

DRAFT VISUAL IMPACT ASSESSMENT

PROPOSED RÖSSING URANIUM MINE Z20 URANIUM DEPOSIT INFRASTRUCTURE CORRIDOR

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This document was completed by Silver Solutions 887 cc trading as VRM Africa, a Visual Impact Study and Mapping organisation located in George, South Africa. VRM Africa cc was appointed as an independent professional visual impact practitioner to facilitate the VIA.

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I, Stephen Stead, principle author of the Visual Impact specialist report, hereby declare that I am an independent consultant, appointed to provide specialist input on the proposed project. I hereby confirm that I have no business, financial, personal or other interest in the activity, application or appeal in respect of which I have been appointed, other than fair remuneration for work performed in connection with the activity and application. All opinions expressed in this specialist report are my own.



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ACRONYMS

<i>APHP</i>	Association of Professional Heritage Practitioners
<i>BLM</i>	Bureau of Land Management (United States)
<i>BPEO</i>	Best Practicable Environmental Option
<i>CALP</i>	Collaborative for Advanced Landscape Planning
<i>DEA&DP</i>	Department of Environmental Affairs and Development Planning (South Africa)
<i>DEM</i>	Digital Elevation Model
<i>DoC</i>	Degree of Contrast
<i>EIA</i>	Environmental Impact Assessment
<i>EMP</i>	Environmental Management Plan
<i>GIS</i>	Geographic Information System
<i>GRN</i>	Government of the Republic of Namibia
<i>HPS</i>	High-Purity Standards
<i>IAIAsa</i>	International Association of Impact Assessment, South African Affiliate
<i>I&APs</i>	Interested and Affected Parties
<i>IEMA</i>	Institute of Environmental Management and Assessment (United Kingdom)
<i>KOP</i>	Key Observation Point
<i>LRC</i>	Lighting Research Centre
<i>MAMSL</i>	metres above mean sea level
<i>MET</i>	Ministry of Environment and Tourism
<i>MLA</i>	Mine License Area
<i>MME</i>	Ministry of Mines and Energy
<i>NNP</i>	Namib-Naukluft National Park
<i>NELPAG</i>	New England Light Pollution Advisory Group
<i>ROD</i>	Record of Decision
<i>SAIEA</i>	Southern African Institute for Environmental Assessment
<i>SEA</i>	Strategic Environmental Assessment
<i>SEMP</i>	Strategic Environmental Management Plan
<i>VAC</i>	Visual Absorption Capacity
<i>VIA</i>	Visual Impact Assessment
<i>VRM</i>	Visual Resource Management
<i>ZVI</i>	Zone of Visual Influence

GLOSSARY

Best Practicable Environmental Option (BPEO)

This is the option that provides the most benefit, or causes the least damage, to the environment as a whole, at a cost acceptable to society, in the long, as well as the short, term.

Cumulative Impact

The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time.

Impact (visual)

A description of the effect of an aspect of a development on a specified component of the visual, aesthetic or scenic environment, within a defined time and space.

Issue (visual)

Issues are concerns related to the proposed development, generally phrased as questions, taking the form of "what will the impact of some activity be on some element of the visual, aesthetic or scenic environment?".

Key Observation Points (KOPs)

KOPs refer to receptors (people affected by the visual influence of a project) located in the most critical locations surrounding the landscape modification, who make consistent use of the views associated with the site where the landscape modifications are proposed. KOPs can either be a single point of view that an observer/evaluator uses to rate an area or panorama, or a linear view along a roadway, trail or river corridor.

Management Actions

Actions that enhance the benefits of a proposed development, or avoid, mitigate, restore or compensate for, negative impacts.

Receptors

Individuals, groups or communities who would be subject to the visual influence of a particular project.

Sense of Place

The unique quality or character of a place, whether natural, rural or urban.

Scenic Corridor

A linear geographic area that contains scenic resources, usually, but not necessarily, defined by a route.

Scoping

The process of determining the key issues, and the space and time boundaries, to be addressed in an environmental assessment.

Viewshed

The outer boundary defining a view catchment area, usually along crests and ridgelines. Similar to a watershed. This reflects the area in which, or the extent to which, the landscape modification is likely to be seen.

Zone of Visual Influence (ZVI)

The ZVI is defined as 'the area within which a proposed development may have an influence or effect on visual amenity.'

1 INTRODUCTION

VRM Africa was appointed by Aurecon Namibia Pty (Ltd) to undertake a Visual Impact Assessment (VIA) for the proposed infrastructure corridor of the Z20 uranium deposit for Rössing Uranium Limited (Rössing). The Rössing mining area is bordered by the town of Arandis near the western edge of the Central Namib Desert, which lies approximately 10 km to the north-west, and by steep undulating slopes of the Khan River Valley and its tributaries, approximately 4, 5 km to the south-east.

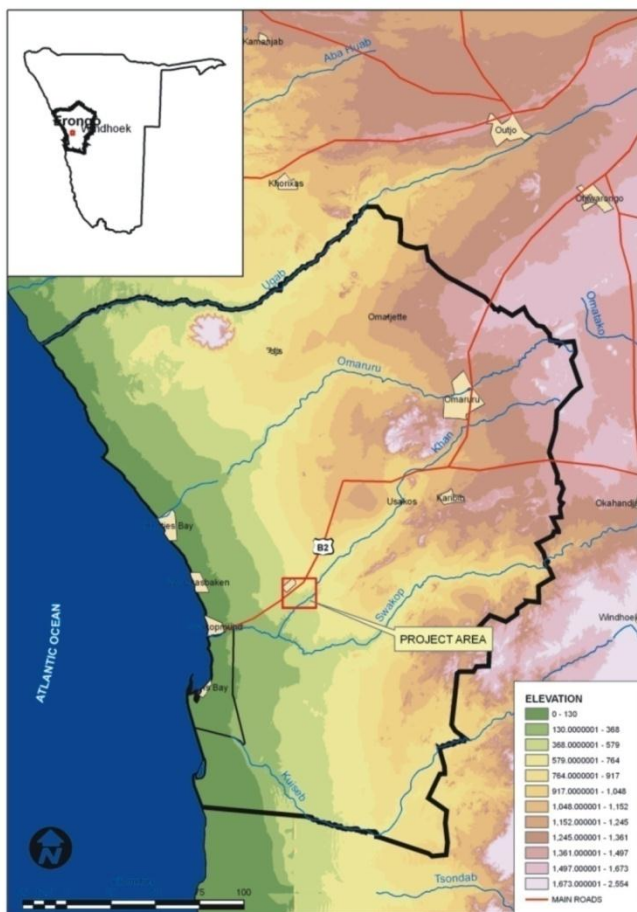


Figure 1: Regional Locality Map

Figure 1: Regional location map

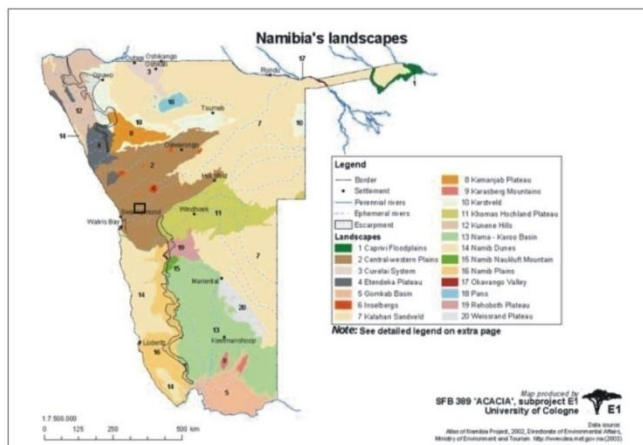


Figure 2: Geological Map of Namibia



Figure 3: Google Tourist Map of Erongo

2 APPROACH TO STUDY

2.1 Terms of Reference

- The scope of the study is to cover the entire affected project area. This includes a site visit of the full site extent, as well as where potential impacts may occur beyond the site boundaries such as cumulative impacts.
- Collate and analyse all available secondary data relevant to the affected project area. The Rössing Uranium Mine Phase 1 and Phase 2 Visual Impact Assessments are to be used in the report.
- Cumulative effects: these must be considered in all impact reports.
- Specific attention must be given to the following:
 - Quantifying and assessing the existing scenic resources/ visual characteristics on, and around, the proposed site.
 - 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 for inclusion into the project design, including input into the Environmental Management Plan (EMP).

2.2 Summary of Visual Impact Assessment Methodology

The process that VRM Africa follows when undertaking a VIA is based on the United States Bureau of Land Management's (BLM) Visual Resource Management method. This mapping and GIS-based method of assessing landscape modifications allows for increased objectivity and consistency by using a standard assessment criteria and involves the measurement of contrast in the form, line, texture and colour of the proposed landscape modification brought about by a project, against the same elements found in the existing natural landscape.

The first step in the VIA process is determining the existing landscape context. A regional landscape survey is undertaken, which identifies defining landscape features that surround the site of a proposed development, and sets the scene for the VIA process to follow. These features, also referred to as visual issues, are assessed for their scenic quality/ worth. A VIA also assesses to what degree people who make use of these locations (e.g. a nearby holiday resort) would be sensitive to change(s) in their views, brought about by a proposed project (e.g. a mine).

These people are referred to as receptors and are identified early on in the VIA process. Only those sensitive receptors who qualify as Key Observation Points (KOPs) by applying certain criteria, are used to measure the amount of contrast generated by changes caused by project activities, against the existing landscape (i.e. visual impact).

The landscape character of the proposed project site is then surveyed to identify areas of similar land use and landscape character. These areas are evaluated in terms of scenic quality (landscape significance) and receptor sensitivity to landscape change (of the site) in order to define the visual objective for the project site. The overall objective is to maintain a landscape's integrity, but this can be achieved at varying levels, called VRM Classes, depending on various factors, including the visual absorption capacity of a site (i.e., how much of the project would be "absorbed" or "disappear", into the landscape). The areas identified on site are categorised into these Classes by using a matrix developed by BLM Visual Resource Management, which is then represented in a visual sensitivity map.

Landscapes are sub-divided into 3 distance zones based on relative visibility from travel routes or

observation points. Proximity to surrounding receptors is evaluated in terms of these distance buffers: Foreground zone is less than 7km, background zone is from 7 to 24km. Viewshed maps are generated that indicate the overall area where the project activities would be visible, and in which distance buffer zone the receptors fall.

The proposed project activities are then finally assessed from the KOPs around the site to see whether the visual objectives (VRM Classes) defined for the site, are met in terms of measuring the potential change to the site's form, line, colour and texture visual elements, as a result of the proposed project (i.e. are the expected changes within acceptable parameters to ensure that the visual character of the landscape is kept intact and, if not, what can be done by the project to ensure that it is). Photo montages are generated to represent the expected change in the views, as seen from each KOP and, if class objectives are not met, to also show how proposed mitigation measures could improve the same views.

Using the impact assessment method provided by the environmental consultant, each project activity is then assessed for its visual impact. This is based on the contrast rating which was undertaken from each of the surrounding receptors on whether the proposed activities meet the recommended visual objectives defined, to protect the landscape character of the area. Recommendations are made and mitigations are provided.

Refer to Annexure 2 for a detailed description of the applied Visual Impact Assessment and Specialist Impact Assessment methodology.

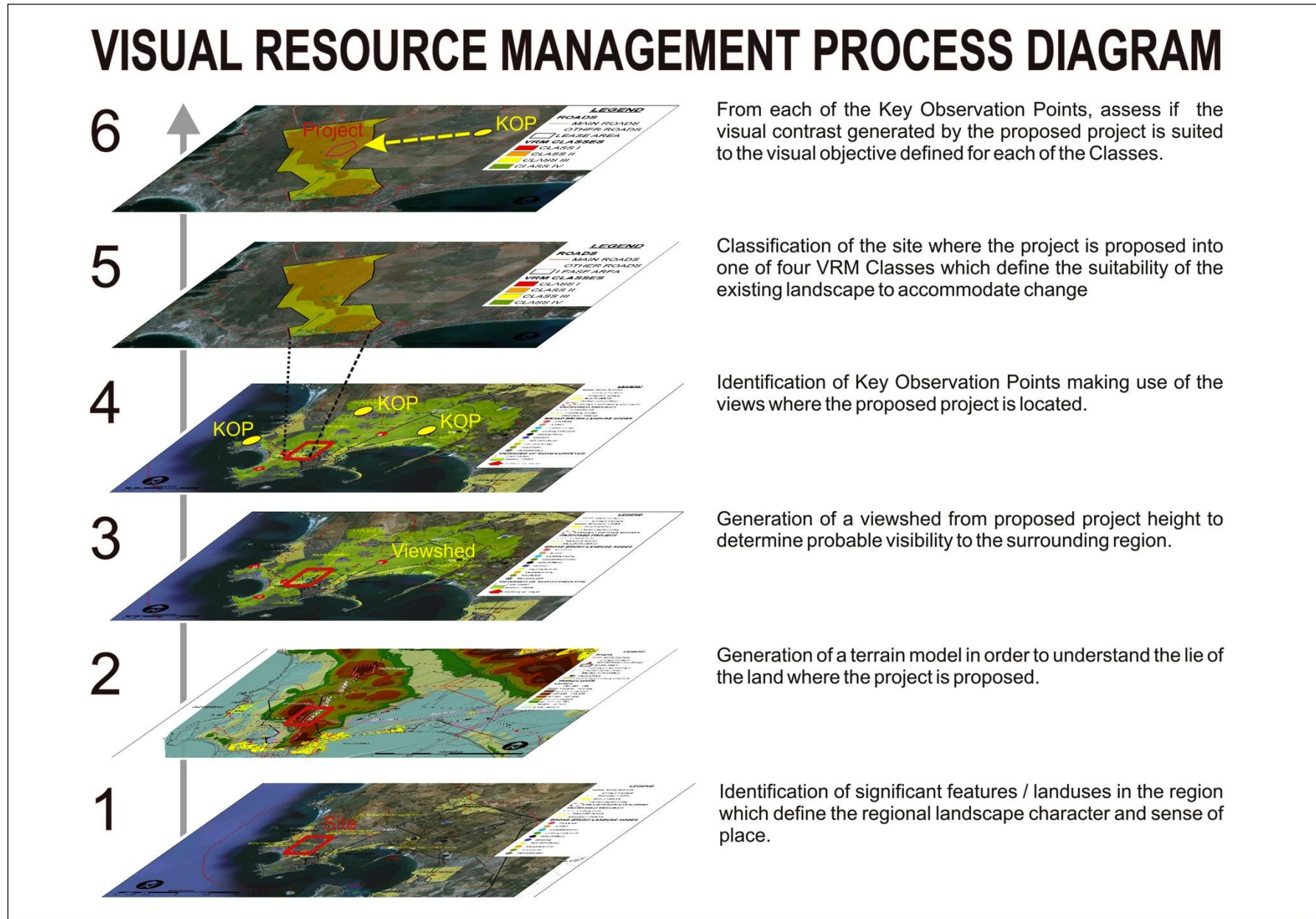


Figure 2: VRM Process Diagram

3 LIMITATIONS AND ASSUMPTIONS

- Although every effort to maintain accuracy was undertaken, as a result of the Digital Elevation Model (DEM) being generated from satellite imagery and not being a true representation of the earth's surface, the viewshed mapping is approximate and may not represent an exact visibility incidence.
- The use of Google Earth Pro for mapping is licensed for use in this document.
- The information for the terrain used in the 3D computer model on which the visibility analysis is based on is:
 - The ASTGTM_S2 3E014 and ASTGTM_S24E014 data set. ASTER GDEM is a product of METI and NASA (ASTER, Source: <https://lpdaac.usgs.gov>), and
 - South African Provincial Survey General data.
- Determining visual resources is a subjective process where absolute terms are not achievable. Evaluating a landscape's visual quality is complex, as assessment of the visual landscape applies mainly qualitative standards. Therefore, subjectivity cannot be excluded in the assessment procedure (*Lange 1994*). The project deliverables, including electronic copies of reports, maps, data, shape files and photographs, are based on the author's professional knowledge, as well as available information. The study is based on assessment techniques and investigations that are limited by time and budgetary constraints applicable to the type and level of assessment undertaken. VRM Africa reserves the right to modify aspects of the project deliverables if and when, new/ additional information may become available from research or further work in the applicable field of practice, or pertaining to this study.

In terms of best practice, and in the absence of specific Namibian regulations for Visual Impact Assessment, the following guidelines were referred to:

- Internationally, the U.K. Institute of Environmental Management and Assessment's (IEMA) 'Guidelines for Landscape and Visual Impact Assessment'; and
- from a Southern African perspective, the 'Guideline for Involving Visual and Aesthetic Specialists in EIA Processes' generated by South Africa's Provincial Government of the Western Cape, Department of Environmental Affairs and Development Planning.

'Principles that influences (development) within a receiving environment include the following:

- The need to maintain the overall integrity (or intactness) of the particular landscape or townscape;
 - The need to preserve the special character or 'sense of place' of a particular area; and
 - The need to minimize visual intrusion or obstruction of views within a particular area.'
- (*Oberholzer, B., 2005*).

4 LEGISLATIVE CONTEXT

4.1 Applicable Laws and policies

In order to comply with the Visual Resource Management requirements, it is necessary to clarify which planning policies govern the property area to ensure that the scale, density and nature of activities or developments are harmonious and in keeping with the sense of place and character of the area. The proposed landscape modifications must be assessed taking the following planning policies into consideration:

- Namibian Environmental Management Act
- Namibia Minerals Policy
- Rio Tinto policies
- Rössing Uranium Limited (RUL) policies

NAMIBIA'S ENVIRONMENTAL MANAGEMENT ACT (EMA)

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

- by establishing general principles for the management of the environment and natural resources;
- to promote the co-ordinated and integrated management of the environment;
- to give statutory effect to Namibia's Environmental Assessment Policy;
- to enable the Minister of Environment and Tourism to give effect to Namibia's obligations under international environmental conventions; and
- to establish certain institutions in particular to provide for a Sustainable Development Commission and Environmental Commissioner".

NAMIBIA'S MINERALS POLICY, NAMIBIAN MINISTRY OF MINES AND ENERGY

- Government must ensure that short to medium-term projects such as mining do not jeopardize the potential for long-term sustainable development in tourism. (*Minerals Policy of Namibia, Pg 13*)
- However, mining is also important to the national economy and this policy envisages controlled and justified prospecting and mining in these areas under conditions that will satisfy the protection of the environment. (*Minerals Policy of Namibia, Pg 13*)
- In order to reconcile the objectives of mineral exploitation and environmental protection, it is essential that the negative impacts of prospecting or mining activities on the environment be avoided, minimised and mitigated in accordance with national policy and legislation, and international best practice. (*Minerals Policy of Namibia, Pg 13*)
- While mining forms a very important part of the Namibian economy, it also has contributed to major environmental degradation. With respect to current and future operations, there is a need for appropriate legislation to regulate the environment in mining. (*Minerals Policy of Namibia, Pg 26*)

RIO TINTO ENVIRONMENTAL AND SUSTAINABILITY POLICIES

- Wherever possible we prevent, or otherwise minimise, mitigate and remediate, harmful effects of the Group's operations on the environment. (*Rio Tinto Environmental Policy*)
- Excellence in environmental performance is essential to our business success. Compliance with all environmental laws and regulations is the foundation on which we build our environmental performance. (*Rio Tinto Environmental Policy*)
- Rio Tinto develops Group wide standards and builds systems to identify, assess and manage environmental risk... to achieve continuous improvement in environmental performance. (*Rio Tinto Environmental Policy*)

- Rio Tinto businesses, projects, operations and products should contribute constructively to the global transition to sustainable development.
- Rio Tinto contributes to sustainable development by helping to satisfy global and community needs and aspirations, whether economic, social or environmental. This means making sustainable development considerations an integral part of our business plans and decision making processes. (*Rio Tinto Sustainability Policy*)

RÖSSING URANIUM LIMITED (RUL) POLICIES

In order to accomplish their vision and commitment to ... social responsibility and sustainability, Rössing will:

- commit to operate our business with respect and care for both the local and global environment in order to prevent and mitigate residual pollution
- be in full compliance with all applicable legislation, standards and requirements
- provide adequate training and resources to employees, contractors and visitors
- enhance biodiversity protection by assessing and considering ecological values and land-use aspects in investment, operational and closure activities (*Rössing Policy document www.rössing.com*)

URANIUM RUSH STRATEGIC ENVIRONMENTAL ASSESSMENT (SEA)

In 2009, the Southern African Institute for Environmental Assessment (SAIEA) was contracted by the Government of the Republic of Namibia (GRN) to undertake a Strategic Environmental Assessment (SEA) for the so-called 'central Namib Uranium Rush'. Some of their recommendations are listed below:

- 'The Erongo Uranium Rush presents significant opportunities for Namibia in terms of growth and development. However, in order to realise these benefits, all tiers of government, the mining companies and civil society (to a lesser extent) will have to overcome some major challenges and constraints. There are significant opportunities available to enhance the undoubted benefits of the Uranium Rush if the GRN has the political will and sufficient finances to implement all the necessary measures outlined in this Strategic Environmental Assessment (SEA) and Strategic Environmental Management Plan (SEMP).
- On the other hand, these benefits will come at a price – the Uranium Rush is partly located in a proclaimed national park and one of the most popular tourist hotspots in the country. Unless it is well managed and the necessary safeguards are in place, the Uranium Rush will negatively affect the environment – both at individual mine level and on a cumulative basis, which in turn will affect sense of place, tourism, lives and livelihoods. To ensure that the Uranium Rush has a positive influence on future development, the GRN, mining companies, local authorities and civil society must work together to eliminate, reduce or offset the negative impacts and enhance the benefits and synergies. For the Uranium Rush to leave a sustainable legacy, the recommendations made in the Strategic Environmental Management Plan (Chapter 8) must be successfully implemented.
- Most of the existing and proposed uranium mines are in, or adjacent to, national parks and protected areas. These areas are protected because of their special landscapes, biodiversity and heritage resources. While the Policy on Mining in Protected Areas allows mining and prospecting in Protected Areas, it is also possible in terms of the proposed Parks and Wildlife Management Bill of 2009, for MET and MME to agree to withdraw certain areas within parks from mining. One of the recommendations of this SEA is that certain biodiversity, tourism and heritage hotspots should be given Red Flag status and thus be permanently unavailable for mining and prospecting. This could limit the expansion of the uranium mines into certain areas in future, but at present there are numerous, extensive ore bodies which do not fall in the proposed Red Flag areas.
- The **natural beauty and ambience** of the desert will be compromised by the Uranium Rush because, even with the best environmental management plans in place, prospecting and

mining will result in visually intrusive infrastructure, dust and noise, and will scar the Namib for decades, or longer. At present, the largely undisturbed desert with its dramatic landscapes, interesting biodiversity and sense of place and space attracts numerous tourists every year.' (SAIEA, 2010)

4.2 Relevant standards to comply with

The International Finance Corporation (IFC) prescribes eight performance standards (PS) on environmental and social sustainability. The first is to identify and evaluate the environmental and social risks and impacts of a project, as well as to avoid, minimise or compensate for any such impacts. Under Performance Standard 6, ecosystem services are organized into four categories, with visual/ aesthetic benefits falling into the category of cultural services, which are the non-material benefits people obtain from ecosystems. This emotional enrichment that people experience and obtain from cultural ecosystems services is described by The Millennium Ecosystem Assessment, 2005, Ecosystems and Human Well-being: Synthesis report as follows: "Cultural ecosystems services: the non-material benefits that people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences."

The above includes the following, amongst others:

- Inspiration: Ecosystems provide a rich source of inspiration for art, folklore, national symbols, architecture, and advertising;
- Aesthetic values: Many people find beauty or aesthetic value in various aspects of ecosystems, as reflected in the support for parks, scenic drives, and the selection of housing locations;
- Sense of place: Many people value the "sense of place" that is associated with recognised features of their environment, including aspects of the ecosystem;
- Cultural heritage values: Many societies place high value on the maintenance of either historically important landscapes ("cultural landscapes") or culturally significant species; and
- Recreation and ecotourism: People often choose where to spend their leisure time based in part on the characteristics of the natural or cultivated landscapes in a particular area.

The visual experience is not limited to the visual senses, but is a multisensory emotional involvement experienced by people when they perceive a specific scene, landmark, landscape, etc. The assessment subject of Visual Impact assessment (VIA) is in itself a result of human perception.

5 DESCRIPTION OF THE AFFECTED ENVIRONMENT

5.1 Regional Landscape Context

Landscape character is defined by the U.K. Institute of Environmental Management and Assessment (IEMA) as the 'distinct and recognisable pattern of elements that occurs consistently in a particular type of landscape, and how this is perceived by people. It reflects particular combinations of geology, land form, soils, vegetation, land use and human settlement.' It creates the specific sense of place or essential character and 'spirit of the place' (*Spon Press, 2002*). The first step in the VIA process is determining the existing landscape context of the region and of the site(s) where the project is proposed.

Within the national context, the property is located in Namibia (*see Regional Locality Map in Figure 1*). 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-faceted grandeur and harsh splendour. 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. Etosha Pan, a dried-out saline lake to the north-east of the Rössing mine, is surrounded by grasslands and bush which supports a large, and varied, population of wildlife.

The population density is one of the lowest in the world at less than 2 people per km² which has resulted in an unspoilt coast, and vast untouched scenery and nature conservation areas. Namibia has 14 vegetation zones, ranging from several variations of desert vegetation to semi-desert, mopane, mountain, thorn bush, highland, dwarf shrub, camel thorn and mixed tree and shrub savannahs, as well as the forest savannahs and woodlands of the north-east. A desert plant that has stirred much interest amongst botanists worldwide is the living fossil, *Welwitschia mirabilis*, endemic to the Namib Desert and one of the oldest plants known to man.

Namibia, with its excellent infrastructure, is currently attracting a growing tourist industry. More specifically, the open desertscapes in the Erongo region 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 significance of the visual impact of mining in the region therefore, is potentially high.

Landscapes associated with the Erongo area are diverse. However, there is no specific desert-related form that is more significant than another. 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. Significant features within this viewscape are the mountain ranges and ridges which protrude from the flat horizons, creating focal points. 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.

Due to the inherent lack of available screening in context with the flatter, wide open vistas, there is a high potential for visual impact in desertscapes. The advantage of this type of environment is specifically related to isolation and its rugged nature, which limit the number of receptors to the area and increases the Visual Absorption Capacity (VAC) value. It is therefore of critical importance that development is managed in such a way that it does not detract from the elements which define the

significant landscape character that relates specifically to the tourist industry in the country. With regard to the Erongo Region, a number of key regional limitations were identified. Visual limitations are defined as landscape modifications which exceed the visual carrying capacity of the existing landscape and results in a radical change to the sense of place of an area or region. The key regional limitations in the area are:

- Cumulative visual impacts of existing and proposed large-scale mining operations in areas of significant desert landscape character. This is especially related to the associated impacts of the infrastructure – i.e. the roads, the power lines, railway lines, pipelines and water reservoirs, which are often inappropriately located in significant vistas.
- The lack of guidelines for Visual Resource Management for these very significant desert areas could result in uncontrolled development in significant desert vistas and tourist view corridors, which have the potential to undermine the sustainability of the flourishing tourist economy in the region.

5.2 Local Landscape Context

The Rössing mining area is bordered by the town of Arandis, near the western edge of the Central Namib Desert, which lies approximately 10km to the north-west, and by steep undulating slopes of the Khan River Valley and its tributaries, approximately 4,5km to the south-east. Much of the land surrounding the Rössing mining area remains uninhabited and unproclaimed, apart from the designated National Parks areas further to the east. This sparse inhabitancy and land-use pattern in the surrounding areas arises from the lack of surface and groundwater and the associated low agricultural potential. Vehicle access to the site's main gate is via a single, privately-owned road, also referred to as the 'Rössing Road', off the B2 highway that connects Swakopmund to Usakos (*Ninham Shand. 2007*). As indicated in Figure 3, the main features within this landscape are:

- The Rössing mine, which is one of the largest open pit uranium mines in the world, started in 1976 and which has resulted in a number of major mining-related landscape modifications. The mine has recently undertaken a Social Environmental Impact Assessment (SEIA) for the expansion of its mining and processing capacity. The new projects include the expansion of the tailings storage facility, a heap leach facility, a ripios site (leached ore residue) and additional processing plants. The footprints of the projects are indicated in yellow on Figure 3 on the following page.
- The small town of Arandis was initially developed by Rössing to accommodate its employees.
- The B2 National Road, which is the main link road between the Namibian interior and the coast. This route carries a large volume of tourist traffic and as such is recognised as having a regional View Corridor status.
- The Arandis airport, a small aerodrome currently being utilised by a Swakopmund-based flight training school.
- Swakop Uranium Husab Mine, which has been granted mining rights in the area and which is indicated on the map in Figure 3 as a red dotted line. The proposed mine would include two open pits, a combined waste rock dump and tailings facility, a processing plant, as well as an access route through the Khan River Valley, which includes a section of road which is routed along the Khan River. The predicted viewshed and zone of visual influence of the planned Husab mine is depicted in Figure 4. As indicated, the section where the Z20 pit is located is adjacent to the Husab mine, and the landscape character of this site would be significantly impacted. The VIA impact rating defined for the Husab mine VIA was High. (*Newtown Landscape Architects. 2010*) Although preliminary work has started on construction of the proposed mine with the establishment of a temporary access road through the Khan River, the visual impact of the proposed mine will not be taken into consideration in determining the baseline as the main mining activities have not started and the landscape context is still strongly associated with a natural landscape.

- The Khan River, which is utilised as a tourist 4x4 route. Tourists travelling up the Khan River will be exposed to the Husab Mine access road, which is routed along the Khan River for 2,4 km.
- The Welwitschia Plains and Namib Naukluft National Park (NNP) areas which are currently an important tourist destination.

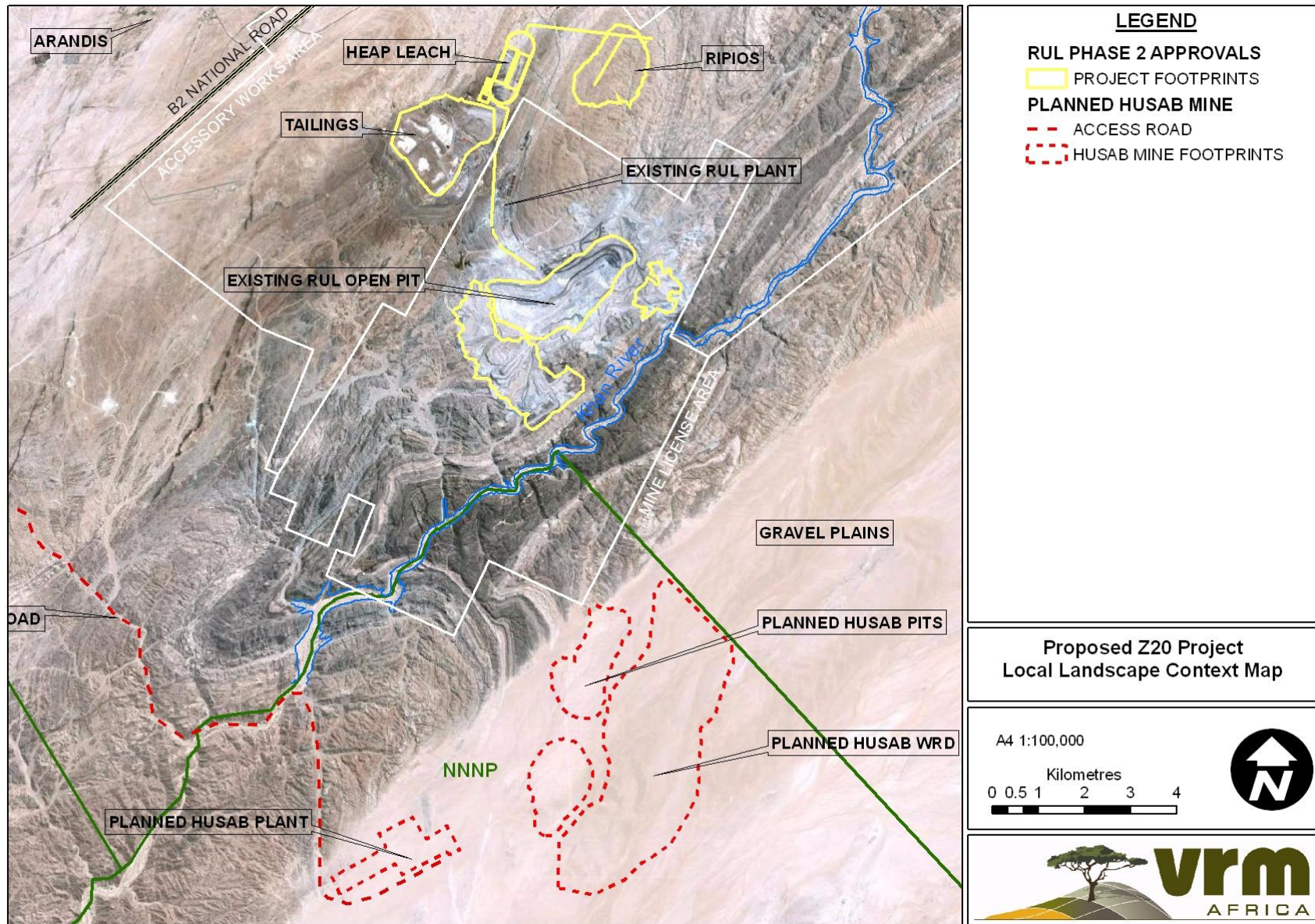


Figure 3: Local landscape context overlaid onto Google Earth Satellite Map

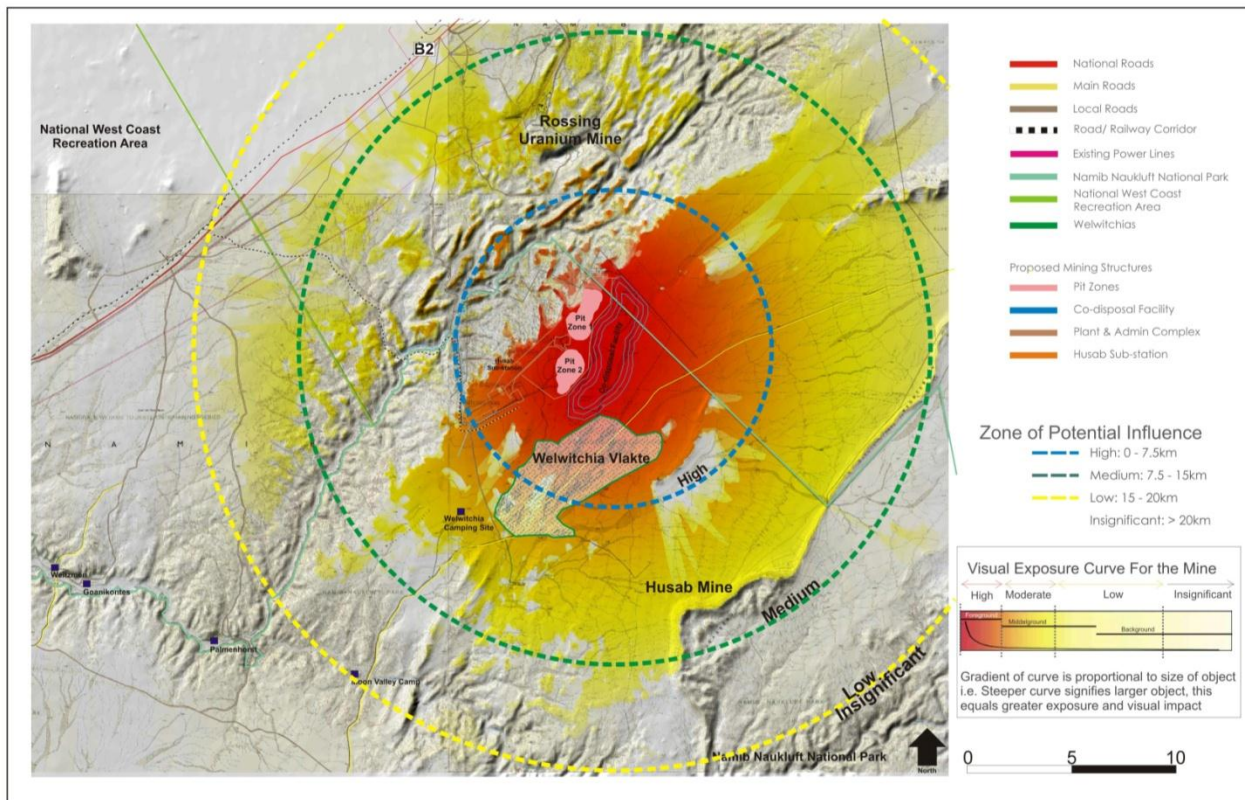


Figure 11: VIEWSHED - Swakop Uranium Husab Project: Co-Disposal Site (180m)

Figure 4: Swakop Uranium Husab Project Viewshed (Newtown Landscape Architects. 2010)

5.2.1 Topography and Geology

“Rössing is located on the generally south-west-facing rough and undulating slopes at a mean elevation of 575 mamsl near the western edge of the Central Namib Desert. The topography is broken down into the following: (Ninham Shand. 2007)

- The southern reaches of the site are characterised by the several steeply-incised and deep storm-washed gullies and gorges that run into the Khan River to the south, resulting in a rugged and hilly landscape.
- As one moves north from the Khan River, toward the town of Arandis, the storm-washed gullies become less pronounced and are interspersed with resilient rock ridges and occasional inselbergs, resembling a more typical Namibian desert plain.
- The landscape character to the north and west of the ridgeline is characterised by rolling hills.
- 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, whereafter they dissipate abruptly, giving way to the gravel plains of the Welwitschia Plains, which covers almost the entire area between the Khan and Swakop Rivers, up to the confluence between them, an area forming part of the Namib-Naukluft Park.

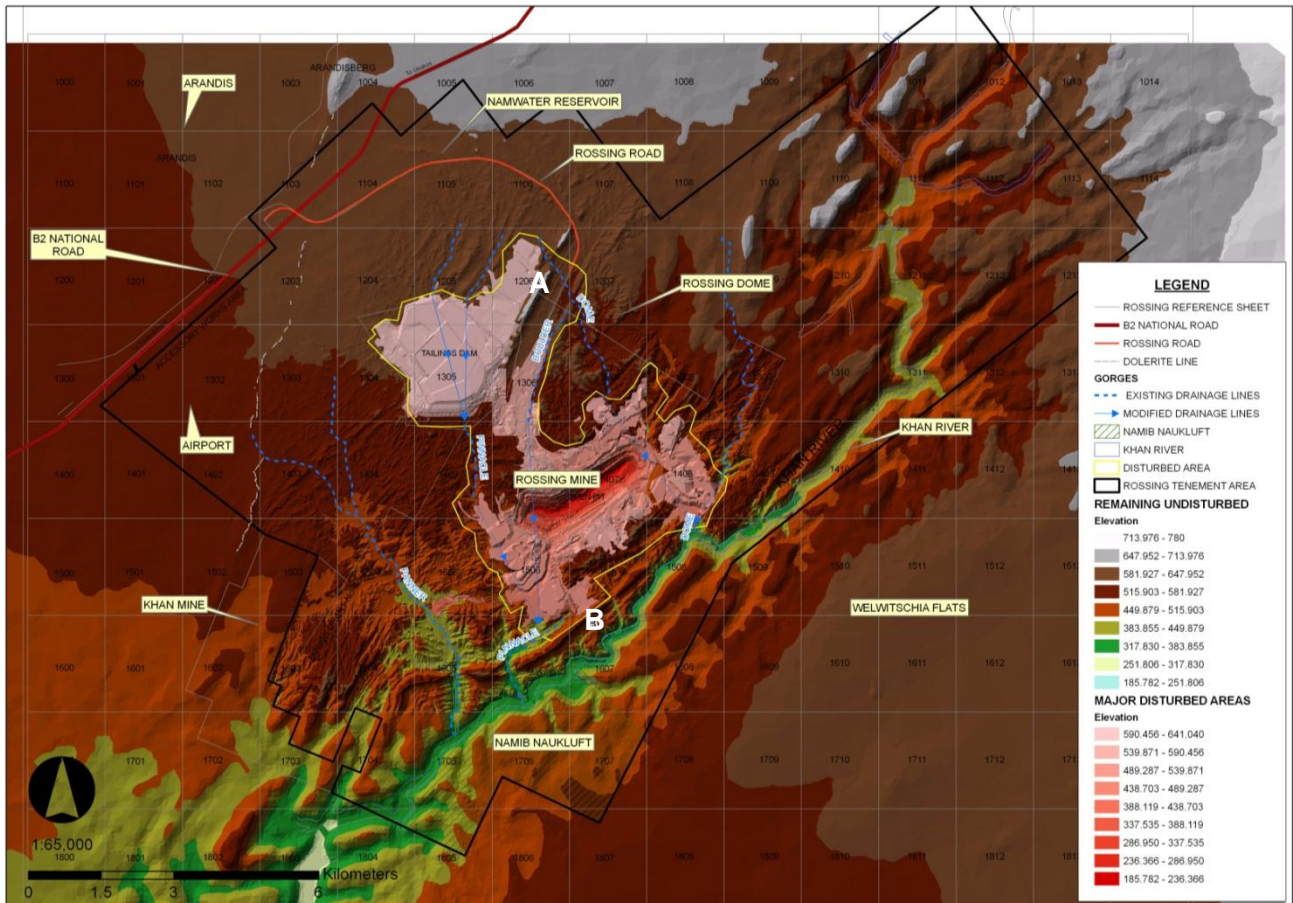


Figure 5: Digital Elevation Model (DEM) Map

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. Four distinctive habitat types can be identified, briefly described as follows: (Berg, 2002)

<p>Undulating granite hills</p>	<p>The granite hills are characterised by gentle slopes, with large areas of surface quartz gravel. Plant cover in this habitat is patchy, although most slopes support a few widely-spaced individual shrubs. After rains, these hills become almost continuously covered with annual grasses. The habitat supports a relatively diverse arid plant community, with several species of conservation importance</p>
<p>Drainage lines and gorges</p>	<p>The larger drainage lines running through the site are aligned, and drain in a north-east to south-west direction. Larger drainage lines form wide, open valleys, the valley floors lined with coarse, mostly granite-derived sands. Although there is rarely surface water in the river systems, there remains an appreciable sub-surface flow that is able to support riparian vegetation. Summer rainfalls on the interior plateau region provide a major source of water to the riverine vegetation and seasonal variations in vegetation are largely related to the frequency, intensity and duration of river flows.</p>
<p>Quartz outcrops (See Map reference point A in Figure 5)</p>	<p>Small quartz outcrops occur throughout the site, usually emerging on hilltops. This habitat often supports a greater number of species than the surrounding area, and often a species assemblage of great conservation importance.</p>
<p>Marble-quartzite ridges (See Map reference point B in Figure 5)</p>	<p>The marble-quartzite ridges, running predominantly in a north-east to south-west direction, are comprised of dark, exposed quartzite rock and loose quartzite gravel on the surface. This habitat type, after good rains, has continuous annual grass cover and a widely-spaced perennial shrub component, which has lower species diversity than the surrounding granite hills habitat type.</p>

Alluvial sand	Alluvial sand deposits in the gorges vary in thickness up to about 8m and up to 20m in the Khan River bed. Alluvial sand was mined from the dry river beds to the north of the Khan River and was used for various purposes at the Rössing mine, including rehabilitation, building material and road material. The open pit requires large quantities of sand for the surfacing of haul roads, ramps and waste rock disposal areas. Currently Rössing mines on average 133 000 tonnes of sand per year.
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The variation in geological features creates a rugged and harsh beauty which adds to the significant desert sense of place but also increase the VAC for the area. These mountain features, as a result of their prominence, are visually very significant and mitigations need to be set in place to ensure that visual degradation of these natural features is avoided.

5.3 Site Landscape Character

The Z20 uranium deposit is located south of the Khan River. Successful exploration showed that the Z20 uranium deposit is one of a number of similar anomalies located south of the Khan River where Rössing Uranium's mining license area ML28 and the Namib Naukluft Park overlap. The Z20 site is situated in the Namib Naukluft National Park, in biodiversity sensitive areas along the upper bank of the Khan valley. The Rössing Formation in this area is characterised by containing significantly more pyritic quartzite than the equivalent stratigraphic levels in the southern side of the SJ pit. The Z20 resource contains roughly 720 Mt of ore and waste, of which 160Mt of ore could potentially be mined. It is located on the southern slope of the Khan River valley, between the Welwitschia Plains and the Khan River bed. The area is underlain by tributaries to the Khan River, which have been classified as sensitive biodiversity areas (*Aurecon, 2012*).

In terms of the VRM methodology, landscape character is derived from a combination of scenic quality, receptor sensitivity to landscape change, and the distance of the proposed landscape modification from key receptor points.

The scenic quality is determined using seven key factors:

- **Land Form:** Topography becomes more interesting as it gets steeper, or more massive, or more severely or universally sculptured.
- **Vegetation:** Primary consideration given to the variety of patterns, forms, and textures created by plant life.
- **Water:** That ingredient which adds movement or serenity to a scene. The degree to which water dominates the scene is the primary consideration.
- **Colour:** The overall colour(s) of the basic components of the landscape (e.g. soil, rock, vegetation, etc.) are considered as they appear during seasons or periods of high use.
- **Scarcity:** This factor provides an opportunity to give added importance to one, or all, of the scenic features that appear to be relatively unique or rare within one physiographic region.
- **Adjacent Land Use:** Degree to which scenery and distance enhance, or start to influence, the overall impression of the scenery within the rating unit.
- **Cultural Modifications:** Cultural modifications should be considered, and may detract from the scenery or complement or improve the scenic quality of a unit.

Sensitivity levels are a measure of public concern for scenic quality. Receptor sensitivity to landscape change is determined using the following factors:

- **Type of Users:** Visual sensitivity will vary with the type of users, e.g. recreational sightseers may be highly sensitive to any changes in visual quality, whereas workers who pass through the area on a regular basis may not be as sensitive to change.
- **Amount of Use:** Areas seen and used by large numbers of people are potentially more sensitive.
- **Public Interest:** The visual quality of an area may be of concern to local, or regional, groups. Indicators of this concern are usually expressed via public controversy created in response to proposed activities.
- **Adjacent Land Uses:** The interrelationship with land uses in adjacent lands. For example, an area within the viewshed of a residential area may be very sensitive, whereas an area surrounded by commercially developed lands may not be as visually sensitive.
- **Special Areas:** Management objectives for special areas such as Natural Areas, Wilderness Areas or Wilderness Study Areas, Wild and Scenic Rivers, Scenic Areas, Scenic Roads or Trails, and Critical Biodiversity Areas frequently require special consideration for the protection of their visual values.
- **Other Factors:** Consider any other information such as research or studies that include indicators of visual sensitivity.

The above tables are utilised to define the VRM Classes that represent the relative value of the visual resources of an area:

- i. **Classes I and II** are the most valued
- ii. **Class III** represent a moderate value
- iii. **Class IV** is of least value

This is undertaken making use of the matrix below developed by BLM Visual Resource Management method as seen below, which is then represented in a visual sensitivity map.

		VISUAL SENSITIVITY LEVELS								
		High			Medium			Low		
SCENIC QUALITY	A (High)	II	II	II	II	II	II	II	II	II
	B (Medium)	II	III	III/ IV *	III	IV	IV	IV	IV	IV
	C (Low)	III	IV	IV	IV	IV	IV	IV	IV	IV
DISTANCE ZONES		fore/middle ground	Background	seldom seen	fore/middle ground	background	seldom seen	fore/middle ground	background	seldom seen

(A= scenic quality rating of ≥ 19 ; B = rating of 12 – 18, C= rating of ≤ 11)

* If adjacent areas are **Class III** or lower, assign **Class III**, if higher, assign **Class IV**

The following locations, which are associated with the various proposed project activities, were surveyed during the field study to determine scenic quality, receptor sensitivity to landscape change and distance from nearest receptors:

- S1: Access Road
- S2: Access Road, Panner Gorge
- S3: Access Road, Rocky Outcrops
- S4: Khan River, where the proposed bridge, power line, pipelines and overhead conveyor would cross the river.
- S5: Gravel Plains

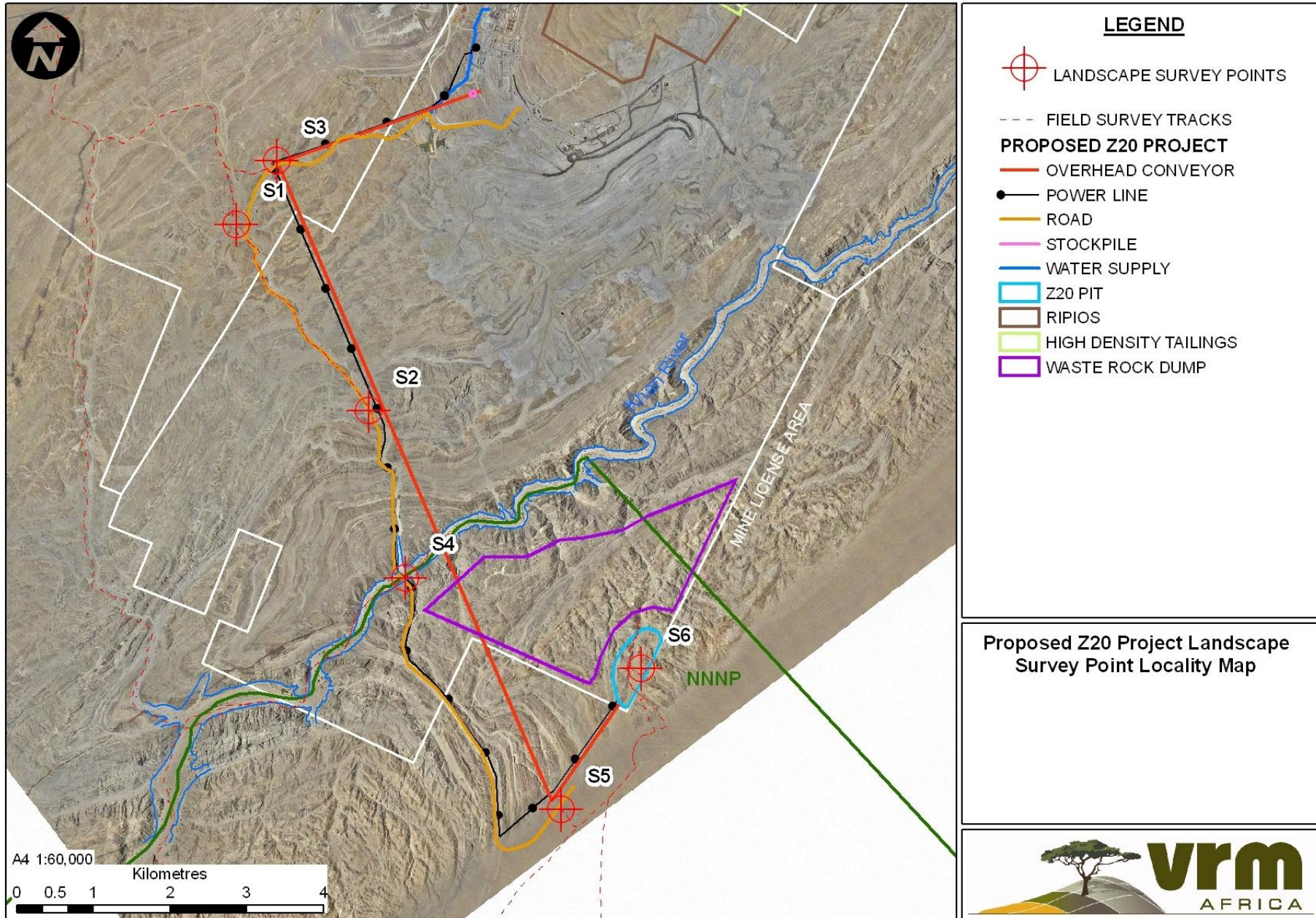


Figure 6: Survey point map

5.3.1 S1 Survey Point: Access Road



Figure 7: S1 survey point

S1 is located adjacent to the proposed access road. The co-ordinate points for the survey point are: 22°29'7.22"S, 15° 0'40.18"E

The landscape is dominated by rocky outcrops formed by the erosion of the Khan River and is located 3.1 km from the existing Rössing mine. The combination of these two factors increases the ability of the landscape to absorb the proposed landscape modification. As the site is located in the lower-lying valley of the upper section of the Panner Gorge, the visibility of the site is contained. The land form of the site is rated *moderate* due to the rugged rocky outcrops. In the desert landscape, vegetation is sparse, but is important within the context. Water is not apparent although the road does follow a dry river bed. The colours add value, with the range of dark and light browns of the rocks contrasting with the light colours of the sands. The adjacent scenery is similar to that of the site, which has value but is fairly widespread in the Khan River area and fairly common.

Due to the close proximity of the site to the Rössing mine, there are clear views of the Tailings Storage Facility (TSF) and power line infrastructure (as seen on the northern and eastern photographs) and the cultural modifications are rated as a *moderate negative*. The overall scenic quality is rated *moderate to low* and assigned a VRM Scenic Quality of B. Due to the close proximity of the site to the Rössing mine, where views of the TSF and Waste Rock Dump (WRD) dominate the surrounding landscape, the sensitivity of the receptors to landscape change at this location would be *low*, even though the area has value in terms of defining the desert landscape.

Using the VRM Matrix, VRM Class III is assigned to the area due to moderate landscape character, lower receptor sensitivity due to the close proximity of the existing Rössing mine and with receptors located within 7 km from the site. This allows for moderate levels of landscape change as seen from the surrounding Key Observation Points.

5.3.2 S2 Survey Point: Access Road, Panner Gorge



Figure 8: S2 survey point

S2 is located on the proposed access road further down the Panner Gorge. The co-ordinate points for the survey point are: 22°30'26.25"S, 15° 1'40.68"E

The landscape is dominated by the rocky outcrops formed by the erosion of the Khan River, increasing the ability of the landscape to absorb the proposed landscape modification, and is located 2.7 km from the existing Rössing mine. As the site is located in the lower-lying valley of the middle section of the Panner Gorge, the visibility of the site is contained and the adjacent mining activities are not visible. The land form of the site is rated *high* due to the increased height of the rugged rocky outcrops. In the desert landscape, vegetation is sparse but is important within the context and the few trees add value. Water is not apparent at the site. The colours add value, with the range of dark and light browns of the rocks contrasting with the light colours of the sands. The adjacent scenery is similar to that of the site, which has value, but is fairly widespread in the Khan River area and fairly common. The only man made modification is the gravel road which does dominate the scene and rated low. The overall scenic quality is rated *high* and assigned a VRM Scenic Quality of A.

Due to the close proximity of the site to the Rössing mine, where views of the TSF and WRD dominate the surrounding landscape, the sensitivity of the receptors to landscape change at the location would be *low*, even though the area does have value in terms of defining the desert landscape. With the site being in an area that is seldom seen (located within the Rössing mine license area which has restricted access), scenic quality would be *moderate* and receptor sensitivity *low*, due to close proximity to the Rössing mine.

Using the VRM Matrix, VRM Class II is assigned to the area. This allows for *low* levels of landscape change, as seen from the surrounding Key Observation Points, if the current landscape character was to remain intact.

5.3.3 S3 Survey Point: Access Road, Rocky Outcrops



Figure 9: S3 survey point

S3 is located on the proposed access road further to the west of the existing Rössing mine. The coordinate points for the survey point are: 22°29'7.22"S, 15° 0'40.18"E

The landscape is dominated by the rocky outcrops formed by the erosion of the Khan River, increasing the ability of the landscape to absorb the proposed landscape modification. The visibility of the site is high due to the elevated ground in relation to the surrounds but has a moderate VAC level due to close proximity to the existing mine. The land form of the site is rated *moderate to low* due to smaller low rolling rocky outcrops that are interesting but not exceptional. In the desert landscape, vegetation is sparse but is important within the context. Water is not apparent at the site. The colours add value, with the range of dark and light browns of the rocks contrasting with the light colours of the sands. The adjacent scenery is similar to that of the site, which has value, but is fairly widespread. The man made modifications include the power line as well as clear views of the Rössing mine TSF and is rated low. The overall scenic quality is rated *low* and assigned a VRM Scenic Quality of C.

Due to the close proximity of the site to the Rössing mine, where views of the TSF and WRD dominate the surrounding landscape, the sensitivity of the receptors to landscape change at the location would be *low*, even though the area does have value in terms of defining the desert landscape. With the site being in an area that is seldom seen (located within the Rössing mine license area which has restricted access), scenic quality would be *moderate* and receptor sensitivity *low*, due to close proximity to the Rössing mine.

Using the VRM Matrix, VRM Class IV is assigned to the area. However, due to clear views of the site from the B2 receptors, the scenic quality of the site do add to the surrounding desert wilderness sense of place and it is recommended that a VRM Class III is assigned to the site. This allows for *moderate* levels of landscape change, as seen from the surrounding Key Observation Points, if the current landscape character was to remain intact.

5.3.4 S4 Survey Point: Khan River

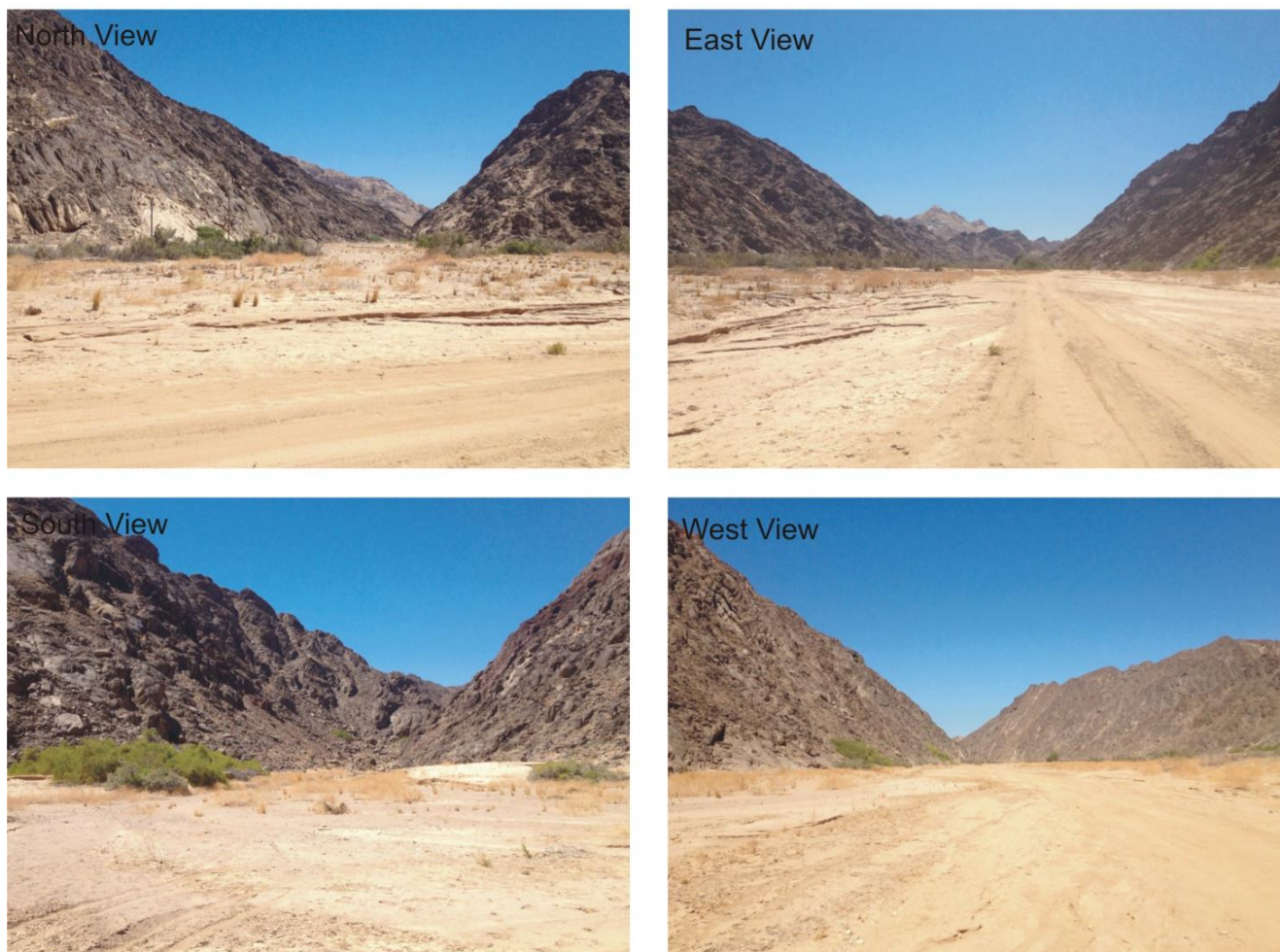


Figure 10: S4 survey point

The S4 survey point is located in the Khan River where the proposed bridge, power line, pipelines and overhead conveyor would cross the river. This point is located 4.3 km from the existing Rössing mine and the co-ordinate points for the survey point are 22°31'37.15"S, 15° 1'57.29"E.

Due to the high rocky outcrops on either side of the river, the visibility is contained to the immediate section of the river valley. The surrounding rocky landscape increases the ability of the landscape to absorb the proposed landscape modifications, but these would be clearly visible by adventure tourists driving along the Khan River. With the large rocky outcrops surrounding the meandering river, the landscape value is rated as *high*. Vegetation values are higher due to more prolific vegetation stimulated by water in the nearby river. Colour contrast is strong, with the black/ brown rocks and the paler colours of sand in the dry river bed. As this is a river, the scarcity is of *high* value, but the landscape does extend for the length of the Khan River. The only man made modifications evident around the site were a single power line and the occasional borehole cover. The overall scenic quality rating is defined as *high*, with a VRM rating of A.

The Khan River is a well-known 4x4 route for tourists and local residents seeking wilderness camping experiences, and the user sensitivity is defined as *high*. The area is remote and the amount of use is *low*. As the Husab Uranium Mine has been granted access rights to cross the Khan River further to the west and have started this access road construction, it is likely that public interest in this crossing will be *moderate*. However, this increase in cumulative impacts to the Khan River landscape would increase concern from environmental groups. Adjacent land users are mining-related and sensitivity would be moderated with concern to meet environmental legislation requirements. The Khan River was identified in the Uranium Rush as a special red flag area. The overall receptor sensitivity to landscape change at this location is defined as *high*. With the *high* exposure to tourist receptors in a remote wilderness location which has *high* scenic quality, a Class II VRM Objective is defined for the site, which would allow for *low* levels of landscape change if the current landscape character is to remain intact.

5.3.5 S5 Survey Point: Gravel Plains

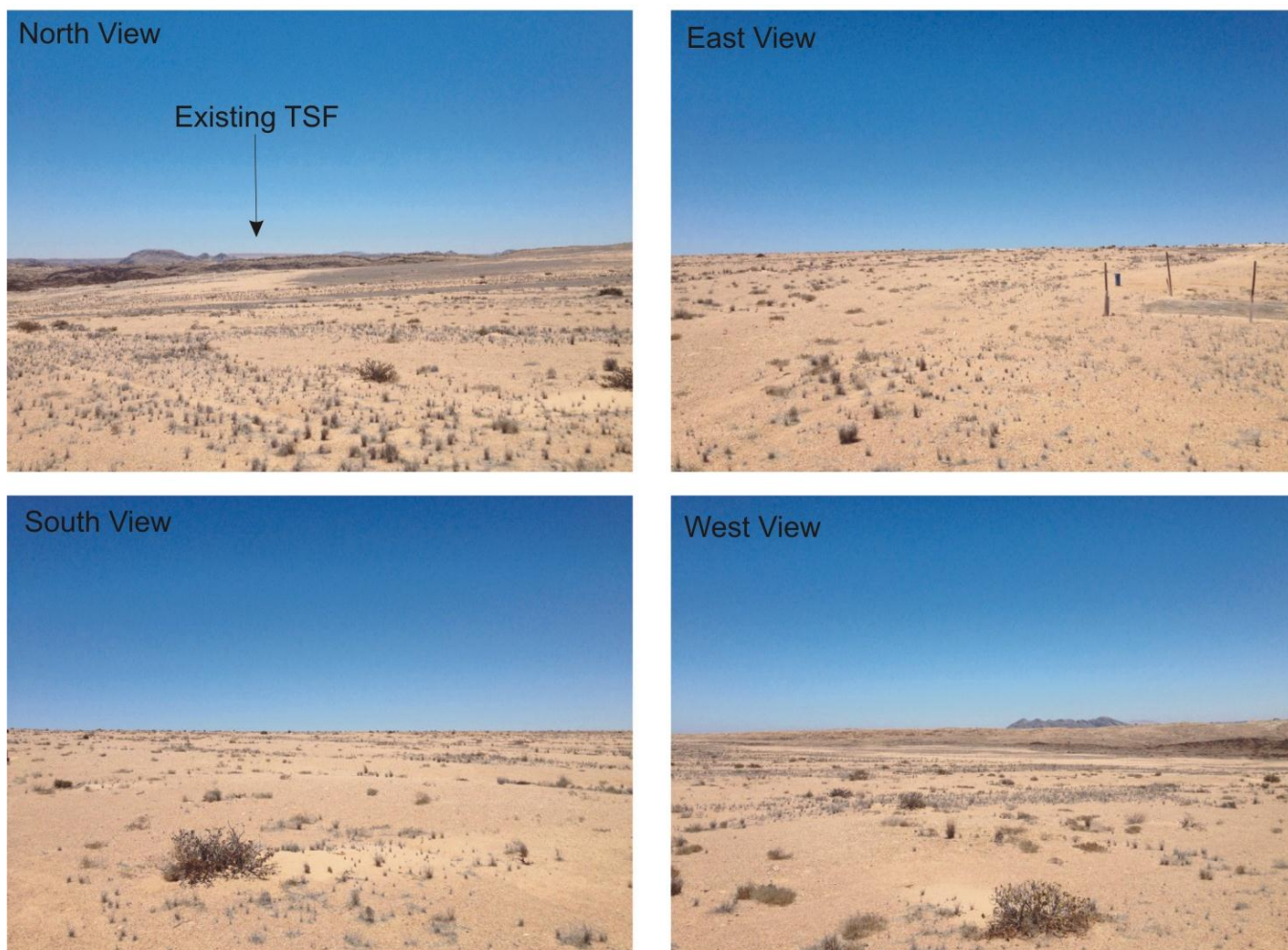


Figure 11: S5 survey point

Located on the gravel plains to the south, and outside of the Khan River valley, survey point S5 is associated with the area where the access road, conveyor, power line and pipelines are proposed. S5 is located 5.2 km from the existing Rössing mine within the NNP and the co-ordinate points for the survey point are 22°33'15.38"S, 15° 3'8.50"E.

Due to the close proximity of this site to the Khan River rocky outcrops, which contrasts strongly to the gravel plains, the land form was rated *moderate to high*. Vegetation is sparse and mainly located in river washes, and colours are subtle with muted tones. Adjacent scenery of the Khan River to the west, and the gravel plains to the east, is rated *moderate to high* and is fairly common in the region and gravel roads have been established as part of the Husab Mine construction which detracts from the Wilderness experience of the National Park. As indicated in the northern photograph from the site, the existing Rössing Tailings is visible in the background and the overall scenic quality was defined as moderate to high.

As the survey point is located within the NNP the sensitivity of the receptors to landscape change at this location would be *High* as the area does have value in terms of defining the desert landscape and for the protection of the Welwitschia plants, which are important as a tourist attraction to the area. Although the amount of use is low, public interest would be high and as a protected area, would have Special Area status. The adjacent land uses are mining related and the users would have a low sensitivity to landscape change (within the mining lease area). Due to the location of the site within the NNP and the moderate to high scenic qualities, the overall receptor sensitivity to landscape change would be high.

With the site having *moderate to high* scenic qualities and *high* receptor sensitivities but located in the background, a VRM Class III is assigned to the area. This recommends *moderate* levels of landscape change, as seen from the surrounding KOPs in order to maintain the surrounding landscape character.

5.3.6 S6 Survey Point: Gravel Plains



Figure 12: S6 survey point

The co-ordinate points for the survey point are 22°32'15.67"S, 15° 3'45.02"E. Located to the north of the S5 but outside the NNP, the scenic quality is the same but with clearer views of the Rössing WRD. Although the site is located outside the NNP, the close proximity to the park would result in similar receptor sensitivities to large scale landscape modifications.

As with S5, the site having *moderate* to high scenic qualities and *high* receptor sensitivities but located in the background, a VRM Class III is assigned to the area. This recommends *moderate* levels of landscape change, as seen from the surrounding KOPs in order to maintain the surrounding landscape character.

5.3.7 Site Landscape Character Summary Table

Survey Points						
ID	S1	S2	S3	S4	S5	S6
Name	Access road	Access Road, Panner Gorge	Access road Rocky outcrops	Khan River	Gravel Plains	Rocky outcrops
Activities	Access road	Road, conveyor, pipelines	Road, conveyor, pipelines	Road, conveyor, pipelines	All	Pit and WRD
VAC	High	High	Medium	Medium	Medium	Medium

Scenic Quality						
Land form	3	4	2	5	4	4
Vegetation	3	2	2	2	3	3
Water	2	2	1	3	1	1
Colour	3	4	2	4	2	2
Adjacent scenery	3	4	1	4	4	4
Scarcity	1	3	1	3	3	3
Cultural modifications	-3	0	-1	-1	-1	-1
Score	12	19	8	20	16	16
Category	B	A	C	A	B	B

(A= scenic quality rating of ≥ 19 ; B = rating of 12 – 18, C= rating of ≤ 11)

Sensitivity						
Type of user	Low	Low	Low	High	High	High
Amount of use	Low	Low	Medium	Low	Low	Low
Public interest	Low	Low	Low	Medium	High	High
Adjacent land users	Low	High	Low	Medium	Low	Low
Special areas	Medium	Medium	Low	High	High	High
Score	Low	Medium	Low	High	High	High

(H = High, M = Moderate, L = Low Sensitivity)

Distance zone	FG	BG	FG	FG	BG	BG
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(FG = Foreground, BG = Background, SS = Seldom Seen)

VRM Class	III	II	IV (III)	II	III	III
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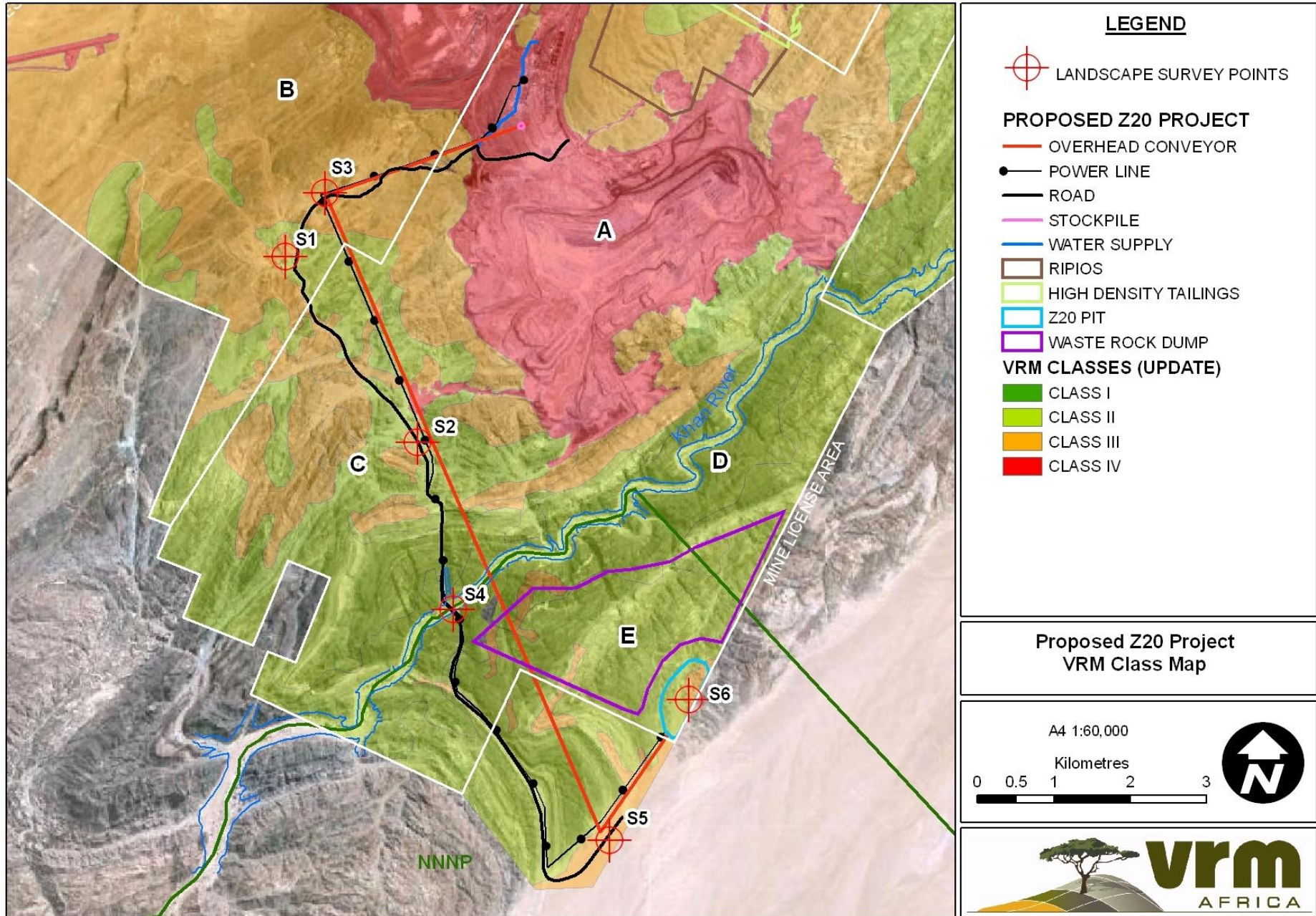


Figure 13: VRM Class Map

5.4 VRM Classes and Objectives

Evaluation of the suitability of a proposed landscape modification (brought about by elements or activities of a proposed project) is undertaken by means of assessing the proposed modification against a predefined management objective assigned to each class. The USA Bureau of Land Affairs has defined four Classes that represent the relative value of the visual resources of an area:

- i. **Classes I and II** are the most valued; e.g. wilderness areas
- ii. **Class III** represent a moderate value; and
- iii. **Class IV** is of least value.

The VRM Classes Map (Figure 12 above) generated for the RUL Phase 1 & 2 projects was updated (and extended) from landscape character information derived from the site visit for the Z20 project. The following recommendations were made:

Class I

- Due to the precedent being set for planned development along the Khan River in terms of the Husab Mine, and within the Namib Naukluft National Park in accordance with the Uranium Rush SEA that was undertaken in 2010, no Class I areas (No-Go) were identified in the study.

Class II (VRM Class Map Reference D & C)

- There are still some sections in the Panner Gorge and Khan River areas where the topographic screening of the rugged rocky outcrops restricts views of the existing Rössing waste rock dumps. Although receptor sensitivity to landscape change would be moderated by the surrounding mining landscapes, the scenic quality is *high* and defined as requiring Class II visual objectives to maintain the existing landscape character. This visual objective requires low levels of landscape modifications if the existing character of the landscape is to be retained.

Class III (VRM Class Map Reference B & E)

- A Class III visual objective was assigned to the areas adjacent to the site, which has a *moderate to high* exposure to the Rössing Waste Rock Dumps which moderates the scenic quality. This visual objective requires moderate levels of landscape modifications if the existing character of the landscape is to be retained.

Class IV (VRM Class Map Reference A)

- The existing Rössing Mine area was defined as Class IV due to the existing historic mining infrastructure which has *low* levels of scenic quality and *low* receptor sensitivities to landscape modification. The objective of this class is to provide for management activities which require major modifications of the existing character of the landscape. The level of change to the characteristic landscape can be *high*.

6 DESCRIPTION OF PROJECT ALTERNATIVES AND VISIBILITY

The objective of this section is to describe the character of the project activities and define the extent to which it will be visible to the surrounding areas. This is undertaken by depicting the project activities and determining the extent of their visibility to the surrounding areas. Rössing Uranium has already received approval for the Phase 2 of their extension to the existing mine, shown in yellow on the map below (Figure 14). Rössing Uranium is investigating the feasibility of mining the Z20 ore body located to the south of the Khan River and is investigating related infrastructure requirements. The proposed project is an infrastructure corridor across the Khan River, which includes the following: (Aurecon. 2012)

- Overhead conveyor
- Access road and pipeline
- Bridge over the Khan River
- Power line

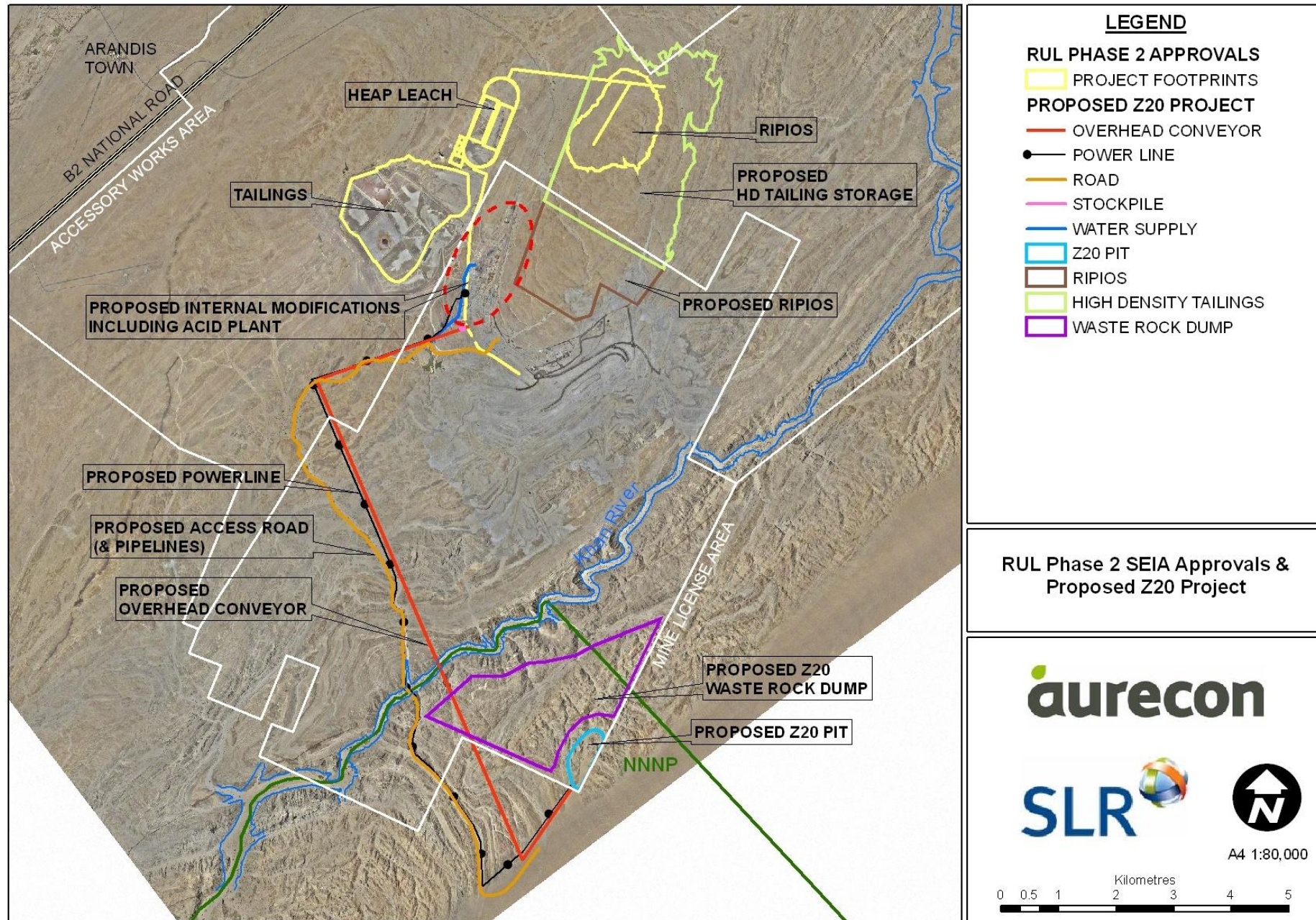


Figure 14: Proposed project locality map overlaid onto aerial survey

Overhead Conveyor Infrastructure Corridor

The proposed infrastructure corridor will facilitate the transfer of ore between the Z20 ore body and the Rössing Uranium Mine. The infrastructure will house a product transport system in the form of a rope conveyor, an access road, and other services such as a power line and water and diesel supply pipelines. The proposed conveyor system consists of two sections and is of a continuous conveying type with containing side walls along the belt carrying the ore.

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

The system is designed to transport ore over a total length of approximately 13 km, at speeds of up to 4.65 m/s, with a capacity in one direction of 2.250 t/h (*Aurecon 2012*).

The components of the rope conveyor include a motor and drive assembly, tensioning system, towers, track ropes and rope frame, conveyor belt, roof cover, and belt turning device.



Figure 15: Example of proposed RopeCon conveyor

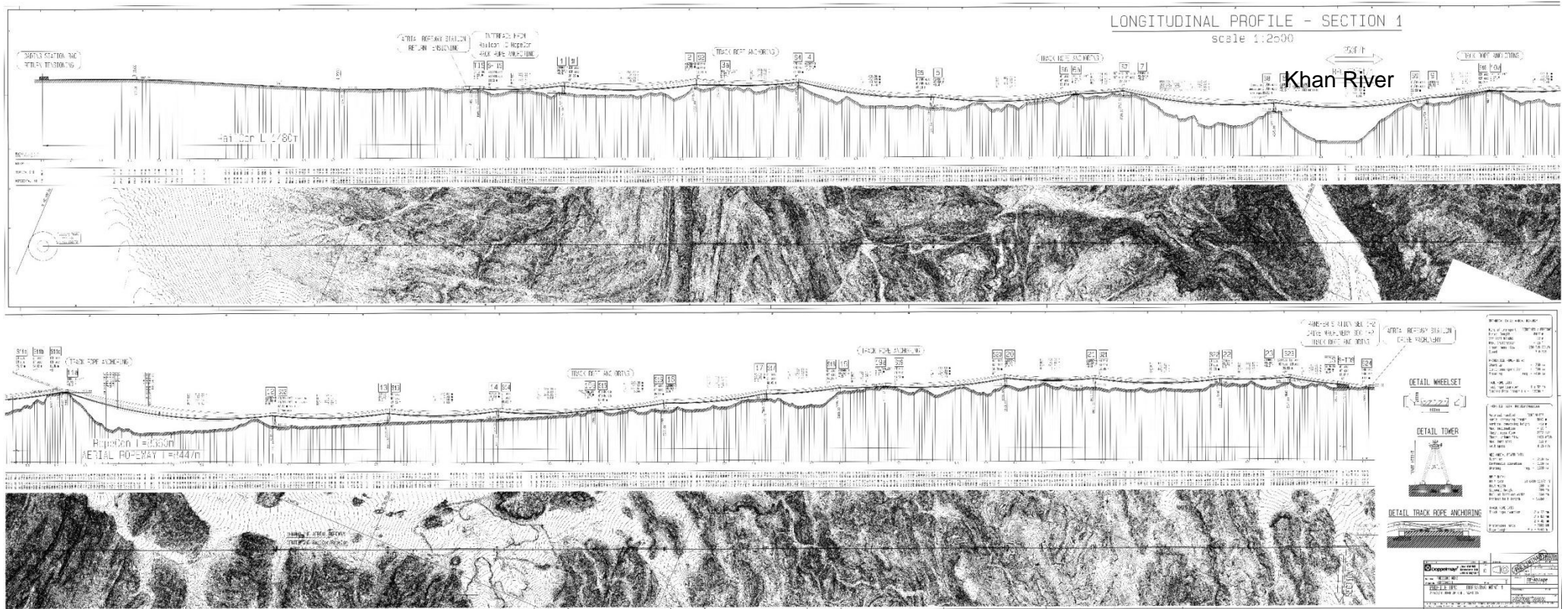


Figure 16: Profile of proposed conveyor Section 1

Road and Bridge

The proposed access road will be 12 m wide with a 7.2 m wide asphalt surfacing. The proposed route starts at the Rössing Uranium Mine, continues on an existing track to the south of the tailings dam and then follows a dry river bed from the north. The Khan River is then crossed via a reinforced concrete bridge (approximately 4m above the Khan River), after which it traverses a valley through mountainous terrain to the end point at the Z20 ore body. The total length of the road is approximately 14 km. The road will have a 2.4 m wide shoulder in both directions. (Aurecon. 2012)

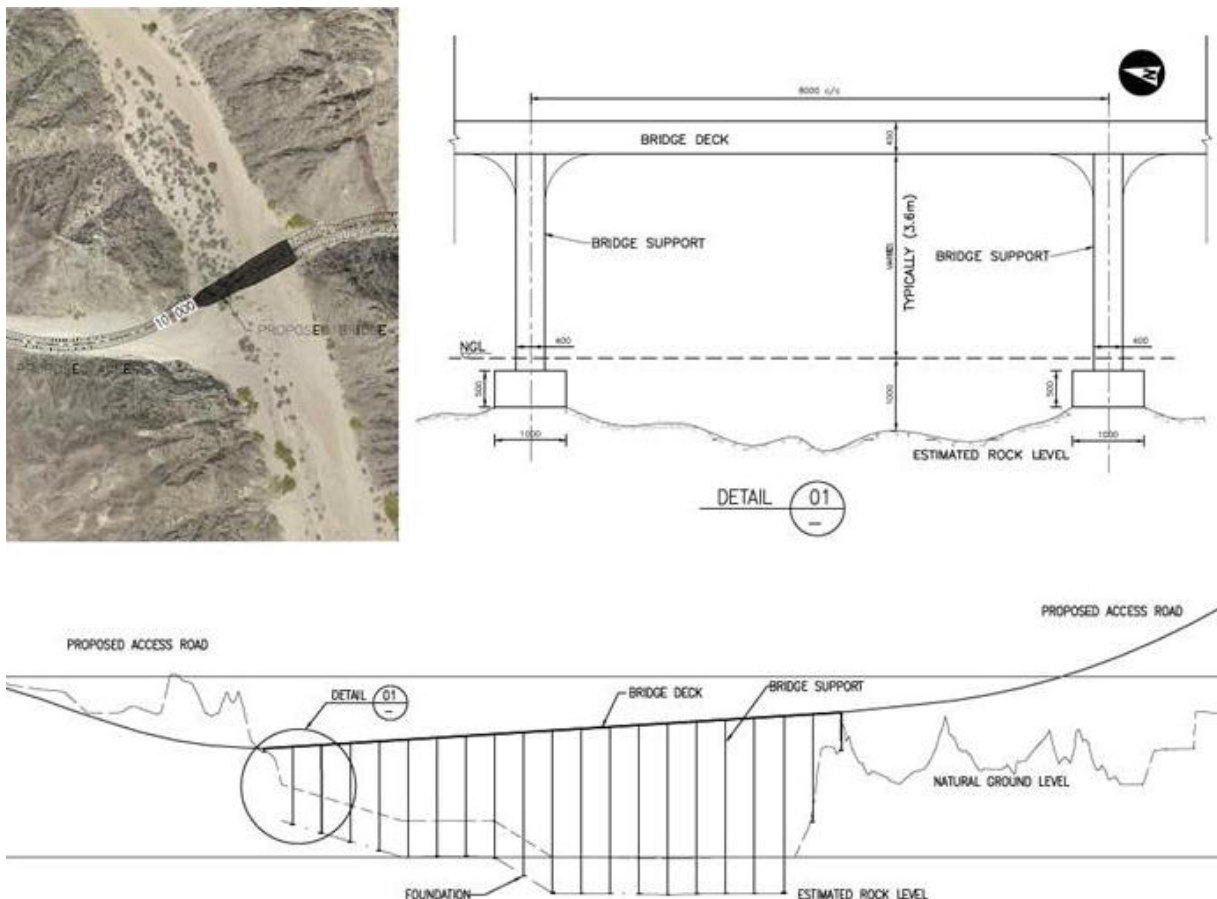


Figure 17: Proposed bridge section and detail drawing

Power Distribution and Supply

An overhead power line will be established within the infrastructure corridor to the Z20 area, to provide electricity to the proposed mining operations.

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 onsite distribution will be at 11kV, with the Heap Leach, Acid Plant and Milling Circuit 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. (Aurecon. 2012)

6.1 Project Visibility and Exposure

Making use of Rössing survey data supplemented with ASTGTM elevation data, a terrain model was generated for the area around the proposed project. A viewshed was generated from each of the project components, making use of the high values as metres above point ground level as indicated in the table below:

- Road construction and traffic - 4 m height
- Power lines and structures - 20 m height
- Overhead conveyor structures - 55 m height
- Bridge over the Khan River - 4 m height

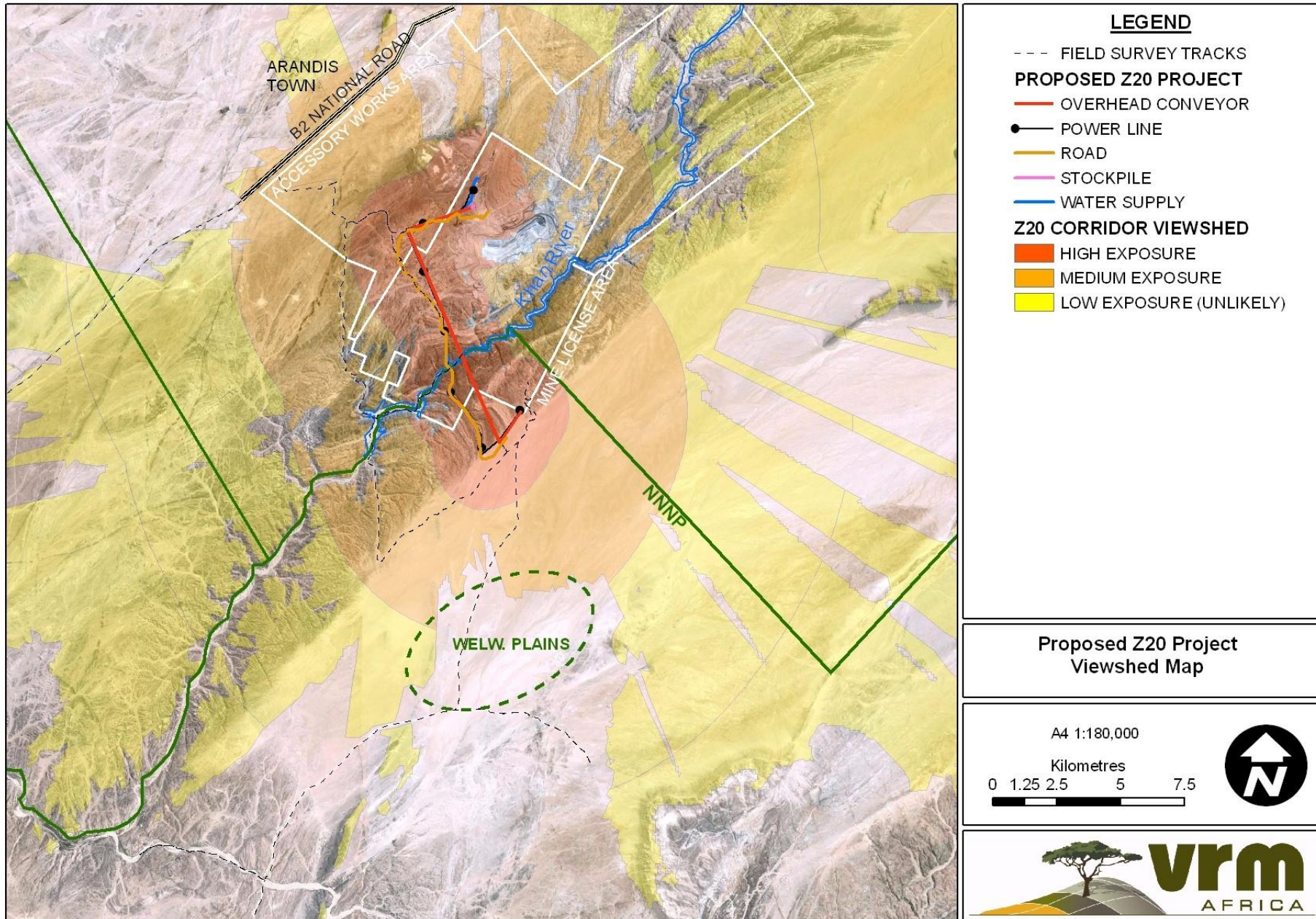


Figure 18: Proposed viewshed

High Exposure (0 – 2km)

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. This area is located within the Rössing Mine License Area, and is restricted, and receptors would be limited to Rössing employees only. The Khan River is included in the high exposure areas, and tourist receptors utilising this Khan 4x4 route will have clear views of the construction of the bridge and of traffic using the bridge, views of the overhead conveyor and structures, as well as views of the power line. This area is remote and traffic is limited but does include local and tourist receptors and should be considered as an important Key Observation Point where landscape change would need to be assessed. To the south of the Khan River, receptors using the northern section of the Namib Naukluft National Park (NNP) will have high exposure. This area is now included in the Husab Mine mine license area (MLA) and access is restricted to Husab Mine employees only.

Medium Exposure (2 – 7km)

Defined by the BLM as the foreground/ middle ground distance zone, which is susceptible to landscape change, the Medium Exposure areas include the B2 Road receptors and the northern sections of the NNP. As indicated above, the northern sections of the NNP are located in the Husab Mine MLA and access is restricted to employees only. The B2 is an important tourist view corridor and carries high volumes of traffic. As such, this is an important Key Observation Point and landscape change would need to be assessed from this location. 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 as temporary access for the Husab Mine that is currently laying a water pipe above ground. The landscape character of the route is currently fairly degraded.

Low Exposure (7 – 14km)

These areas, located in the background, are unlikely to be affected by landscape modifications associated with the proposed Z20 project. Receptors located in these areas include the Welwitschia Plains in the NNP.

The following receptor points are exposed to the proposed infrastructure corridor expansion for the Z20 uranium deposit, and would need to be included as key receptor locations:

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

7 KEY OBSERVATION POINT CONTRAST RATING

The assessment of the Degree of Contrast (DoC) is a systematic process undertaken from Key Observation Points (KOPs) surrounding the project site, and is used to evaluate the potential visual impacts associated with the proposed landscape modifications. Key Observation Points (KOPs) are defined by the Bureau of Land Management as the people (receptors) located in strategic locations surrounding the property that make consistent use of the views associated with the site where the landscape modifications are proposed. These locations are important in terms of the VRM methodology, which requires that the DoC that the proposed landscape modifications will make to the existing landscape is measured from these most critical locations, or receptors, surrounding the property. The DoC generated by the proposed landscape modifications is measured against the existing landscape context in terms of the elements of form, line, colour and texture. Each alternative activity is then assessed in terms of whether it meets the objectives of the established class category, and whether mitigation is possible (*USA Bureau of Land Management, 2004*).

To define the KOPs, potential receptor locations were identified in the viewshed analysis, and screened, based on the following criteria:

- Angle of observation
- Number of viewers
- Length of time the project is in view
- Relative project size
- Season of use
- Critical viewpoints, e.g. views from communities, road crossings
- Distance from property

As indicated in the map below, Figure 18, four receptor locations were identified as KOPs. These locations are used to assess the suitability of the proposed landscape modifications, with the most significance being placed on the Khan River, for which a photomontage was generated in order to fully understand the predicted changes to the existing landscape character.

Map ID	KOP	Motivation
K1	B2 Eastbound	Modifications seen at a distance from a tourist route
K2	Khan Mine access road	Modifications seen at a distance
K3	Khan River	High exposure to tourist route (photomontage)
K4	Welwitschia Plains/ NNP	Modifications seen at a distance from a tourist area (NNP)

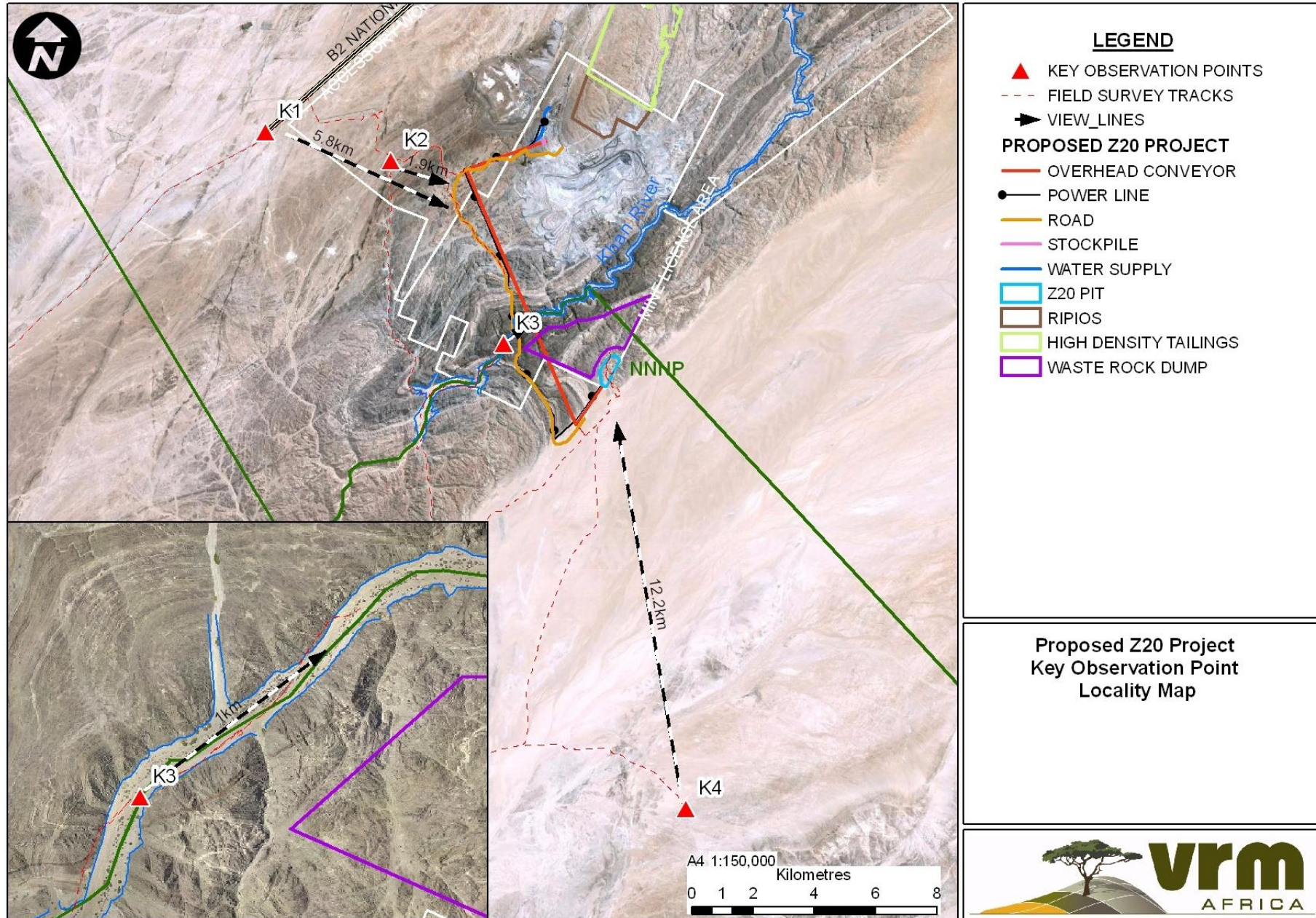
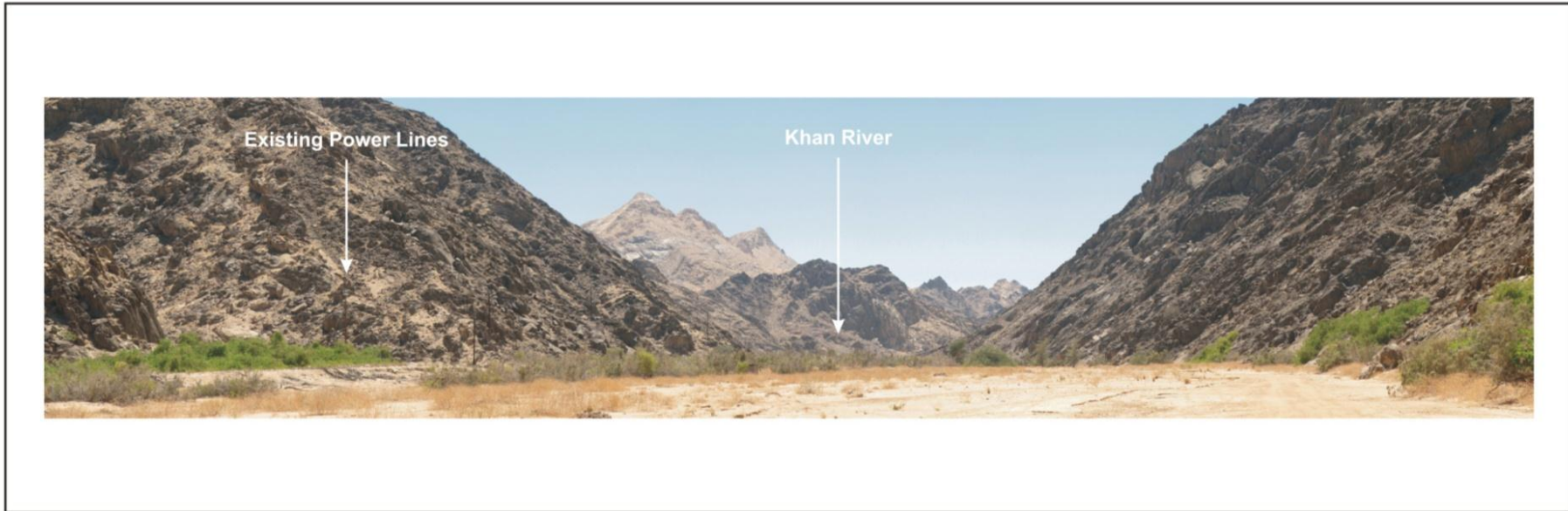


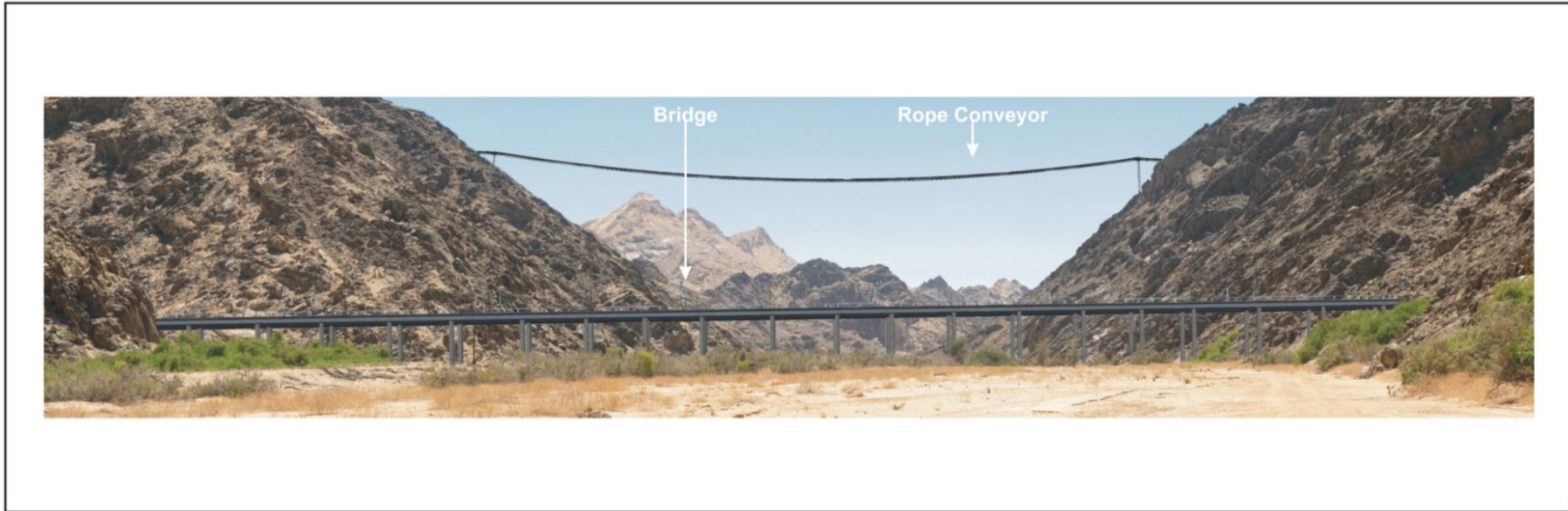
Figure 19: Receptor and KOP locality sites overlaid onto Google Earth Satellite



Existing Power Lines

Khan River

Existing View



Bridge

Rope Conveyor

Proposed view

For illustrative purposes only

Figure 20: K3: Photomontage of view from Khan River

7.1 KOP Descriptions

K1: B2 Eastbound



View from receptor towards project location

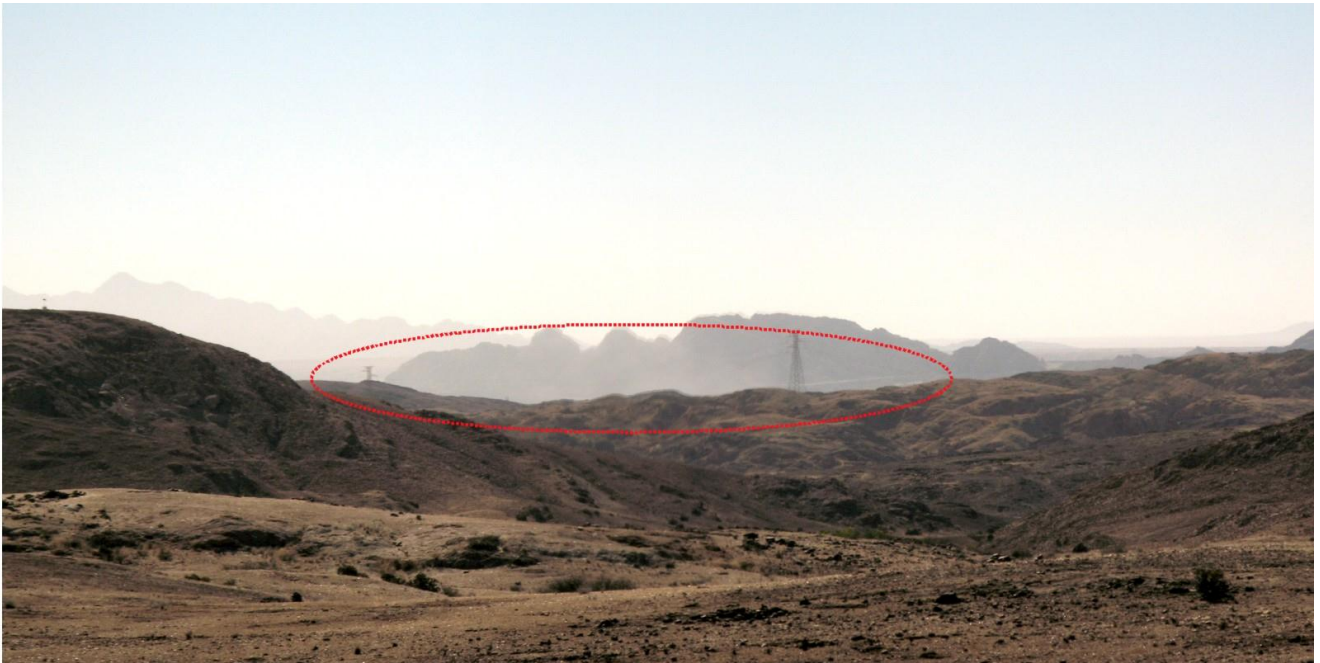


Receptor landscape character

Figure 21: K1: B2 eastbound view to the proposed project (above) and local landscape character

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 5.2 km. It is within the Foreground (6 km) 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*.

The recommended visual objective is for a Class III, which allows for *moderate* levels of landscape modification.

K2: Khan Mine Access Road

View from receptor towards project location



Receptor landscape character

Figure 22: K2: Khan Mine Access Rd view to proposed project (above) and local landscape character

The access road to the Khan mine, an old copper mine, is well known for its artistic views it offers of the interesting historical structures and is a popular destination for tourists to visit. It is a gravel road within a rural desert landscape. 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 6 km radius. The sensitivity for the receptor would therefore be *low*.

The VRM class objective is Class III, which allows for *moderate* levels of landscape modification due to the importance of this location as a tourist route.

K3: Khan River

(See photomontage of view shown in Figure 19)



View from receptor towards project location



Receptor landscape character

Figure 23: K3: Khan River view towards proposed project (above) and local landscape character

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.

As the route is a recognised tourist destination located on the border of the NNP, the type of user is rated as *highly sensitive* to landscape modification. The area is remote and the amount of use would be *low*. Adjacent users are mainly mining-related, with the existing Rössing mine and planned Husab mine. The SEA has placed value on the Khan and Swakop River as requiring protection and, as such, the area is rated *high as a special area*.

With the *high* scenic quality and *high* receptor sensitivity to landscape modification the VRM Class II was assigned which would require *low* levels of change to maintain the existing *high* levels of landscape character.

K4: Welwitschia Plains, Namib Naukluft National Park

View from receptor towards project location



Receptor landscape character

Figure 24: K4: Welwitschia Plain view to proposed project (above) and local landscape character

Located in the background (12 km) 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 NNP, mitigation for reducing light spillage should be undertaken.

7.1.1 Contrast Rating Summary Table

GPS ID	R1	R2	R3	R4	
Name	B2 eastbound	Khan mine access road	Khan River	Welwitschia Plains/ NNP	
Land use	Rural	Road	Tourist	Tourist/ nature reserve	
Distance	5.2	2	Adjacent	12	
Exposure	FG	FG	FG	BG	
VRM Class	III	III	II	III	

Contrast					
Form	Weak	Weak	Strong	Weak	
Lines	Weak	Weak	Strong	Weak	
Colour	Weak	Weak	Strong	Weak	
Texture	Weak	Weak	Strong	Weak	
DoC	Weak	Weak	Strong	Weak	

Key: N = Neutral, S = Strong, M = Moderate, W = Weak

Visual Objectives Met					Conclusion
Conveyor	Y (M)	Y (M)	No	x	No
Pipeline	x	x	Y (M)	x	Y (M)
Power line	x	Yes	Y (M)	x	Y (M)
Access road	x	x	No	x	No
Bridge	x	x	No	x	No
Lights at night	Y (M)	Y (M)	Y (M)	Y (M)	Y (M)
SUMMARY	With MIT.	With MIT.	No	With MIT.	No

Key: Y = Yes, N = No, Y (M) = Yes with mitigation, x = Not visible

The overhead conveyor will be visible from two of the four receptors. The Class III visual objectives 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, 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 objective.

The power line would not be visible from the B2 or NNP 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 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 NNP 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 NNP.

8 IMPACT ASSESSMENT

Impact, as defined by South Africa's Department of Environmental Affairs and Development Planning's (DEA&DP) Guideline for involving Visual and Aesthetic Specialists in EIA processes (2005), is: 'A description of the effect of an aspect of the development on a specified component of the biophysical, social or economic environment within a defined time and space' (Oberholzer. 2005).

Based on the contrast rating, which was undertaken from each of the surrounding KOP receptors, an assessment was made on whether the proposed activities met the recommended visual objectives defined in order to protect the landscape character of the area.

8.1 No-Go Alternative

The Uranium Rush SEA states that "most of the existing and proposed uranium mines are in, or adjacent to, national parks and protected areas. These areas are protected because of their special landscapes, biodiversity and heritage resources. While the Policy on Mining in Protected Areas allows mining and prospecting in Protected Areas, it is also possible in terms of the proposed Parks and Wildlife Management Bill of 2009, for MET and MME to agree to withdraw certain areas within parks from mining. One of the recommendations of this SEA is that certain biodiversity, tourism and heritage hotspots should be given Red Flag status and thus be permanently unavailable for mining and prospecting. This could limit the expansion of the uranium mines into certain areas in future, but at present there are numerous, extensive ore bodies which do not fall in the proposed Red Flag areas." In relation to the proposed project, the Khan River is defined as a tourism Yellow Flag area.

The Husab mine was granted permission for a large-scale mining operation in the NNP. The project includes two open pits, a large waste rock dump and tailing **co-disposal facility**, a large processing plant, as well as an access road which is routed through the Khan River with a 2.4 km section of the road located alongside the river. The proposed Z20 project is located in an existing mine license area in very similar areas to the planned Husab mine, and the crossing of the Khan River will be direct.

8.2 Visual Impact to Landscape Character for Preferred Alternative

8.2.1 Construction

Visual impact will be caused by landscape changes brought about by construction of the road, power line, water pipes, bridge over the Khan River and the overhead conveyor, which will be clearly visible from receptors utilising the Khan River as a 4x4 recreation route, and partially visible from the old Khan Mine access route.

Criteria	Mitigation		Motivation
	Without	With	
Nature of the Impact	Negative	Negative	With or without mitigation, the proposed project will result in direct negative visual impacts during the construction phase.
Extent	Local	Local	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.
Magnitude	High	High	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.
Duration	Medium	Medium	The duration of the impacts would be <i>short-term</i> during construction and would be completed within approximately three years.
Probability	Definite	Definite	The visual impact of the Khan River will generate <i>strong</i> levels of landscape change, which will be clearly visible from the Khan River receptors. The visual impact will

			definitely occur.
Confidence	Certain	Certain	The site visit and 3D modelling increases the certainty of the decision.
Reversibility	Irreversible	Irreversible	Given the large scale of filling required for the road, which will include blasting, it is likely that some aspects of the road construction will be irreversible.
SIGNIFICANCE	Medium	Medium	The short term of the construction period, and the local geographic area of influence, reduce the significance to <i>Medium</i> for with, and without, mitigation. Construction phase impacts will be difficult to manage but should be implemented in terms of meeting best practice standards.

(See Annexure 2 for criteria definitions)

Mitigations

- 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 scree 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 3).

- Power Line
 - 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.

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 NNP. This could result in an indirect impact to the NNP. To minimize this, all possible options to reduce the combined (duplicated) impacts from the Z20 and Husab projects should be considered, especially with the option of a single access routing across the Khan, which limits the visibility of the road/ bridge to a minimum. In this instance, the Z20 access road through the Panner Gorge is preferred as it does not have the 2, 4 km routing along the Khan River which the Husab access road has. The possibility of utilising the Rössing processing plant for the Husab mine should be considered, as this would reduce the requirement of a separate processing plant and tailings storage facility.

8.2.2 Operation

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.

Criteria	Mitigation		Motivation
	Without	With	
Nature of the Impact	Negative	Negative	With or without mitigation, the proposed project will result in direct negative visual impacts during the construction phase
Extent	Local	Local	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.
Magnitude	High	Medium	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. 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.
Duration	Long	Long	The visual impacts, with or without mitigation, would last for a long time period.
Probability	Definite	Definite	The visual impact would definitely occur, with and without mitigation.
Confidence	Certain	Certain	Confidence levels are certain.
Reversibility	Irreversible	Irreversible	Without and with mitigation, elements of the project would be irreversible.
SIGNIFICANCE	High	Medium to High	With the reduction in the number of pillars, the bridge will appear less cluttered. Without the mitigations, the visual impact will remain high.

(See Annexure 2 for criteria definitions)

Mitigations

- Road and Bridge

- o No street lights along the road or bridge.
- o The bridge should be left cement-grey in colour.
- o The road should be tarred to reduce dust.
- Overhead Conveyor
 - o No lights on the overhead conveyor (unless required for aircraft warning).
 - o Paint all structures desert colours (grey-brown).
- Lights at Night
 - o Use Mesopic LED lighting that is downward-directional and side-screened for the conveyor turning points (refer to lighting recommendations in Annexure 3).

Cumulative Impacts

As for construction phase.

8.2.3 Decommissioning

Visual impact will be caused by remaining landscape changes after mine closure, related to the road, power line, water pipes, bridge over the Khan River and the overhead conveyor.

Criteria	Mitigation		Motivation
	Without	With	
Nature of the Impact	Negative	Positive	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 NNP.
Extent	Regional	Regional	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).
Magnitude	High	Low	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.
Duration	Long	Long	The visual impacts without mitigation could lead to long-term visual scarring. The road as a tourist route would also have a long-term positive duration.
Probability	Definite	Probable	The <i>high</i> 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.
Confidence	Certain	Unsure	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.
Reversibility	Irreversible	Irreversible	Without and with mitigation, the visual impacts will be irreversible.
SIGNIFICANCE	High	Low	Without mitigation, the negative visual significance would be high. With mitigation, the positive visual significance would be low.

(See Annexure 2 for criteria definitions)

Mitigations

- All Activities
 - Unless the road can be utilised for post mine tourism, 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 accessed 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 CONCLUSION

The Erongo Regions most predominant features are the extreme arid nature of the coastline and surrounding Namib Desert. Namibia, with its excellent infrastructure, is currently attracting a growing tourist industry. 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 conflict between the natural conservation and mining landuse resulted in the Uranium Rush SEA being undertaken in 2010. Subsequent to the SEA, the Rössing mine has recently undertaken a Social & Environmental Impact Assessment (SEIA) for the expansion of its mining and processing capacity. Swakop Uranium Husab Mine, which is located to the south of the Z20 pit site, has been granted mining rights in the area and will include two open pits, a combined waste rock dump and tailings facility, a processing plant, as well as an access route through the Khan River Valley, which includes a section of road which is routed along the Khan River. The cumulative impacts of this project need to be considered especially in terms of the two separate access roads proposed over the Khan River.

The Z20 uranium deposit is located south of the Khan River in the Namib Naukluft National Park. The proposed infrastructure corridor would cross from the existing Rössing mine to the north of the river. The Khan River was identified in the Uranium Rush as a Yellow Flag tourism area and rated high due to potential receptors sensitivity to landscape modifications. 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 key receptors other than the Khan River receptors 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. From this location, the visible project activities would be the overhead conveyor, the transmission line and the bridge structure. The Class II visual objective defined for the Khan River area which requires *low* levels of landscape change 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. 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 *negative and high* due to permanent *high* exposure to the Khan River receptors and the proximity to the NNP. As the Husab Mine access road crosses the Khan River downstream, 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. To reduce cumulative impacts, opportunities for single access from the B2 to the Welwitschia Plains should be considered with the preferred access being the Panner Gorge route (as the Husab Route is routed 2.4 kilometres along the Khan River). 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.

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12 ANNEXURE 1: MODEL PROOF

Photo Montages and 3D Visualisation

As a component in this contrast rating process, visual representation, such as photo montages, are vital in large-scale modifications, as this serves to inform I&APs and decision-making authorities of the nature and extent of the impact associated with the proposed project/development. There is an ethical obligation in this process, as visualisation can be misleading if not undertaken ethically. In terms of adhering to standards for ethical representation of landscape modifications, VRM Africa subscribes to the Proposed Interim Code of Ethics for Landscape Visualisation developed by the Collaborative for Advanced Landscape Planning (CALP) (July 2003) (Sheppard, S.R.J., 2005). This code states that professional presenters of realistic landscape visualisations are responsible for promoting full understanding of proposed landscape changes, providing an honest and neutral visual representation of the expected landscape, by seeking to avoid bias in responses and demonstrating the legitimacy of the visualisation process. Presenters of landscape visualisations should adhere to the principles of:

- Access to Information
- Accuracy
- Legitimacy
- Representativeness
- Visual Clarity
- Interest

For details of Code of Ethical Conduct, see Methodology in Annexure 2.

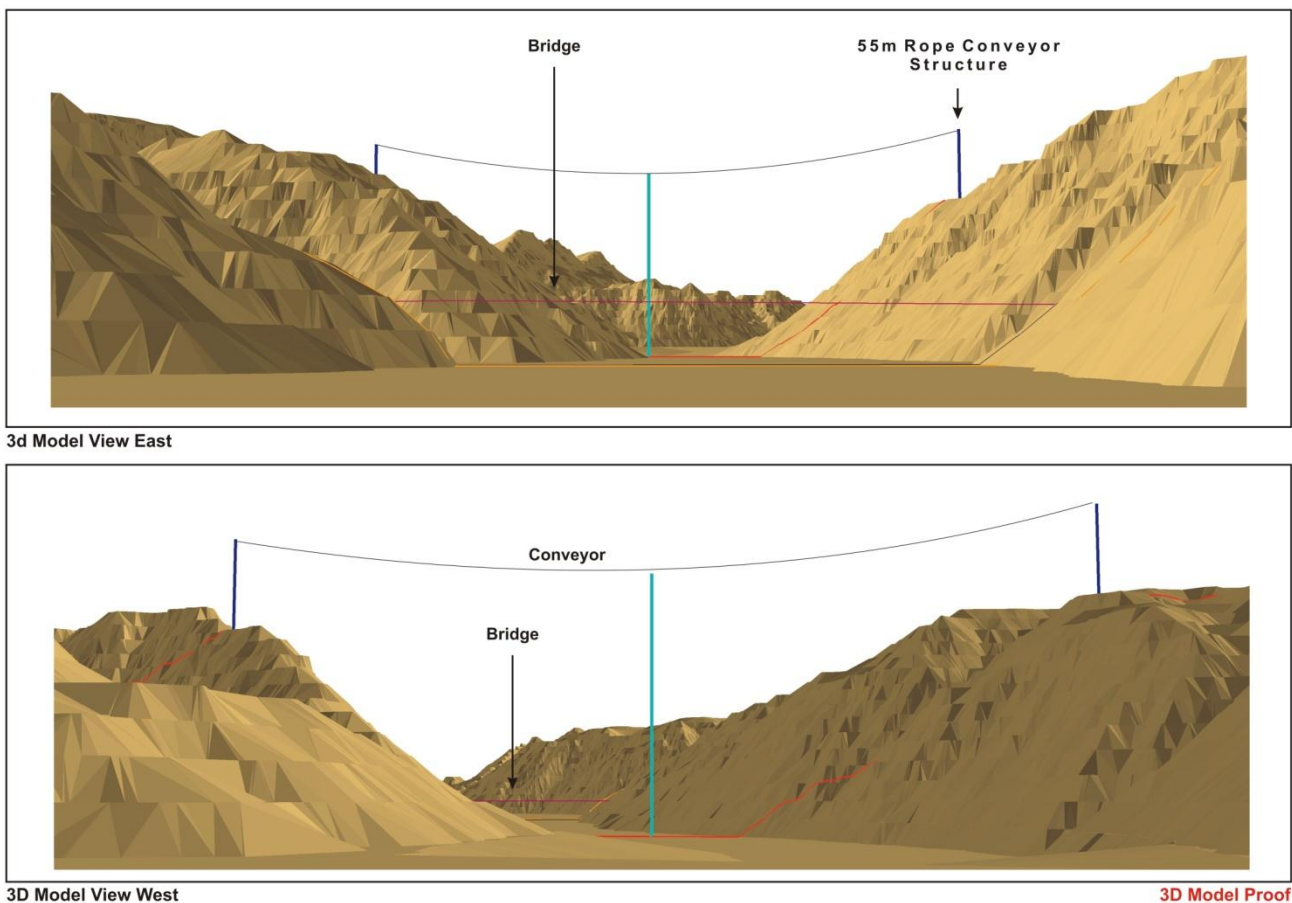


Figure 25: 3D Model Proof View West

13 ANNEXURE 2: METHODOLOGY

Visual impact is defined as ‘the effect of an aspect of the development on a specified component of the visual, aesthetic or scenic environment within a defined time and space.’ (*Oberholzer, B., 2005*). As identified in this definition, ‘landscapes are considerably more than just the visual perception of a combination of landform, vegetation cover and buildings, as they embody the history, land use, human culture, wildlife and seasonal changes to an area.’ (*U.K IEMA, 2002*). These elements combine to produce distinctive local character that will affect the way in which the landscape is valued and perceived.

VRM Africa’s objective is to provide Interested and Affected Parties (I&APs) and decision-makers with sufficient information to take “early opportunities for avoidance of negative visual effects.” This is based on the U.K. Institute of Environmental Management and Assessment’s (IEMA), and South Africa’s Western Cape Department of Environmental Affairs and Development Planning’s (DEA&DP), guidelines:

- “The ideal strategy for each identifiable, negative effect is one of avoidance. If this is not possible, alternative strategies of reduction, remediation and compensation may be explored. If the consideration of mitigation measures is left to the later stages of scheme design, this can result in increased mitigation costs because early opportunities for avoidance of negative visual effects are missed.” (*U.K IEMA, 2002*).
- “In order to retain the visual quality and landscape character, management actions must become an essential part of the guidelines throughout construction and operation...Proper management actions ensure that the lowest possible impact is created by the project...
- Ongoing monitoring programmes, with regard to the control of aesthetic aspects, for all stages of the project, are a vital component, ensuring that the long-term visual management objectives are met.” (*Oberholzer, B., 2005*).

The impact assessment methodology that VRM Africa uses is based on the VRM methodology developed by the United States Bureau of Land Management (BLM) in that the study involves the measurement of contrast in the form, line, texture and colour of the proposed landscape modification, against the same elements found in the natural landscape. The contrast rating is a systematic process undertaken from KOPs surrounding the project site, and the assessment of the degree of contrast (DoC) is used to evaluate the potential visual impacts associated with the proposed landscape modifications. The method is based on the premise that the degree to which a proposed landscape modification affects the visual quality of a landscape depends on the visual contrast created between a project and the existing landscape (*USA Bureau of Land Management, 2004*).

Landscape Significance

Landscape significance is assessed in order to highlight the nature and degree of significance of the landscape context by differentiating between those landscapes of recognized or potential significance or sensitivity to modification to those landscape contexts that have low sensitivity and scenic value. ‘Different levels of scenic values require different levels of management. For example, management of an area with high scenic value might be focused on preserving the existing character of the landscape, and management of an area with little scenic value might allow for major modifications to the landscape. Determining how an area should be managed first requires an assessment of the area’s scenic values. Assessing scenic values and determining visual impacts can be a subjective process. Objectivity and consistency can be greatly increased by using standard assessment criteria to describe and evaluate landscapes, and to also describe proposed projects.’ (*USA Bureau of Land Management, 2004*).

Viewshed Analysis

A viewshed is ‘the outer boundary defining a view catchment area, usually along crests and ridgelines’ (*Oberholzer, B., 2005*). This reflects the area within which, or the extent to which, the landscape modification is likely to be seen. It is important to assess the extent to which the proposed landscape modifications are visible in the surrounding landscape, as a point of departure for defining the shared landscape context, and to identify the receptors making use of the common views. Viewshed analyses are not absolute indicators of the level of significance, but an indication of

potential visibility (*Centre for Advanced Spatial Analysis, 2002*). Once the sites and heights of the proposed activities have been finalised, the viewshed analysis will be undertaken.

Key Observation Points (KOPs)

KOPs are defined by the BLM Visual Resource Management as the people located in strategic locations surrounding the property that make consistent use of the views associated with the site where the landscape modifications are proposed. These locations are used to assess the suitability of the proposed landscape modifications by means of assessing the degree of contrast of the proposed landscape modifications to the existing landscape, taking into consideration the visual management objectives defined for the area. The following selection criteria were utilised in defining the KOPs:

- Angle of observation
- Number of viewers
- Length of time the project is in view
- Relative project size
- Season of use
- Critical viewpoints, e.g. views from communities, road crossings
- Distance from property

Visual Sensitivity of Receptors Criteria

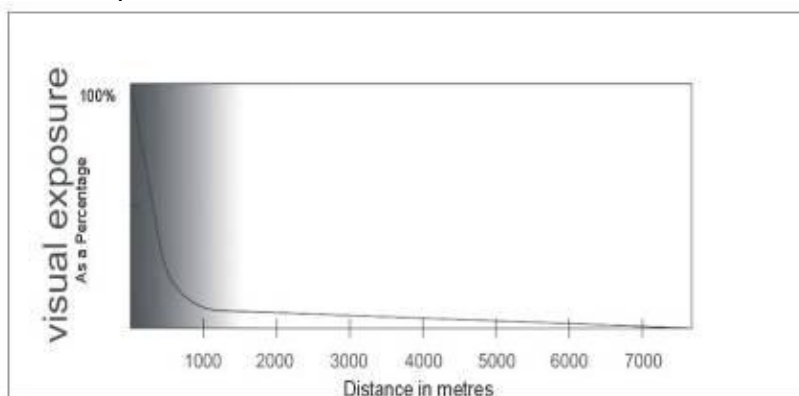
The level of visual impact considered acceptable is dependent on the types of receptors.

- *High sensitivity* : e.g. residential areas, nature reserves and scenic routes or trails
- *Moderate sensitivity* : e.g. sporting or recreational areas, or places of work
- *Low sensitivity* : e.g. industrial, mining or degraded areas

Receptor Exposure

The area where a landscape modification starts to influence the landscape character is termed the Zone of Visual Influence (ZVI) and is defined by the U.K. Institute of Environmental Management and Assessment's (IEMA) '*Guidelines for Landscape and Visual Impact Assessment*' as 'the area within which a proposed development may have an influence or effect on visual amenity (of the surrounding areas).'

The inverse relationship of distance and visual impact is well recognised in visual analysis literature (*Hull, R.B. and Bishop, I.E., 1988*). According to Hull and Bishop, exposure, or visual impact, tends to diminish exponentially with distance. The areas where most landscape modifications would be visible are located within 2 km from the site of the landscape modification. Thus the potential visual impact of an object diminishes at an exponential rate as the distance between the observer and the object increases due to atmospheric conditions prevalent at a location, which causes the air to appear greyer, thereby diminishing detail. For example, viewed from 1000 m from a landscape modification, the impact would be 25% of the impact as viewed from 500 m from a landscape modification. At 2000m it would be 10% of the impact at 500 m. The relationship is indicated in the following graph generated by Hull and Bishop.



The VRM methodology also takes distance from a landscape modification into consideration in terms of understanding visual resource. Three distance categories are defined by the Bureau of Land

Management (United States Department of Interior): (*USA Bureau of Land Management, 2004*). The distance zones are:

1. Foreground / Middle ground, up to approximately 6 km, which is where there is potential for the sense of place to change;
2. Background areas, from 6 km to 24 km, where there is some potential for change in the sense of place, but where change would only occur in the case of very large landscape modifications; and
3. Seldom seen areas, which fall within the Foreground / Middle ground area but, as a result of no receptors, are not viewed or are seldom viewed.

In order to determine the level of exposure to receptors, the following criteria were utilised, and the receptors located within each distance zone were identified:

Visual Exposure Criteria (*Oberholzer, B., 2005*)

- *High* : Dominant or clearly noticeable (<2 km)
- *Moderate* : Recognisable to the viewer (2 – 6 km)
- *Low* : Minimally visible areas in the landscape (>6 km)

Receptor Sensitivity

Sensitivity levels are a measure of public concern for scenic quality. Public lands are assigned high, medium or low sensitivity levels by analysing the various indicators of public concern. The following criteria were used to assess the sensitivity of each of the communities:

- **Public Interest:** The visual quality of an area may be of concern to local, state, or national groups. Indicators of this concern are usually expressed in public meetings, letters, newspaper or magazine articles, newsletters, landuse plans, etc. Public controversy, created in response to proposed activities that would change the landscape character, should also be considered.
- **Special Areas:** Management objectives for special areas such as natural areas, wilderness areas or wilderness study areas, wild and scenic rivers, scenic areas, scenic roads or trails, and Areas of Critical Environmental Concern (ACEC), frequently require special consideration for the protection of visual values. This does not necessarily mean that these areas are scenic, but rather that one of the management objectives may be to preserve the natural landscape setting. The management objectives for these areas may be used as a basis for assigning sensitivity levels.
- **Adjacent Land Uses:** The interrelationship with land uses in adjacent land can affect the visual sensitivity of an area. For example, an area within the viewshed of a residential area may be very sensitive, whereas an area surrounded by commercially developed lands may not be visually sensitive.
- **Type of User:** Visual sensitivity will vary with the type of users. Recreational sightseers may be highly sensitive to any changes in visual quality, whereas workers who pass through the area on a regular basis may not be as sensitive to change.
- **Amount of Use:** Areas seen and used by large numbers of people are potentially more sensitive. Protection of visual values usually becomes more important as the number of viewers increase (*USA Bureau of Land Management, 2004*).

Scenic Quality

In the VRM methodology, scenic quality is a measure of the visual appeal of a tract of land. In the visual resource inventory process, public lands are given a rating based on the apparent scenic quality, which is determined using seven key factors. During the rating process, each of these factors is ranked on a comparative basis with similar features in the region (*USA Bureau of Land Management, 2004*). These seven elements are:

1. **Landform:** Topography becomes more interesting as it gets steeper, or more massive, or more severely or universally sculptured.
2. **Vegetation:** Give primary consideration to the variety of patterns, forms, and textures created by plant life. Consider short-lived displays when they are known to be recurring or spectacular. Also consider smaller-scale vegetation features which add striking and intriguing detail elements to the land.

3. **Water:** That ingredient which adds movement or serenity to a scene. The degree to which water dominates the scene is the primary consideration.
4. **Colour:** Consider the overall colour(s) of the basic components of the landscape (e.g., soil, rock, vegetation, etc.) as they appear during seasons or periods of high use. Key factors to use when rating "colour" are variety, contrast and harmony.
5. **Scarcity:** This factor provides an opportunity to give added importance to one, or all, of the scenic features that appear to be relatively unique or rare within one physiographic region.
6. **Adjacent Land Use:** Degree to which scenery, outside the scenery unit being rated, enhances the overall impression of the scenery within the rating unit. The distance at which adjacent scenery will start to influence scenery within the rating unit ranges, depending upon the characteristics of the topography, the vegetative cover, and other such factors.
7. **Cultural Modifications:** Cultural modifications in the landform, water, and vegetation, and addition of structures, should be considered, and may detract from the scenery in the form of a negative intrusion, or complement or improve the scenic quality of a unit.

Visual Sensitivity Rating Criteria

This is the inherent sensitivity of the landscape, which is usually determined by a combination of topography, landform, vegetation cover and settlement pattern.

- *High visual sensitivity* : highly visible and potentially sensitive areas in the landscape;
- *Moderate visual sensitivity* : moderately visible areas in the landscape; and
- *Low visual sensitivity* : minimally visible areas in the landscape.

Photo Montages and 3D Visualisation

As a component in this contrast rating process, visual representation, such as photo montages are vital in large-scale modifications, as this serves to inform I&APs and decision-making authorities of the nature and extent of the impact associated with the proposed project/development. There is an ethical obligation in this process, as visualisation can be misleading if not undertaken ethically. In terms of adhering to standards for ethical representation of landscape modifications, VRM Africa subscribes to the Proposed Interim Code of Ethics for Landscape Visualisation developed by the Collaborative for Advanced Landscape Planning (CALP) (July 2003) (*Sheppard, S.R.J., 2005*). This code states that professional presenters of realistic landscape visualisations are responsible for promoting full understanding of proposed landscape changes, providing an honest and neutral visual representation of the expected landscape, by seeking to avoid bias in responses and demonstrating the legitimacy of the visualisation process. Presenters of landscape visualisations should adhere to the principles of:

- Access to Information
- Accuracy
- Legitimacy
- Representativeness
- Visual Clarity
- Interest

The Code of Ethical Conduct states that the presenter should:

- Demonstrate an appropriate level of qualification and experience.
- Use visualisation tools and media that are appropriate to the purpose.
- Choose the appropriate level of realism.
- Identify, collect and document supporting visual data available for, or used in, the visualisation process.
- Conduct an on-site visual analysis to determine important issues and views.
- Seek community input on viewpoints and landscape issues to address in the visualisations.
- Provide the viewer with a reasonable choice of viewpoints, view directions, view angles, viewing conditions and timeframes appropriate to the area being visualised.
- Estimate and disclose the expected degree of uncertainty, indicating areas and possible visual consequences of the uncertainties.

- Use more than one appropriate presentation mode and means of access for the affected public.
- Present important non-visual information at the same time as the visual presentation, using a neutral delivery.
- Avoid the use, or the appearance of, ‘sales’ techniques or special effects.
- Avoid seeking a particular response from the audience.
- Provide information describing how the visualisation process was conducted and how key decisions were taken (*Sheppard, S.R.J., 2005*).

VRM Classes

The landscape character of the proposed project site is surveyed to identify areas of common land use and landscape character. These areas are then evaluated in terms of scenic quality (landscape significance) and receptor sensitivity to landscape change (of the site) in order to define the visual objective for the project site. The overall objective is to maintain a landscape’s integrity, but this can be achieved at varying levels, called VRM Classes, depending on various factors, including the visual absorption capacity of a site (i.e., how much of the project would be “absorbed” or “disappear” into the landscape). The areas identified on site are categorised into these Classes by using a matrix from the BLM Visual Resource Management method as seen below, which is then represented in a visual sensitivity map

The BLM has defined four Classes that represent the relative value of the visual resources of an area:

- iv. **Classes I and II** are the most valued
- v. **Class III** represent a moderate value
- vi. **Class IV** is of least value

		VISUAL SENSITIVITY LEVELS								
		High			Medium			Low		
SCENIC QUALITY	A (High)	II	II	II	II	II	II	II	II	II
	B (Medium)	II	III	III/ IV *	III	IV	IV	IV	IV	IV
	C (Low)	III	IV	IV	IV	IV	IV	IV	IV	IV
DISTANCE ZONES		fore/middle ground	Background	seldom seen	fore/middle ground	background	seldom seen	fore/middle ground	background	seldom seen

(A= scenic quality rating of ≥19; B = rating of 12 – 18, C= rating of ≤11)

* If adjacent areas are **Class III** or lower, assign **Class III**, if higher, assign **Class IV**

Evaluation of the suitability of a proposed landscape modification is undertaken by means of assessing the proposed modification against a predefined management objective assigned to each class. The VRM class objectives are defined as follows:

1. The **Class I** objective is to preserve the existing character of the landscape, where the level of change to the characteristic landscape should be very low, and must not attract attention. **Class I** is assigned to those areas where a *specialist decision* has been made to maintain a natural landscape.
2. 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.

3. 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.
4. The **Class IV** objective is to provide for management activities which require major modifications of the existing character of the landscape. The level of change to the landscape can be high, and these management activities may dominate the view and be the major focus of the viewer's (s') attention.

Contrast Rating Stage

The contrast rating, or impacts assessment phase, is undertaken after the inventory process has been completed. The suitability of landscape modification is assessed by measuring the Degree of Contrast (DoC) of the proposed landscape modification to the existing contrast created by the existing landscape. This is done by evaluating the level of change to the existing landscape in terms of the line, colour, texture and form, in relation to the visual objectives defined for the area. The following criteria are utilised in defining the DoC:

- **None** : The element contrast is not visible or perceived.
- **Weak** : The element contrast can be seen but does not attract attention.
- **Moderate** : The element contrast begins to attract attention and begins to dominate the characteristic landscape.
- **Strong** : The element contrast demands attention, will not be overlooked, and is dominant in the landscape.

As an example, in a Class I area, the visual objective is to preserve the existing character of the landscape, and the resultant contrast to the existing landscape should not be notable to the casual observer and cannot attract attention. In a Class IV area example, the objective is to provide for management activities which require major modifications of the existing character of the landscape. Based on whether the VRM objectives are met, mitigations, if required, are defined to avoid, reduce or mitigate the proposed landscape modifications so that the visual impact does not detract from the surrounding landscape sense of place.

13.1 Aurecon Impact Assessment Methodology

A standardised and internationally recognised methodology¹ has been applied to assess the significance of the potential environmental impacts of Rössing Uranium's project, outlined as follows: 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 RU as the proponent, and their acceptance and approval ultimately with MET:DEA and MME. The SEIA Report will explicitly describe RU's commitments in this regard. The tables on the following pages show the scales used to assess these variables and define each of the rating categories.

¹As described, *inter alia*, in the South African Department of Environmental Affairs and Tourism's Integrated Environmental Management Information Series (Government of SA, 2004).

Table 1: 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 <i>severely</i> altered
	Medium	Social and/or natural functions and/ or processes are <i>notably</i> altered
	Low	Social and/or natural functions and/ or processes are <i>slightly</i> altered
	Very Low	Social and/or natural functions and/ or processes are <i>negligibly</i> altered
	Zero	Social and/or natural functions and/ or processes remain <i>unaltered</i>
Duration of impact	Short term	Up to 3 years
	Medium Term	4 to 10 years after construction
	Long Term	More than 10 years after construction

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 the following table, 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 2: Definition of significance ratings

SIGNIFICANCE RATINGS	LEVEL OF CRITERIA REQUIRED
High	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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 the following two tables. It is important to note that the significance of an impact should always be considered in concert with the probability of that impact occurring.

Table 3: 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 4: 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.

Lastly, the REVERSIBILITY of the impact is estimated using the rating system outlined in the following table.

Table 5: 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.

13.2 DEA&DP Nature of the visual impacts for the total project with mitigation

EXTENT	<p style="text-align: center;">Geographical area of influence.</p> <p>Site Related (S): <i>extending only as far as the activity</i> Local (L): <i>limited to immediate surroundings.</i> Regional (R): <i>affecting a larger metropolitan or regional area</i> National (N): <i>affecting large parts of the country</i> International (I): <i>affecting areas across international boundaries</i></p>
DURATION	<p style="text-align: center;">Predicted lifespan</p> <p>Short term (S): <i>duration of the construction phase.</i> Medium term (M): <i>duration for screening vegetation to mature.</i> Long term (L): <i>lifespan of the project.</i> Permanent (P): <i>where time will not mitigate the visual impact.</i></p>
INTENSITY	<p style="text-align: center;">Magnitude of impact on views, scenic or cultural resources</p> <p>Low (L): <i>where visual and scenic resources are not affected.</i> Moderate (M): <i>where visual and scenic resources are affected</i> High (H): <i>where scenic and cultural resources are significantly affected.</i></p>
PROBABILITY	<p style="text-align: center;">Degree of possible visual impact:</p> <p>Improbable (I): <i>possibility of the impact occurring is very low.</i> Probable (P): <i>distinct possibility that the impact will occur.</i> Highly probable (HP): <i>most likely that the impact will occur.</i> Definite (D): <i>impact will occur regardless of any prevention measures.</i></p>
SIGNIFICANCE	<p style="text-align: center;">A synthesis of nature, duration, intensity, extent and probability</p> <p>Low (L): <i>will not have an influence on the decision.</i> Moderate (M): <i>should have an influence on the decision unless it is mitigated.</i> High (H): <i>would influence the decision regardless of any possible mitigation.</i></p>
CONFIDENCE LEVELS	Key uncertainties and risks in the VIA process, which may influence the accuracy of, and confidence in, the VIA process.

Source: DEA&DP Guideline for involving Visual and Aesthetic Specialists in EIA Processes, page 29

13.3 Visual Resource Management Criteria

1. Scenic Quality Rating Questionnaire

KEY FACTORS	RATING CRITERIA AND SCORE		
	5	3	1
Land Form	High vertical relief as expressed in prominent cliffs, spires or massive rock outcrops, or severe surface variation or highly eroded formations including dune systems: or detail features that are dominating and exceptionally striking and intriguing.	Steep-sided river valleys, or interesting erosion patterns or variety in size and shape of landforms; or detail features that are interesting, though not dominant or exceptional.	Low rolling hills, foothills or flat valley bottoms; few or no interesting landscape features.
Vegetation	A variety of vegetative types as expressed in interesting forms, textures and patterns.	Some variety of vegetation, but only one or two major types.	Little or no variety or contrast in vegetation.
Water	Clear and clean appearing, still or cascading white water, any of which are a dominant factor in the landscape.	Flowing, or still, but not dominant in the landscape.	Absent, or present but not noticeable.
Colour	Rich colour combinations, variety or vivid colour: or pleasing contrasts in the soil, rock, vegetation, water.	Some intensity or variety in colours and contrast of the soil, rock and vegetation, but not a dominant scenic element.	Subtle colour variations contrast or interest: generally mute tones.
Adjacent Scenery	Adjacent scenery greatly enhances visual quality.	Adjacent scenery moderately enhances overall visual quality.	Adjacent scenery has little or no influence on overall visual quality.
Scarcity	One of a kind: unusually memorable, or very rare within region. Consistent chance for exceptional wildlife or wildflower viewing etc.	Distinctive, though somewhat similar to others within the region.	Interesting within its setting, but fairly common within the region.
SCORE	2	0	-4
Cultural Modification	Modifications add favourably to visual variety, while promoting visual harmony.	Modifications add little or no visual variety to the area, and introduce no discordant elements.	Modifications add variety but are very discordant and promote strong disharmony.

2. Sensitivity Level Rating Questionnaire

The following VRM questionnaire was completed for general receptors in the area:

FACTORS	QUESTIONS	
Type of Users	Maintenance of visual quality is:	
	A major concern for most users	High
	A moderate concern for most users	Moderate
	A low concern for most users	Low
Amount of use	Maintenance of visual quality becomes more important as the level of use increases:	
	A high level of use	High
	Moderately level of use	Moderate
	Low level of use	Low
Public interest	Maintenance of visual quality:	
	A major concern for most users	High
	A moderate concern for most users	Moderate
	A low concern for most users	Low
Adjacent land Users	Maintenance of visual quality to sustain adjacent land use objectives is:	
	Very important	High
	Moderately important	Moderate
	Slightly important	Low
Special Areas	Maintenance of visual quality to sustain Special Area management objectives is:	
	Very important	High
	Moderately important	Moderate
	Slightly important	Low

3. Distance Zones

Landscapes are subdivided into four distance zones, based on relative visibility from travel routes or observation points. The four zones are:

DISTANCE ZONES	DISTANCE ZONES DEFINITION
Foreground	The foreground (fig) zone includes areas seen from highways, rivers, or other viewing locations that are less than 1 kilometres away.
Middle ground	The middle ground (mg) zone includes areas seen from highways, rivers, or other viewing locations that are greater than 1 kilometre but less than 2 kilometres away.
Background	Seen areas beyond the foreground-middle ground zone greater than 2 kilometres away are in the background (big) zone.
Seldom seen	Areas not seen as foreground-middle ground or background (i.e. hidden from view) are in the seldom-seen (sis) zone

4. VRM Terminology

The following terms were used in the Contrast Rating Tables to help define Form, Line, Colour, and Texture. The definitions were a combination of Microsoft Word Dictionary and simple description.

FORM	LINE	COLOUR	TEXTURE
Simple	Horizontal	Dark Light Mottled	Smooth
Weak	Vertical		Rough
Strong	Geometric		Fine
Dominant	Angular		Coarse
Flat	Acute		Patchy
Rolling	Parallel		Even
Undulating	Curved		Uneven
Complex	Wavy		Complex
Plateau	Strong		Simple
Ridge	Weak		Stark
Valley	Crisp		Clustered
Plain	Feathered		Diffuse
Steep	Indistinct		Dense
Shallow	Clean		Scattered
Organic	Prominent		Sporadic
Structured	Solid		Consistent

Simple	Basic, composed of few elements	Organic	Derived from nature; occurring or developing gradually and naturally
Complex	Complicated; made up of many interrelated parts	Structure	Organised; planned and controlled; with definite shape, form, or pattern
Weak	Lacking strength of character	Regular	Repeatedly occurring in an ordered fashion
Strong	Bold, definite, having prominence	Horizontal	Parallel to the horizon
Dominant	Controlling, influencing the surrounding environment	Vertical	Perpendicular to the horizon; upright
Flat	Level and horizontal without any slope; even and smooth without any bumps or hollows	Geometric	Consisting of straight lines and simple shapes
Rolling	Progressive and consistent in form, usually rounded	Angular	Sharply defined; used to describe an object identified by angles
Undulating	Moving sinuously like waves; wavy in appearance	Acute	Less than 90°; used to describe a sharp angle
Plateau	Uniformly elevated flat to gently undulating land bounded on one or more sides by steep slopes	Parallel	Relating to or being lines, planes, or curved surfaces that are always the same distance apart and therefore never meet
Ridge	A narrow landform typical of a highpoint or apex; a long narrow hilltop or range of hills	Curved	Rounded or bending in shape
Valley	Low-lying area; a long low area of land, often with a river or stream running through it, that is surrounded by higher ground	Wavy	Repeatedly curving forming a series of smooth curves that go in one direction and then another
Plain	A flat expanse of land; fairly flat dry land, usually with few trees	Feathered	Layered; consisting of many fine parallel strands
Steep	Sloping sharply often to the extent of being almost vertical	Indistinct	Vague; lacking clarity or form
Prominent	Noticeable; distinguished, eminent, or well-known	Patchy	Irregular and inconsistent;
Solid	Unadulterated or unmixed; made of the same material throughout; uninterrupted	Even	Consistent and equal; lacking slope, roughness, and irregularity
Broken	Lacking continuity; having an uneven surface	Uneven	Inconsistent and unequal in measurement irregular
Smooth	Consistent in line and form; even textured	Stark	Bare and plain; lacking ornament or relieving features
Rough	Bumpy; knobby; or uneven, coarse in texture	Clustered	Densely grouped
Fine	Intricate and refined in nature	Diffuse	Spread through; scattered over an area
Coarse	Harsh or rough to the touch; lacking detail	Diffuse	To make something less bright or intense

14 ANNEXURE 3: GENERAL MITIGATIONS

14.1 Lights at Night

Due to the lack of development and the remoteness of the area, the surrounding mountainous areas have a strong wilderness appeal, which is reinforced by a dark sky at night. Lights at night have the effect of increasing the visual presence to that of a much wider area if not managed. 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.

Mitigation:

- 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.
- 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.

Mesopic Lighting

Mesopic vision is a combination of photopic vision and scotopic vision in low, but not quite dark, lighting situations. The traditional method of measuring light assumes photopic vision and is often a poor predictor of how a person sees at night. The light spectrum optimized for mesopic vision contains a relatively high amount of bluish light and is therefore effective for peripheral visual tasks at mesopic light levels. (CIE, 2012)

The Mesopic Street Lighting Demonstration and Evaluation Report by the Lighting Research Centre (LRC) in New York found that the 'replacement of white light sources (induction and ceramic metal halide) were tuned to optimize human vision under low light levels while remaining in the white light spectrum. Therefore, outdoor electric light sources that are tuned to how humans see under mesopic lighting conditions can be used to reduce the luminance of the road surface while providing the same, or better, visibility. Light sources with shorter wavelengths, which produce a "cooler" (more blue and green) light, are needed to produce better mesopic vision. Based on this understanding, the LRC developed a means of predicting visual performance under low light conditions. This system is called the unified photometry system. Responses to surveys conducted on new installations revealed that area residents perceived higher levels of visibility, safety, security, brightness, and colour rendering with the new lighting systems than with the standard High-Purity Standards (HPS) systems. The new lighting systems used 30% to 50% less energy than the HPS systems. These positive results were achieved through tuning the light source to optimize mesopic vision. Using less wattage and photopic luminance also reduces the reflectance of the light off the road surface. Light reflectance is a major contributor to light pollution (sky glow).' (Lighting Research Center. New York. 2008)

14.2 ‘Good Neighbour – Outdoor Lighting’

Presented by the New England Light Pollution Advisory Group (NELPAG) <http://cfa.harvard.edu/cfa/ps/nelpag.html>) and Sky & Telescope <http://SkyandTelescope.com/>). NELPAG and Sky & Telescope support the International Dark-Sky Association (IDA) (<http://www.darksky.org/>).

What is good lighting? Good outdoor lights improve visibility, safety, and a sense of security, while minimizing energy use, operating costs, and ugly, dazzling glare.

Why should we be concerned? Many outdoor lights are poorly designed or improperly aimed. Such lights are costly, wasteful, and distractingly glary. They harm the night-time environment and neighbours’ property values. Light directed uselessly above the horizon creates murky sky glow — the “light pollution” that washes out our view of the stars.

Glare Here’s the basic rule of thumb: If you can see the bright bulb from a distance, it’s a bad light. With a good light, you see lit ground instead of the dazzling bulb. “Glare” is light that beams directly from a bulb into your eye. It hampers the vision of pedestrians, cyclists, and drivers.

Light Trespass Poor outdoor lighting shines onto neighbours’ properties and into bedroom windows, reducing privacy, hindering sleep, and giving the area an unattractive, trashy look.

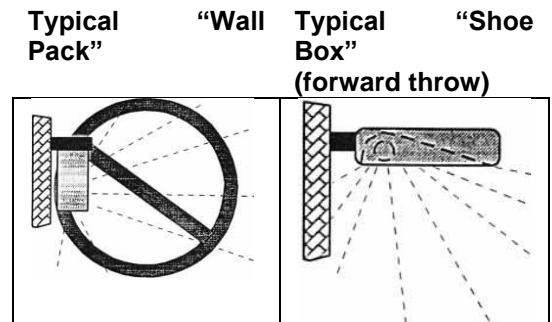
Energy Waste Many outdoor lights waste energy by spilling much of their light where it is not needed, such as up into the sky. This waste results in high operating costs. Each year we waste more than a billion dollars in the United States needlessly lighting the night sky.

Excess Lighting Some homes and businesses are flooded with much stronger light than is necessary for safety or security.

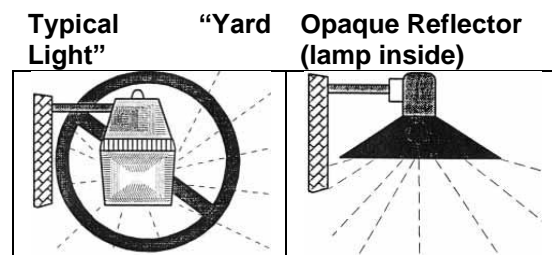
How do I switch to good lighting?

Provide only enough light for the task at hand; don’t over-light, and don’t spill light off your property. Specifying enough light for a job is sometimes hard to do on paper. Remember that a full Moon can make an area quite bright. Some lighting systems illuminate areas 100 times more brightly than the full Moon! More importantly, by choosing properly shielded lights, you can meet your needs without bothering neighbours or polluting the sky.

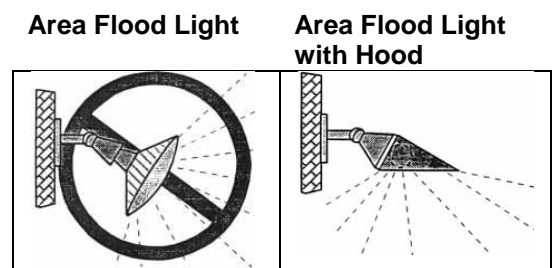
Good and Bad Light Fixtures



<p>BAD Waste light goes up and sideways</p>	<p>GOOD Directs all light down</p>
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<p>BAD Waste light goes up and sideways</p>	<p>GOOD Directs all light down</p>
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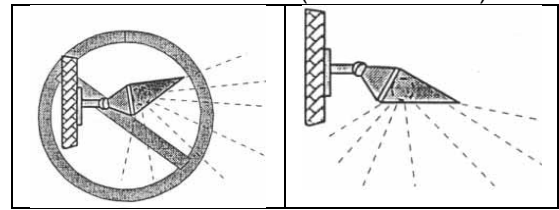


<p>BAD Waste light goes up and sideways</p>	<p>GOOD Directs all light down</p>
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1. Aim lights down. Choose “full-cutoff shielded” fixtures that keep light from going uselessly up or sideways. Full-cutoff fixtures produce minimum glare. They create a pleasant-looking environment. They increase safety because you see illuminated people, cars, and terrain, not dazzling bulbs.
2. Install fixtures carefully to maximize their effectiveness on the targeted area and minimize their impact elsewhere. Proper aiming of fixtures is crucial. Most are aimed too high. Try to install them at night, when you can see where all the rays actually go. Properly aimed and shielded lights may cost more initially, but they save you far more in the long run. They can illuminate your target with a low-wattage bulb just as well as a wasteful light does with a high-wattage bulb.
3. If color discrimination is not important, choose energy-efficient fixtures utilising yellowish high-pressure sodium (HPS) bulbs. If “white” light is needed, fixtures using compact flourescent or metal-halide (MH) bulbs are more energy-efficient than those using incandescent, halogen, or mercury-vapor bulbs.

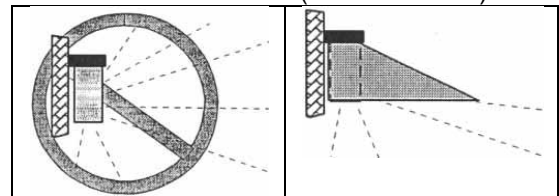
What You Can Do To Modify Existing Fixtures

Change this . . . to this (aim downward)



Floodlight:

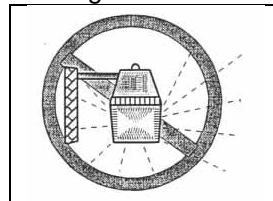
Change this . . . to this (aim downward)



4. Where feasible, put lights on timers to turn them off each night after they are no longer needed. Put home security lights on a motion-detector switch, which turns them on only when someone enters the area; this provides a great deterrent effect!

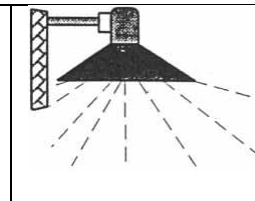
Wall Pack

Change this . . .



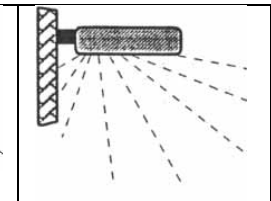
Yard Light

to this



Opaque Reflector

or this



Show Box

Replace bad lights with good lights.

You'll save energy and money. You'll be a good neighbour. And you'll help preserve our view of the stars.