close proximity to the Rössing mine, which already has a visual effect at night as seen from the B2 and the Welwitschia Plains NNNP area. It is also unlikely that tourists will be driving the Khan River at night but the lights at night will add to the cumulative impacts which are reducing the dark sky sense of place of the NNNP.

9.8.1.3 Impact rating

With or without mitigation, the proposed project will result in direct negative visual impacts during the construction phase.

The rugged and undulating terrain would reduce the visibility, and the remoteness of the location reduces the visual exposure to people other than the Khan River receptors.

[7] The **Class II** objective is to retain the existing character of the landscape and the level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer, and should repeat the basic elements of form, line, colour and texture found in the predominant natural features of the characteristic landscape.

The landscape modification would result in a change in the landscape character and sense of place. This is due to the Class II visual objectives for the bridge not being met as the required weak levels of change to the existing landscape would not be achieved by the bridge and conveyor.
The duration of the impacts would be short-term during construction and would be completed within approximately three years.

The visual impact of the Khan River will generate strong levels of landscape change, which will be clearly visible from the Khan River receptors. The visual impact will definitely occur.

Given the large scale of filling required for the road, and cutting through narrow areas which will include blasting, it is likely that some aspects of the road construction will be irreversible.

The short term of the construction period, and the local geographic area of influence, reduce the significance to Medium for with, and without, mitigation. Construction phase impacts will be difficult to manage but should be implemented in terms of meeting best practice standards.

Table 55: Summary of construction phase visual impact assessment rating

	Before Mitigation	After Mitigation
Extent	Local	Local
Magnitude	High	High
Duration	Medium	Medium
SIGNIFICANCE	Medium (-)	Medium (-)
Probability	Definite	Definite
Confidence	Certain	Certain
Reversibility	Irreversible	Irreversible

9.8.1.4 Mitigation measures

A discussion of the mitigation measures is provided below. More detail regarding the mitigation measures is provided in the infrastructure corridor SEMP (Annexure D).

Table 56: Construction phase visual mitigation measures

Aspect	Mitigation measure
Road and Bridge	• Reduce the number of bridge pillars, or investigate the feasibility of using a V-shape for the bridge support pillars to reduce their numbers. • Use local, medium-sized crushed rock instead of gabions for support (or cover gabions with medium-sized crushed local rock) to appear as natural screen slope. • No street lights along the road or bridge. • Blasting of rock passage to leave rough finish to rock face. • The road should be routed around large indigenous trees in the Panner Gorge area as these trees are significant features in the landscape. • Plant medium-sized trees (Camel thorns proposed) to screen off some of the pillars (a third). • Fixtures required on the bridge should be painted grey-brown. • Incorporate the pipelines into the bridge. • Dust management during construction of the road needs to be implemented. • The bridge should be left cement-grey in colour. • The road should be tarred to reduce dust

Overhead Conveyor	• No lights on the overhead conveyor (unless required for aircraft warning). • Paint all structures desert colours (grey-brown). • Blasting of rock outcrop crests to be rough-blasted to reduce even slopes. • Assess the possibility of reducing the heights of the two towers visible from the Khan River. • Assess the possibility of moving the towers back from the Khan River.
Lights at Night	• Use Mesopic LED lighting that is downward directional and side-screened for the conveyor turning points (refer to lighting recommendations in Annexure C).
Powerline	• Specific attention should be given to the location of the structures in relation to the road, given that the road could be used for tourist purposes post-closure. It is recommended that, should the post-closure tourism option of the road be considered, the consulting services of an accredited landscape architect (SACLAP) should be utilised. • The power line structures should not be located in the river area but should be located on either side of the river and set back into the Panner Gorge so that the pylons are not viewed from down or up the river area. • The structures should preferably be constructed from timber poles.

9.8.2 Operational phase

9.8.2.1 Impact statement

A visual impact will be caused by landscape changes brought about by the operation of vehicles on the tarred road and on the bridge over the Khan River, the power line, water pipes and overhead conveyor.

9.8.2.2 Discussion

A visual impact will be caused by landscape changes brought about by the operation of vehicles on the tarred road and on the bridge over the Khan River, the power line, water pipes and overhead conveyor.

9.8.2.3 Impact rating

With or without mitigation, the proposed project will result in direct negative visual impacts during the operational phase.

The rugged and undulating terrain would reduce the visibility, and the remoteness of the location reduces the visual exposure to key receptors other than the Khan River receptors.

As with the construction phase, the landscape modification would result in a change in the landscape character and sense of place, as the Class II visual objectives for the bridge would not be met, as the required weak levels of contrast change to the existing landscape would not be achieved by the bridge and conveyor. The visual impact could be reduced in the longer term by reducing the number of bridge supports (cluttered effect), using desert colours on the bridge fixtures (if required) and placing the power line towers back from the river (if possible). The incorporation of trees around the bridge pillar and making visible fill sections appear as scree slopes (using local roughly crushed rock) would also reduce the contrast of the bridge structure.
The visual impacts, with or without mitigation, would last for a long time period. The visual impact would definitely occur, with and without mitigation. Confidence levels are certain.

Without and with mitigation, elements of the project would be irreversible.

With the reduction in the number of pillars, the bridge will appear less cluttered and the withdrawal of the power line and conveyor structures away from the Khan River would reduce the visual intrusion. Without the mitigations, the visual impact will remain high.

Table 57: Summary of operational phase visual impact assessment rating

	Before Mitigation	After Mitigation
Extent	Local	Local
Magnitude	High	Medium
Duration	Long	Long
SIGNIFICANCE	High (-)	Medium to High (-)
Probability	Definite	Definite
Confidence	Certain	Certain
Reversibility	Irreversible	Irreversible

9.8.2.4 Mitigation measures

A discussion of the mitigation measures is provided below. More detail regarding the mitigation measures is provided in the infrastructure corridor SEMP (Annexure D).

Table 58: Operational phase visual mitigation measures

Aspect	Mitigation measure
Road and Bridge	• No street lights along the road or bridge. • The bridge should be left cement-grey in colour. • The road should be tarred to reduce dust.
Overhead Conveyor	• No lights on the overhead conveyor (unless required for aircraft warning). • Paint all structures desert colours (grey-brown).
Lights at Night	• Use Mesopic LED lighting that is downward-directional and side-screened for the conveyor turning points (refer to lighting recommendations in Annexure C).

9.8.3 Decommissioning phase

9.8.3.1 Impact statement

Visual impact will be caused by remaining landscape changes after mine closure, related to the road, power line, water pipes and bridge over the Khan River and the overhead conveyor.

9.8.3.2 Impact rating

Without mitigation, the nature of the visual impact will be negative and could lead to landscape degradation if not removed. With mitigation, which would include removal and recycling of the overhead conveyor and power line, the road could be opened as a tourist access route to the post-closure tourists associated with the pit, and access to the Welwitschia Plains in the NNNP.

Should the overhead conveyor not be removed it could lead to landscape decay and negatively influence the attraction value of the Khan River and surrounding areas. The road winding through the Panner Gorge and across the Khan River could offer tourist appeal, which could in turn add value to the region as a tourist attraction (low confidence, as this depends on rehabilitation/ closure of the Husab Mine).

The visual impact without mitigation would be high. With mitigation and the inclusion of the road as a tourist route, the result could be low positive impacts as; in general, the area will be degraded by large-scale mining.

The visual impacts without mitigation could lead to long-term visual scarring. The road as a tourist route could also have a long-term positive impact.

The high magnitude negative visual impacts without mitigation would definitely result in landscape degradation. The road could result in a positive influence on the area if in a post mine scenario it is incorporated into a tourist route allowing access to the NNP from the B2, creating a small tourist attraction.

Without mitigation, negative visual impact is certain. With mitigation, the positive impacts are unsure as the road as a tourist attraction depends on rehabilitation/ closure of the Husab Mine.

Without and with mitigation, the visual impacts will be irreversible.

Without mitigation, the negative visual significance would be high. With mitigation, the positive visual significance would be low.

Table 59: Summary of decommission phase visual impact assessment rating

	Before Mitigation	**After Mitigation**
Extent	Regional	Regional
Magnitude	High	Low
Duration	Long	Long
SIGNIFICANCE	High (-)	Low (+)
Probability	Definite	Probable
Confidence	Certain	Unsure
Reversibility	Irreversible	Irreversible

9.8.3.3 Mitigation measures

A discussion of the mitigation measures is provided below. More detail regarding the mitigation measures is provided in the infrastructure corridor SEMP (Annexure D).

Table 60: Decommission phase visual mitigation measures

Aspect	**Mitigation measure**
All infrastructures	• Unless the road can be utilised for post mine tourist, all infrastructure associated with the Z20 corridor should be broken down and removed.
	• Dust suppression measures should be implemented during the deconstruction phase.
	• The areas which can be access should be landscaped to allow for hydrological flow and rehabilitated back to a natural landscape making use of the services of a professional landscape architect.

9.8.4 General mitigation measures

The following general mitigation measures should be taken into consideration for the proposed project:

- Effective light management needs to be incorporated into the design of the lighting to ensure that the visual influence is limited to the mine, without jeopardising mine operational safety and security (See lighting mitigations by The New England Light Pollution Advisory Group (NELPAG) and Sky Publishing Corp in 14.2).
- Utilisation of specific frequency LED lighting with a green hue on perimeter security fencing.
- Directional lighting on the more exposed areas of operation, where point light source is an issue.
- Directional lighting on the more exposed areas of operation, where point light source is an issue.
- No use of overhead lighting and, if possible, locate the light source closer to the operation.
- If possible, the existing overhead lighting method utilised at the mine should be phased out and replaced with an alternative lighting using closer to source, directed LED technology.

9.8.5 Cumulative impacts

Due to the remoteness, and the location of the project within the existing Rössing Mine License Area, as well as the close proximity of the project to the Rössing Mine and planned Husab mine, it is unlikely that cumulative impacts would occur on site. There is the potential that the combined impacts of the Husab mine and the Rössing expansion projects (with two crossings over the Khan River) could result in indirect cumulative impacts whereby the area is more associated with a mining landscape than with a natural landscape and which could reduce the wilderness destination experience of the area and of the NNNP. This could result in an indirect impact to the NNNP.

9.9 ASSUMPTIONS AND LIMITATIONS

In undertaking this investigation and compiling the SEIA Report, the following has been assumed:

- The information provided by the applicant is accurate and unbiased; and
- The scope of this investigation is limited to assessing the social and environmental impacts associated with the proposed mining of the Z20 uranium deposit and infrastructure corridor.

10 TERMS OF REFERENCE FOR FURTHER INVESTIGATIONS

This section forms describes the specific work required to assess the social and environmental impacts associated with the various phases.

10.1 ASSESSMENT METHODOLOGY

The overarching assessment methodology and criteria that will be used for the further investigations will be the same as applied for the infrastructure corridor. This assessment methodology and criteria is presented in Section 7 of this report.

10.2 TERMS OF REFERENCE

Section 8 (Table 24) of this report provides a summary of all the identified aspects and potential social and environmental impacts associated with the mining and processing components of the proposed project. This section of the report provides the terms of reference for further investigations relating to the following:

- Mining of the Z20 ore body;
- Disposal of Z20 waste rock;
- Amendment of the approved Acid Plant Environmental Clearance;
- Processing plant modifications;
- Changes to the present Tailings Storage Facility (TSF); and
- Establishment of a new High Density TSF on the Rössing Dome.

It therefore excludes the infrastructure corridor, which was assessed as part of Section 9 of this report.

10.2.1 Social

It is proposed that a socio-economic study be conducted by Ptersa Environmental Management Consultants.

A participatory approach will be followed whereby the affected public will be involved in the research and planning where it is realistically possible and executable. The aim of the study will be to identify possible socio-economic impacts associated with the project, and to recommend the most suitable mitigation measures.

The study will have the following methodology and objectives:

- To conduct a baseline study of the study area, which will include an in-depth review of available literature. This will include relevant legislation and existing provincial and municipal documents and studies, existing SIA's for the area, as well as any additional literature that is deemed to be applicable to the study. This study will focus on the local and regional level.
- To address the social and economic issues that was identified in the public participation process to date. This will be substantiated by further stakeholder involvement/input from key focus groups by means of the following:

  - Field work will be conducted to obtain additional information and communicate with key stakeholders.
  - Focus groups meetings, formal and informal interviews, participatory rural appraisal, observation, internet and literature reviews.
- To assess the potential positive and negative social and/or economic impacts associated with the proposed project, taking the current conditions into consideration.
- To provide mitigation measures.

10.2.2 Visual

It is proposed that a visual impact assessment be conducted by Visual Resource Management Africa cc.

The study will have the following methodology and objectives:

- To cover the entire affected project area. This will include a site visit of the full site extent, as well as where potential impacts may occur beyond the site boundaries such as cumulative impacts.
- To collate and analyse all available secondary data relevant to the affected project area. This will include the Rössing Uranium Mine Phase 1 and Phase 2 Visual Impact Assessments reports.
- To consider cumulative effects.
- To give specific attention to the following:
  - Quantifying and assessing the existing scenic resources/visual characteristics on, and around, the proposed site. The study will take into consideration that part of the project falls within the already disturbed areas (i.e. existing Rössing Uranium process plant, tailings facilities, etc.) and another part (i.e. Z20 mining and associated activities) falls in the NNNP.
  - Evaluating and classifying the landscape in terms of sensitivity to a changing land use.
  - Determining viewsheds, view corridors and important viewpoints in order to assess the visual impacts of the proposed project.
  - Determining visual issues, including those identified in the public participation process.
  - Reviewing the legal framework that may have implications for visual/scenic resources.
  - Assessing the significance of potential visual impacts resulting from the proposed project for the construction, operational and decommissioning phases of the project.
  - Identifying possible mitigation measures to reduce negative visual impacts.

10.2.3 Biodiversity

The biodiversity impact assessment will be conducted by African Wilderness Restoration and Biodata Consultancy cc.

The study will have the following methodology and objectives:

- To build on the assessment work conducted as part of the infrastructure corridor.
- To build on other plant an animal biodiversity work previously conducted in the area and will identify sensitive areas and apply a system of biodiversity quantification that includes the level of endemicity of species and their conservation status.
- To identify and list all species in all taxonomic groups and their known distributions mapped in relation to the intended areas of expansion.

- To rank the above mentioned species according to the criteria of vulnerability and irreplaceability, to identify those that have high conservation priority.
- To conduct field surveys in the area to obtain information pertaining to the distribution and occurrence of the prioritised species.
- To identify, describe and map habitats shown to host high-priority species, both within the footprint areas of the proposed project components and adjacent areas.
- To update the existing database following the study.
- To assess the potential impacts the proposed project might have on the identified species, habitats, etc.
- To present the findings in a report that includes multi-layered maps, all of which could serve as a useful baseline for future monitoring of occurrence and abundance of high-priority species.

10.2.4 Archaeology

The Archaeological impact assessment will be conducted by Quaternary Research Services and will have the following methodology and objectives:

- To conduct desktop preparation work and a field survey.
- To conduct an impact assessment that is integrated into project GIS data.
- To provide specification of conservation measures or mitigation.

For the heritage study, the intensity of field survey (i.e. percentage cover) is determined by a desk assessment which involves a statistical weighting of types of terrain that usually yield archaeological remains.

10.2.5 Noise

The noise impact assessment will be conducted by Airshed Panning Professionals. The study will have the following methodology and objectives:

- To conduct baseline noise measurements.
- To estimate noise emissions from proposed operations on baseline noise measurements.
- To calculate the propagation of noise from proposed operations according to SANS 10357:2004. ‘The calculation of sound propagation by the Concawe method’. The Concawe method facilitates the calculation of sound propagation under a variety of meteorological conditions. Average meteorological parameters, representative of conditions in the study area and obtained from the air quality study will be applied in the calculations. Noise impacts will be calculated both in terms of total ambient noise levels as a result of proposed operations as well as the effective change in ambient noise levels. Impacts will be calculated for the construction phase as well as representative operational phases of the project and assessed according guidelines provided by the International Finance Corporation (IFC) and SANS 10103:2008. Noise management measures as prescribed by the IFC EHS Guidelines will be referred to.
- To conduct a cumulative noise impact assessment. This will include an assessment of existing environmental noise levels in the vicinity of the proposed project. Sources of environmental noise associated with the construction and operation of proposed mining area, processing plant and TSF operations will be identified and quantified. Noise propagation to noise sensitive receptors as well as zones of influence from the construction and operation phase will be calculated through the application of a suitable noise

propagation model. The estimated noise impacts will be evaluated based on legislation and (or) guidelines.

The scope of the noise study includes the assessment of blasting related noise (air blast) but not vibration.

10.2.6 Vibration impacts

Aurecon and SLR will qualitatively assess the cumulative vibration impacts on sensitive surrounding areas. Relevant mitigation measures will also be developed.

10.2.7 Geohydrology

It is proposed that a geohydrological impact assessment be conducted by Aquaterra Consulting. The study will have the following methodology and objectives:

- To update the existing groundwater model.
- To predict seepage movement from rock dumps emplaced into the Khan River valley and an assessment of seepage from the tailings disposal in the Dome Gorge area.
- To assess the potential for sulphates as a conservative indicator to be transported from the planned waste rock dumps (located downstream and north of the Z20 Project along the Khan River), the existing tailings storage facility (TSF) and the proposed Dome Gorge HD TSF.
- To provide management and mitigation measures.

10.2.8 Surface Water

A surface water impact assessment for the proposed pit and waste rock dump will be conducted by SLR. The study will have the following methodology and objectives:

- To generate appropriate baseline climatic data for use in the hydrological calculations for the proposed pit and waste rock dump.
- To undertake a catchment delineation for appropriate areas
- To do a flood hydrology calculation for various return periods.
- To determine the potential environmental impacts related to surface water quantity.
- To generate a provisional conceptual stormwater management plan for the general mining operations. The conceptual stormwater management plan will be according to the best practice in South Africa (GN 704) and international guidelines in which clean and dirty water generating areas are defined (where known), operated separately, with dirty water contained for up to the 1:50 year flood event.

10.2.9 Air Quality

The air quality impact assessment will be conducted by Airshed Panning Professionals. The study will have the following methodology and objectives:

- To undertake a baseline air quality characterisation, including the assessment of:
  - The regional climate and site-specific atmospheric dispersion potential;
  - Identification of the potential sensitive receptors within the vicinity of the site;
  - Preparation of hourly average meteorological data for the model input;
  - Identification of existing sources of emission from current mining operations at Rössing Uranium;
  - Characterisation of ambient air quality and dustfall levels in the region based on observational data recorded to data (if available); and

  - Preparation of background maps.
- To determine the impact of airborne contaminants from the current and proposed mining operations on the surrounding environment and human health.
- To develop mitigation measures.

The baseline description will include project benchmarks, which would be derived from local standards (if applicable) and international norms (World Bank, World Health Organisation) in addition to a discussion on health impacts resulting from exposure to potential air pollutants. The legislative and regulatory context include emission limits and guidelines, ambient air quality guidelines and dustfall classifications with specific reference to the Namibian legislation, the new South African legislation and the World Bank requirements.

10.2.10 Radiation

It is proposed that a public dose assessment be conducted by Dawid de Villers. The investigation will have the following objectives:

- To provide a brief description of the relevant legal framework with reference to national legislation, conventions and guidelines.
- To identify and quantify the radiological sources associated with the proposed project.
- To assess the cumulative public exposure radiological impacts for all relevant pathways to the potential critical group and other receptors.
- To determine whether public exposure of the critical group will increase above 300 µSv.a-1.
- To develop mitigation measures.

10.2.11 Traffic

A traffic impact assessment will be conducted by Burmeister & Partners and will have the following objectives:

- To undertake a study of available project data and relevant traffic data relating to the B2 intersection towards the town of Arandis.
- To determine the increase in traffic due to the proposed project.
- To undertake a sensitivity analysis of changes to the current traffic situation at the B2 intersection towards Arandis.
- To summarise the expected traffic impact and provide measures going forward.

11 CONCLUSION AND SEIA STATEMENT RELATING TO THE INFRASTRUCUTRE CORRIDOR

This section concludes the report and provides the SEIA Statement (opinion) for the infrastructure corridor.

11.1 SUMMARY OF POTENTIAL IMPACTS ON THE SOCIAL AND BIOPHYSICAL ENVIRONMENT

The potential impacts associated with the construction, operation and decommissioning phases of the linear infrastructure corridor were identified through a screening and scoping exercise and assessed by a team of specialists. Each impact was assigned with a significance rating with and without the implementation of mitigation measures as indicated in Table 61.

The potential socio-economic impacts that have been identified were covered by other specialist investigations or in the SEMP. Therefore, apart from the identification of overarching issues, a detailed socio economic impact assessment has not been conducted for the construction and operations of the linear infrastructure. A detailed socio-economic specialist study will however be conducted as part of the next phase of the SEIA process considering the mining of the Z20 ore body.

Table 61: Summary table of impact significance

Impact	Significance rating	
	Without mitigation	With mitigation
Socio-economic		
No social study conducted for phase 1		
Air quality		
PM_{10} impact during the construction phase	Low (-)	Low (-)
PM_{10} impact during the operational phase	High (-)	Low (-)
PM_{10} impact during the decommissioning phase	Low (-)	Very low (-)
Dust fallout impact during the construction phase	Low (-)	Low (-)
Dust fallout impact during the operational phase	High (-)	Low (-)
Dust fallout impact during the decommissioning phase	Low (-)	Very low (-)
Radiation		
Dust inhalation, external exposure and radon inhalation during construction and operational	Very low (-)	Very low (-)
Biodiversity		
Impact on watercourse habitat loss due to road construction	High (-)	Low (-)
Impact of road construction and operation on animal movement	Medium (-)	Low to medium (-)
Impact of road construction and operation on Husab Sand Lizard	High (-)	Low (-)
Impact of aquatic habitat loss due to road construction	High (-)	High (-)
Impact of Hillslope habitat loss due to conveyor construction	Very low (-)	Very low (-)
Impact of conveyor and power line on bird populations	Low (-)	Very low (-)
Impact of road operation on susceptible vertebrate populations	Low (-)	Very low (-)
Impact on Khan Hillslope habitat range-restricted endemics	Medium (-)	Medium (-)
Impact on integrity of NNNP	High (-)	High (-)
Archaeology		

Impact on sensitive archaeological sites	High (-)	Medium (-)
Noise		
Day time cumulative noise impact significance at noise sensitive receptors located on the ay plains as a result of the infrastructure corridor	Very low (-)	Very low (-)
Construction phase impacts within the Khan River valley	Medium (-)	Medium (-)
Day time cumulative noise impact significance at noise sensitive receptors located on the plains as a result of the infrastructure corridor	Very low (-)	Very low (-)
Night time cumulative noise impact significance at noise sensitive receptors located on the plains as a result of the infrastructure corridor	Very low (-)	Very low (-)
Day time cumulative noise impact significance within the Khan River valley as a result of the infrastructure corridor	High (-)	Medium (-)
Night time cumulative noise impact significance within the Khan River valley as a result of the infrastructure corridor	High (-)	Medium (-)
Surface water		
Impact assessment of aerial conveyor on surface water	Low	Very low
Impact assessment of access road on surface water	Low	Very low
Visual		
Construction phase impact assessment rating	Medium (-)	Medium (-)
Operational phase impact assessment rating	High (-)	Medium to High (-)
Decommission phase impact assessment rating	High (-)	Low (+)

The most significant negative impacts, i.e. those of a medium or high negative rating, with mitigation include the following:
Impact of road construction and operation on animal movement

- Impact of road construction and operation on animal movement;
- Impact of aquatic habitat loss due to road construction;
- Impact on Khan Hillslope habitat range-restricted endemics;
- Impact on integrity of NNNP;
- Impact on sensitive archaeological sites;
- Construction phase impacts within the Khan River valley;
- Day time cumulative noise impact significance within the Khan River valley as a result of the infrastructure corridor;
- Night time cumulative noise impact significance within the Khan River valley as a result of the infrastructure corridor;
- Construction phase visual impacts; and
- Operational phase visual impacts.

11.2 CONCLUSIONS

The following section concludes the findings of the various specialists' studies and impacts assessments and key issues will again be repeated below.

11.2.1 Socio-economic conclusions

Most of the socio-economic issues were covered by the other specialists investigations. Therefore the conclusions for the visual-, air quality-, noise-, radiation- and biodiversity impact assessments that follows below are relevant as well as the SEMP.

The socio-economic impacts described in Section 8 shall be investigated and assessed further in the SEIA phase, and mitigation measures will be suggested.

11.2.2 Visual impact assessment conclusions

The Erongo Region's most predominant features are the extreme arid nature of the coastline and surrounding Namib Desert. A component of the Erongo Region's sense of place is created by the mining industry, which plays an important role in employment, mineral production, total export earnings and social advancement in Namibia.

The Z20 uranium deposit is located south of the Khan River in the NNNP. The Khan River was identified by MME (2010) as a special red flag area and rated high for this category. The landscape along the corridor is dominated by the rocky outcrops formed by the erosion of the Khan River and a small section of the gravel plains of the Welwitschia plains to the east. With the large rocky outcrops surrounding the meandering dry Khan River, the landscape value is rated as Moderate to High. As the proposed corridor is mainly located in the lower-lying valley areas of the Panner Gorge, Khan River and Khan River tributary, the visibility of the project is contained and has a local geographic zone of influence.

The remoteness of the location reduces the visual exposure to people other than visitors in the Khan River that will be subjected to high exposure The Khan River is a known 4x4 route that is utilised by local 'Swakopmunders' and tourists for desert recreation. Should permission be granted for this proposal, it must be recognised that the current landscape character of this section of the Khan River area will be degraded.

Without mitigation, the visual significance would be High Negative due to permanent high exposure to the Khan River receptors and the proximity to the NNNP.

Should the overhead conveyor not be removed post closure, landscape decay could take place and further reduce the attraction value of the Khan River and surrounding areas. With effective mitigation, the visual significance would be reduced to Moderate in the long term with opportunities for the proposed Z20 access road winding through the Panner Gorge and across the Khan River to become a tourist route.

11.2.3 Biodiversity impact assessment conclusions

The current assessment showed that there are no fatal flaws from a biodiversity perspective and that most impacts can potentially be decreased to at least a level of Low to Medium Negative with appropriate mitigation or avoidance.

Important exceptions to the rule are the expected loss of two springs which could be a critical resource for numerous animals and plants and the likelihood of cumulative impacts both because of this loss and as a result of interference of movement of animals by the construction and maintenance of the access road and water pipeline. Additional cumulative impacts could occur as a result of the associated loss of small parcels of habitat in the important Khan River Mountain / Hillslope habitats.

The loss of the springs cannot be mitigated and can only be avoided by an alternative route for the access road.

There is a proviso on the expected impacts as a result of the loss of the two springs and the interference of movement by the road and pipeline. The magnitude, extent and importance of these impacts can only be assumed at this stage because there are no data available on the distribution, types and temporal dynamics of natural water points, or on the frequency of use of these resources by animals.

11.2.4 Archaeology impact assessment conclusions

The duration of impacts on archaeological sites must be considered as long term. However, there will be little direct impact from the aerial ropeway other than the footings of the support pylons. The other components of the infrastructure corridor will be confined to the Panner Gorge on the northern side of the Khan valley, and the area of possible encroachment on the archaeological sites is easily defined and managed.

The significance of impact in the case of the Pleistocene sites would be considered as Medium to High significance without mitigation. In the case of the relatively insignificant sites (i.e. all except the four Pleistocene sites) the impact rating of the sites could be reduced adopting appropriate mitigation measures.

11.2.5 Noise impact assessment conclusions

A conservative approach was followed in the estimation of predicted noise impacts. Impacts were predicted for the day- and night-time hour during which noise impacts would be most significant. Construction and decommissioning phase noise impacts are likely to be similar.
Impacts were predicted for the day- and night-time hour during which noise impacts would be most significant as follows:

- The increase in noise level over reported baseline noise levels for the construction phase were:
    - Between 1.9km and 5km during the day.
- The increase in noise levels over reported baseline noise levels for the operational phase were:
    - Between 500m and 2.5km during the day; and
    - Between 1.4km and 1.7km during the night.
- The significance of cumulative noise impacts at noise sensitive receptors located on the plains to the north of the Khan River is Very Low negative.
- The significance of cumulative noise impacts on visitors to Khan River valley close to the infrastructure corridor crossing is Medium negative due to very quiet surroundings.
- Overall, with noise mitigation and management measures in place, impacts may be reduced to range between Very Low negative and Medium negative.

11.2.6 Surface Water impact assessment conclusions

The planned infrastructure corridor for the Z20 mining area will consist of amongst others an aerial RopeCon/ RailCon conveyor system and a road bridge. These will cross the Khan River in the vicinity of Panner Gorge, just south of the current Rössing Mine.

The aerial conveyor system will be mounted on towers located on the rocky ridges at the edge of the river channel so this infrastructure will have no physical footprint in the Khan River.

The road bridge will cross the Khan River at Panner Gorge and will consist of a double-lane road deck approximately 10m wide (1 lane per direction) and elevated 3.6m above the river channel. From the review of available literature on rainfall and flooding in the area of interest, it is concluded that the likely risks to surface water associated with these structures are Low to Very Low.

11.2.7 Air Quality impact assessment conclusions

PM_{10} ground level concentrations and dust fallout rates for the proposed operations were assessed in order to identify all possible detrimental impacts on the surrounding environment and human health. It can be concluded that the proposed Z20 infrastructure corridor will have high PM_{10} impacts near the conveyor transfer points with no mitigation in place. With the recommended mitigation measures applied, concentrations will be retained at the source. Dust fallout can be of high significance along the conveyor if not controlled, but is assessed to be low based on the proposed RopCon/ RailCon design and enclosure of the transfer points.

11.2.8 Radiation impact assessment conclusions

The total incremental doses due to unmitigated or mitigated infrastructure corridor operations are all below 10µSv/a. Cumulative doses, from the baseline and the proposed infrastructure corridor operations, ranged from a trivial 4.2µSv/a to a maximum value of 95.9µSv/a (at the Khan Mine site during unmitigated operations).

This low dose is approximately three times lower than the dose constraint of 300µSv/a. There seems to be no significant difference between the impacts of the current baseline operations and the cumulative impacts where the infrastructure corridor operations are added to the baseline operations.

There is no significant difference between the No-Go option and the go-ahead of the construction and operation of the infrastructure corridor. The decision to go forward with this project is therefore not depended on the radiological assessment, but rather on other specialist studies and/or project considerations.

The SEIA impact significance is therefore Very Low negative for both unmitigated and mitigated operations. There seems to be no significant difference between the impacts of the current baseline operations and the cumulative impacts where the infrastructure corridor operations are added to the baseline operations. Since the impact significance is low for both instances it implies that the No-Go option is not dependent on the outcome of this radiological assessment, but rather other specialist studies and project considerations.

11.3 SOCIAL AND ENVIRONMENTAL MANAGEMENT PLAN AND CLOSURE PLAN

The SEMP is intended to serve as a management guideline to ensure responsible OHSEC management of activities on a day-to-day basis for the entire project life cycle. The SEMP is also aimed at addressing concerns raised by environmental interest groups, the general public, and authorities with regard to responsible management, the control of these activities and ensuring that all interests are considered and catered for. The SEMP is included in Annexure D of this Scoping Report to allow authorities to take an informed decision when considering the application and also to review and, if required, have input in the manner in which the infrastructure corridor is managed into the future.

The SEMP further describes the proposed closure plan of the infrastructure corridor. Closure planning within Rio Tinto and its business units, including Rössing Uranium, is guided by the Rio Tinto closure standard and related guidelines. The standard and guidelines are based on best industry practice and are compatible with the International Council for Mining and Metals' sustainable development principles.

The technical studies for the infrastructure corridor have reached prefeasibility level of accuracy. A closure strategy has been conceptualised and follows that for all other infrastructure existing at the Rössing Uranium site. In the current Closure Plan, the approach with infrastructure is acknowledging that:

- Established infrastructure is of value to Namibia and should not be destroyed once funds to establish them are sunk. This is regarded as a sign of beneficial development and every effort should be made to identify alternative uses and to retain its benefits to society.
- Some possibilities of alternative use of the existing mine infrastructure after closure could be:
  - Other mining (and or similar industrial) operations may, for example, benefit from the use of the infrastructure after Rössing Uranium's operations come to an end.
  - Neighbours might identify alternative uses of the infrastructure; for example tourism operators may want to continue using the infrastructure for a non-mining / non-industrial purpose after Rössing Uranium's closure.
  - The dismantling of infrastructure and alternative use elsewhere might be possible, but the economic feasibility to relocate infrastructure requires close investigation. This option only applies to removable infrastructure such as pipelines and overhead infrastructure.
- Total decommissioning of infrastructure is considered as a last resort. Under this scenario the facilities will be demolished, salvaged and redundant material disposed of.

The final post-closure options for the corridor infrastructure are not yet known. The various options need to be identified in consultation with stakeholders closer to the time of closure and harmonised with the objectives of the overall Mine Closure Plan. This may for example imply that all tar roads are removed due to safety reasons. On the other hand, the retention of the corridor infrastructure may provide opportunities to create convenient access into and connections to the NNNP or to sites attractive for mining tourism.

Alternative strategies for each corridor component are described in the following paragraphs.

11.3.1.1 Aerial overland conveyor system

It is unlikely that the overland conveyor will remain in use for the transportation of materials across the Khan River once mining has been completed in the area. However, since the system will have been in place for about 20 years and the environment will have adjusted to its existence, it could be considered to retain it and convert it to a cable way for the transport of people. However, operating and maintaining the system safely and efficiently would require that sufficient funds are in place.

Should no further use be identified, the system will be removed. The conveyor manufacturer will be appointed to do the deconstruction work. Special methodologies and equipment will be required. The demolition of material transfer stations, electrical substation etc. is a common demolition task and would be performed by a specialised demolition contractor. Pylon platforms which are not visible and not accessible without helicopter might be left in place. Environmental disturbance due to the closure activities will be rehabilitated including landscaping, stabilisation of ground and ecological restoration.

Closure costs would generally be expected at 15% of the erection component of total construction cost, but might be higher for the conveyor system since it would require specialised equipment not available in Namibia.

11.3.1.2 Access road

Similar to the conveyor, it needs to be carefully considered whether the road will provide benefit for post mining related land use. This would be established in consultation with stakeholders and the regulatory authorities. Should the road be used in future it would need to be connected to the Rössing tarred private road and connected to the B2 after mine closure. An alternative would be to only maintain the road between the Khan River and the Welwitschia Plains. Preserving the road for future use would require sufficient funds for regular road maintenance.

Should it be decided to remove the road and bridge, this would be carried out by a road construction company that would have the necessary equipment to do so. This work would be the last activity on the schedule of activities to close the Z20 open pit. Prior to removal the access road it would be needed to transport people and equipment doing the demolition work and to transport demolition waste back to the Rössing disposal areas. It would therefore imply that demolition work starts at the Z20 mining site, retreating back to the Rössing Mine.

All demolition rubble would be disposed of at the Rössing Uranium tailings facility. This would mainly consist of broken up tar surfacing. Waste transport would be performed by mining haul trucks and it is estimated that between 100 and 200 truckloads would have to be transported back to the mine.

It will not be possible to remove the fill material brought in to construct the Khan / Welwitschia Plains section of the road. Fill material would be left in place but stabilised in specific areas to prevent erosion and subsequent deposition of the material in the Khan River over time. Run-off retention or diversion features might have to be constructed in certain areas to prevent rain water erosion. Landscaping and erosion control activities will be carried out based on detailed storm water control assessment. The area will be prepared to allow passive recolonisation by desert vegetation.

The top and bottom entrances to the road route will be closed by large boulders or other natural features to screen-off visual impacts caused by original road construction, to prevent vehicular access from the Khan and Welwitschia Plains and to prevent fill eroding into the Khan River.

The bridge would be dismantled and the demolition rubble taken to the mine. Pillars supporting the bridge would be totally excavated so that no reinforced concrete would remain within the river bed sediments.

After removal of the tar surface in Panner Gorge the road’s sub-base would be spread and worked into the Gorge sediments during landscaping and rehabilitation.

11.3.1.3 Water supply pipeline

The above ground portions of the water supply line and water storage facilities at the Z20 site will be demolished. Demolition waste will be taken to the Rössing Uranium site for disposal at the tailings dam or the domestic waste land fill site. Pipes would be made available for alternate use or would be given to the demolition contractor to partly offset demolition costs.

11.3.1.4 Diesel supply pipeline

The diesel supply line will be situated on top of the conveyor roof structure. The RopeCon/ RailCon maintenance trolley will be utilised to deconstruct the diesel line. Prior to removal, the diesel supply line will be emptied and flushed so that there will be no potential for hydrocarbon spillage. Pumping stations at Rössing Uranium and diesel storage tank removal on the Z20 site will follow standard decommissioning procedures routinely applied when fuel stations are demolished. Redundant materials will be disposed of with Rössing Uranium hazardous wastes including other hydrocarbon contaminated waste.

11.3.1.5 Powerline closure alternatives

It is proposed that the powerline and poles be removed by an electrical contractor during the closure phase.

11.4 URANIUM RUSH SEA CONSIDERED IN THIS SEIA

The findings/recommendations from the SEA (and associated SEMP) were considered in each of the specialist studies. The following table provides a summary of how the key recommendations from the SEA and SEMP that relate to the proposed project and this SEIA were addressed. In certain instances these recommendations can only be addressed during the next phase of this SEIA, as reflected in the table below.

Table 62: Uranium Rush recommendations and their link with this SEIA

SEA recommendation	How this is/will be addressed in this SEIA
Mining in protected areas to be avoided where possible.	The section of Rössing Uranium's ML 28 that contains the Z20 uranium resource falls within the NNNP. The impact of the project on the ecological integrity of the NNNP was assessed as part of this Scoping phase and the findings presented in Section 9.4.
Important biodiversity, tourism and heritage hotspot areas (red and yellow flag areas which are identified as unavailable for mining and prospecting unless an extraordinary mineral deposit of national importance occurs within the area) should be avoided.	Two sensitive biodiversity areas have been identified during scoping phase: • Specific areas of high biodiversity value were identified. Amongst these the 'Mountains surrounding Rössing', is especially relevant to this project. It was characterised by a high density of *Lithops ruschiorum* and *Adenia pechuelii*, the lizard *Pedioplanis husabensis* and the only known distribution of the spider *Moggridgea eremicola*. This habitat is the referred to as the "Khan Hillslope habitat" in the Scoping Report. • The Khan River was characterised as a linear

	oasis with riparian woodland, important for aquifer recharge and rich in wildlife). The above mentioned areas were included in the biodiversity assessment. Refer to Section 9.4 of the Scoping Report and Annexure C.
Mines must have specific biodiversity plans to minimise footprints, avoid impacts, and where impacts cannot be avoided, to mitigate, restore or offset impacts.	A biodiversity impact assessment for the infrastructure corridor was conducted as part of the Scoping phase (refer to Section 9.4 of the Scoping Report and Annexure C. Mitigation measures to avoid/minimise impacts on biodiversity are also provided in the above mentioned section of the report and included in the SEMP. However, certain impacts cannot be avoided as no mitigation measures can at this stage be provided (i.e. the loss of springs as a result of the proposed road). Natural water points cannot be recreated once lost. The establishment of replacement artificial waterpoints has been suggested. The excessive provision of water in previously waterless areas (which is usually what happens when artificial water is provided) may lead to local overexploitation of resources, defeating the object of the exercise. In addition, the long term maintenance of such waterpoints beyond decommissioning is problematic. Artificial provision of water should therefore be seen as a last resort. A further cumulative biodiversity impact assessment will be conducted to assess the potential impacts associated with the Z20 mining and associated activities. This will be conducted as part of the next phase of the SEIA.
Infrastructure corridors are to be carefully planned to avoid ecologically sensitive areas, and demonstrate: consideration of alternatives; optimization of service provision; and commitment to the ‘green route.	The proposed infrastructure corridor (including the overland conveyor belt and diesel line on the conveyor, access road and water and electricity lines) will run across the Khan River and run to a certain extent parallel to the proposed (already approved) linear infrastructure for the Husab mine. The two “infrastructure corridors” cross the Khan River approximately 5km from each other. Therefore, should both these infrastructure corridors be implemented, it contradicts the recommendation provided in the SEMP for mines to develop infrastructure corridors together, preventing “infrastructure crisscrossing the desert” and minimising/preventing impacts on ecological sensitive areas. The cumulative impacts resulting from the proposed Rössing Uranium infrastructure corridor, associated with the Z20 mining project, was assessed taking cognizance of the above mentioned. The findings from the

	assessment are presented in Section 9 of the Scoping Report.
Mines to share infrastructure to the greatest extent possible, thus minimising the proliferation of infrastructure.	See previous response.
Infrastructure planning and investment to take into account future demand, thus reduces the need for additional infrastructure with resulting additional impacts (e.g. one shared pipeline as opposed to three).	See previous response.
All EIAs must consider the possibility of extinction of biotic species and resources must be available for reasonable investigation to determine the risk and avoid such an impact.	A biodiversity impact assessment for the infrastructure corridor was conducted as part of the Scoping phase (refer to Section 9.4 of the Scoping Report and Annexure C. The possibility of extinction of biotic species and resources were also considered during this investigation. A further cumulative biodiversity impact assessment will be conducted to assess the potential impacts associated with the Z20 mining and associated activities. This will be conducted as part of the next phase of the SEIA.
Areas of importance for recreation that are not yet alienated by mining or prospecting are declared 'red flag' areas for prospecting or mining (i.e. to be avoided). This includes the Khan River.	The Khan River will be crossed by the proposed linear infrastructure. The potential impacts associated with third parties using the Khan River for recreational purposed was included in the relevant assessments. Refer to Section 9 of the Scoping Report.
Direct and indirect visual scarring is to be avoided and if this is not possible, to be kept within acceptable limits.	A visual impact assessment was conducted for the proposed linear infrastructure, also taking the proposed (approved) linear infrastructure for the Husab mine (approximately 5km downstream of the Khan River into consideration. A further cumulative visual impact assessment will be conducted to assess the potential impacts associated with the Z20 mining and associated activities. This will be conducted as part of the next phase of the SEIA.
Planning should ensure that accidents on public roads and at key intersections should decline from current trends. In addition, all roads carrying more than 250 vehicles per day must be strengthened, tarred and provided with proper intersections to the mines. The mine intersections need to have clear road signs and road markings.	A traffic impact assessment will be conducted as part of the next phase of the SEIA processes. Refer to Section 10.2.11 for the proposed Terms of Reference.
Disease rates amongst the public must not increase as a result of activities/impacts related to the uranium mines.	A Socio-economic impacts assessment will be conducted as part of the next phase of the SEIA. This issue will be taken into consideration.
Cumulative radiation doses to the public must not exceed one mSv/a above background.	The cumulative radiation doses to the public relating to the proposed infrastructure corridor were assessed as part of the scoping phase (Refer to Section 9.3 of the Scoping Report and Annexure C). The study found that cumulative radiation doses to the public will not exceed one mSv/a above background as a result of the proposed activities associated with the linear infrastructure.

	A further cumulative radiation impact assessment will be conducted to assess the potential impacts associated with the other project components. This will be conducted as part of the next phase of the SEIA. (Refer to Section 10.2.10 for the Terms of Reference).
Annual human exposure to particulate concentrations and dust fall out must comply with the limits as determined by the SEA evaluation criteria.	An air quality impact assessment was conducted for the proposed infrastructure corridor as part of the Scoping phase. The study found that the proposed infrastructure corridor will have high PM_{10} impacts near the conveyor transfer points with no mitigation in place. With the recommended mitigation measures applied, concentrations will be retained at the source. Dust fallout can be high along the conveyor if not controlled; but is expected to be low based on the proposed RopeCon/ RailCon design and enclosure of the transfer points. (Refer to Section 9.2 of the Scoping Report and Annexure C.) A further air quality impact assessment will be conducted to assess the potential impacts associated with the other project components. This will be conducted as part of the next phase of the SEIA. (Refer to Section 10.2.9 for the Terms of Reference).
Mines are to implement mitigation measures to control dust emissions at all major dust generating sources such as haul roads, materials transfer points and crushing operations. These measures must be monitored by a network of fallout buckets and by ambient monitoring.	With reference to the above mentioned air quality impacts assessment relevant mitigation measures are provided in the Scoping Report (Section 9.2.4) and was also included in the SEMP. The study further provide recommendations on how the existing dust monitoring network at relating to the Rössing Uranium operations should be updated to allow for the monitoring of the proposed infrastructure corridor.
Public roads that will act as main access routes to mining operations should be paved or changed into salt roads to reduce dust generation.	The proposed road will be tarred. Refer to Section 6.2 of the Scoping Report.
Uranium mines do not compromise surface and groundwater quality, movement and availability.	A surface water study was conducted for the proposed infrastructure corridor as part of the Scoping phases and found that with appropriate designs, etc. the quality, movement and availability will not be compromised. (Refer to Section 9.7 of the Scoping Report and Annexure C.) A surface water and geohydrological impact assessment will be conducted to cumulatively assess the potential impacts associated with the other mining related project components. This will be conducted as part of the next phase of the SEIA. (Refer to Sections 10.2.8 and 10.2.7 for the Terms of Reference).
All mines must use desalinated water for	Rössing Uranium has committed to using desalinated

operational phase activities.	water for all present and future water demands. As soon as desalinated water is available Rössing Uranium will take all water demand from this source to change water sources from aquifers to desalination as soon as possible.
In order to conserve water and control dust from roads, dust emissions from un-surfaced roads should be controlled by chemical binding agents rather than water.	The proposed road will be tarred. Refer to Section 5.2.2.3 of the Scoping Report.
All mining and related developments must be subject to archaeological assessment and no unauthorised archaeological impacts should occur.	An archaeological impact assessment was conducted for the proposed infrastructure corridor as part of the Scoping phases and found that the proposed linear infrastructure may threaten a small number of important Pleistocene archaeological sites, and would therefore require appropriate mitigation measures including design and construction guidelines. Refer to Section 9.5 of the Scoping Report and Annexure C). A further cumulative biodiversity impact assessment will be conducted to assess the potential impacts associated with the Z20 mining and associated activities. This will be conducted as part of the next phase of the SEIA.
Existing proclaimed towns must be supported by mines.	Rössing Uranium supports selected initiatives through its CSI program.
Mines must employ mainly locals.	This commitment was included in the SEMP.

11.5 SEIA STATEMENT

In the mitigated scenario, the potential negative impacts associated with the proposed infrastructure corridor are expected to be mainly between low and medium significance. However three potential impacts relating to visual and biodiversity cannot be mitigated and the potential impacts cannot be avoided.

The potential cumulative negative impacts associated with the integrity of the NNNP was assessed as high and cannot be mitigated, taking into consideration existing and future mining and exploration activities. The proposed linear infrastructure south of the Khan River is also located within the NNNP and will cumulatively contribute to this issue.

The other potential impact that cannot be mitigated relates specifically to the proposed road and the potential impact on the Khan Hillslope habitat range-restricted endemics (i.e. loss of two springs which could be a critical resource for numerous animals and plants). It must further be noted that the potential for mitigation to decrease expected impacts on animal movement is unknown and the assessment for this impact is therefore dependent on adequately demonstrating the extent of use of the tributaries and the bridge underpass by animals, to put the impact into its proper regional context.

There is a proviso on the expected impacts as a result of the loss of the two springs and the interference of movement by the road and pipeline. The magnitude, extent and importance of these impacts can only be assumed at this stage because there are no data available on the distribution, types and temporal dynamics of natural water points or on the frequency of use of these resources by animals.

A study therefore needs to be done to properly quantify the extent of the risk that these developments pose, and to better place the overall impact into context, or to avoid the proposed road route by an alternative route for access to the proposed Z20 mining area.

Also, the proposed infrastructure corridor will run to a certain extent parallel to the proposed (already approved) linear infrastructure for the Husab mine. The two proposed "infrastructure corridors" cross the Khan River approximately 5km from each other. This contradicts the recommendation provided in the SEMP for mines to develop infrastructure corridors together, so that lines for road, power and water are clustered together to reduce to total area of disturbance.

Cumulative impacts from repeated views of mining related road and other infrastructure within the river valley could degrade the existing natural wilderness sense of place and reduce the viability of the Khan River as a tourist attraction.

In this regard, the collaboration between different mines (in this case between Rössing Uranium and Swakop Uranium) must be considered as a preferred option should the proposed Z20 mining and associated activities be approved.

It is therefore recommended that Rössing Uranium should give serious consideration to a solution for the Z20 project that does not require construction of a highly intrusive road. Two possible alternatives might be a road based on the largely unused road to Zhonghe Resources, or a possible shared-use agreement with the new Husab Project access road. Alternatives should be based on a general principle of reducing the number of infrastructure corridors across the Khan valley.

The RopeCon/ RailCon aerial conveyor system will, however, have less significant impacts when compared to the impacts of the road with its associated infrastructure (i.e. waterline and powerline). It is therefore the opinion of Aurecon and SLR that the RopeCon/ RailCon aerial conveyor can be approved based on this assessment. Approval of the other components could only be considered pending the proposed further studies prescribed in this report.

11.6 WAY FORWARD

The way forward for the scoping phase is as follows:

- Distribute the Scoping Report (including the various specialist studies and SEMP relating to the infrastructure corridor) for review to IAPs and relevant authorities by 16 November 2012;
- The comments period for the above mentioned documentation runs from 16 November until 14 December 2012;
- Receive all comments from IAPs and relevant authorities by 14 December 2012;
- Consider comments received and update the report(s) where relevant;
- Submit the final Scoping Report (including the various specialist studies and EMP relating to the infrastructure corridor) to MET; and
- Await decision whether environmental clearance will be issued for the infrastructure corridor and receive comments on the terms of reference for further investigation (relating to the other Z20 related project components) from MET to be communicated to IAPs.

11.6.1 Description of the tasks planned for the SEIA process for the remaining Z20 project components

The terms of reference for an assessment must set out the approach that the proponent intends to follow in undertaking an assessment in accordance with the Act. Section 9 of the Environmental Impact Assessment Regulations promulgated in February 2012 under the Environmental Management Act stipulates the following requirements for the terms of reference:

- A description of all tasks to be undertaken as part of the assessment process, including any specialist studies to be included if needed;
- an indication of the stages at which the Environmental Commissioner (EC) is to be consulted;
- a description of the proposed method of assessing the environmental issues and alternatives; and
- the nature and extent of the public consultation processes to be conducted during the assessment process.

All tasks and activities to be undertaken as part of this SEIA process and the stages at which the EC was/will be consulted are described in Section 1.4 this report. The terms of reference for further planned specialist investigations are provided in Section 10 of this report and relate to the following components of the project:

- Mining of the Z20 ore body;
- Disposal of Z20 waste rock;
- Amendment of the approved Acid Plant Environmental Clearance;
- Processing plant modifications;
- Changes to the present Tailings Storage Facility (TSF); and
- Establishment of a new High Density TSF on the Rössing Dome.

It therefore excludes the infrastructure corridor, which was assessed as part of Section 9 of this Scoping Report.

The terms of reference for the abovementioned specialist investigations have been developed to address all the issues that have been identified in the scoping process and include the methodology in which the tasks will be completed.

11.6.2 Proposed method for assessing social and environmental issues and alternatives

11.6.2.1 Assessment of social and environmental issues

The assessment methodology and criteria that will be used for the further investigations will be the same as applied for the infrastructure corridor. This overarching assessment methodology and criteria is presented in Section 7 of this report. Detailed methodologies and study objectives relating to each specialist investigation are also presented in Section 7.

11.6.2.2 Assessment of alternatives

Project alternatives have been discussed in Section 6 of this report. Any additional alternatives relating to the mining and processing components of the project (excluding the infrastructure corridor) that are identified and that require assessment will be subjected to a relative comparison based on selected criteria.

11.6.3 Stakeholder (including public) consultation process during the assessment phase for the remaining Z20 project components

Copies of the SEIA Report will be distributed to IAPs and relevant authorities for review in the same way as the scoping report. It is expected that the report will be distributed for review towards May 2013.

Public open days and relevant focus group meetings will be held within the 21 day comment period. All comments received from stakeholders in the review period will be considered and, where required, the report will be updated or amended. The final SEIA Report (including stakeholder comments) will be submitted to MET for a decision whether clearance for the mining of the Z20 ore body can be given. It is expected that the final SEIA Report will be submitted to MET towards the middle of June 2013.

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Social and Environmental Management Plan