

**HERITAGE IMPACT ASSESSMENT (AMENDED): PROPOSED URANIUM
MINING AND ASSOCIATED INFRASTRUCTURE ON PORTIONS OF THE
FARMS QUAGGASFONTEIN AND RYST KUIL NEAR BEAUFORT WEST IN
THE WESTERN CAPE**

(Assessment conducted under Section 38 (8) of the
National Heritage Resources Act No 25 of 1999)

HWC Case Number: 15100705WD1009E

Prepared for:

Ferret Mining & Environmental Services (Pty) Ltd

November 2015
Amended July 2017



Prepared by

Lita Webley and David Halkett

ACO Associates cc

Physical: Unit D17, Prime Park, 21 Mocke Rd, Diep River
Postal: 8 Jacobs Ladder St James, 7945
Lita.webley@aco-associates.com
Tel: 021 7064104
Cell: 0721796219
Fax to e-mail: 086 603 7195

Declaration of Independence:

I, Lita Webley, declare that

General declaration:

I act as the independent specialist in this application;

I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;

I declare that there are no circumstances that may compromise my objectivity in performing such work;

I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;

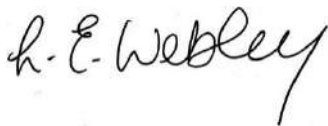
I will comply with the Act, Regulations and all other applicable legislation;

I have no, and will not engage in, conflicting interests in the undertaking of the activity;

I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing – any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;

all the particulars furnished by me in this form are true and correct; and

I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.



Signature of the specialist:

ACO Associates cc

Name of company (if applicable):

30 November 2015

Date:



Our Ref: HM/ CENTRAL KAROO/ BEAUFORT WEST/ URANIUM MINING
Case No.: 15100705WD1009E
Enquiries: Waseefa Dhansay
E-mail: waseefa.dhansay@westerncape.gov.za
Tel: 021 483 9533
Date: 19 October 2015

Lifa Webley
ACO Associates
8 Jacobs Ladder
St James
7945
lifa.webley@aco-associates.com

RESPONSE TO NOTIFICATION OF INTENT TO DEVELOP: HIA REQUIRED
In terms of Section 38(8) of the National Heritage Resources Act (Act 25 of 1999) and the Western Cape Provincial Gazette 6061, Notice 298 of 2003

NOTIFICATION OF INTENT TO DEVELOP: DEVELOPMENT OF URANIUM MINING IN THE EASTERN, CENTRAL, WESTERN AND SOUTHERN BLOCKS IN THE KAROO, SUBMITTED IN TERMS OF SECTION 38(8) OF THE NATIONAL HERITAGE RESOURCES ACT (ACT 25 OF 1999)

CASE NUMBER: 15100705WD1009E
DEADP Reference: N/A

The matter above has reference.

Heritage Western Cape is in receipt of your application for the above matter received on 09 October 2015. This matter was discussed at the Heritage Officers meeting held on 19 October 2015.

You are hereby notified that, since there is reason to believe that the proposed development of uranium mining on the eastern, central, western and southern blocks in the Karoo will impact on heritage resources, HWC requires that a Heritage Impact Assessment (HIA) that satisfies the provisions of section 38(3) of the NHRA be submitted. This HIA must have specific reference to the following:

- Impacts to archaeological heritage resources
- Impacts to palaeontological heritage resources
- Visual impacts of the proposed development
- Impacts to the built environment including a detailed site development plan

The required HIA must have an integrated set of recommendations.

The comments of relevant registered conservation bodies and the relevant Municipality must be requested and included in the HIA where provided. Proof of these requests must be supplied.

HWC reserves the right to request additional information as required.

Should you have any further queries, please contact the official above and quote the case number.

Yours faithfully

.....
Dr. Erol Myburg
(Interim CEO: Heritage Western Cape)

www.westerncape.gov.za/cas

Street Address: Protea Assurance Building, Green Market Square, Cape Town, 8000 • Postal Address: Private Bag 19007, Cape Town, 8000
• Tel: +27 (0)21 483 9533 • E-mail: hwc@westerncape.gov.za

Straatadres: Protea Assurancegebou, Groenemarkersplein, Kaapstad, 8000 • Posadres: Privaatbrieg 19007, Kaapstad, 8000
• Tel: +27 (0)21 483 9533 • E-pos: hwc@westerncape.gov.za

Our Ref: HM\CENTRAL KAROO\BEAUFORT WEST\PTN QUAGGASFONTEIN AND RYST KUIL
Case No.: 15100705WD1009M
Enquiries: Waseefa Dhansay
E-mail: waseefa.dhansay@westerncape.gov.za
Tel: 021 483 9533
Date: 6 July 2017



Lita Webley
ACO Associates
8 Jacobs Ladder
St James
7945

Lita.webley@aco-associates.com

INTERIM COMMENT

In terms of Section 38(8) of the National Heritage Resources Act (Act 25 of 1999) and the Western Cape Provincial Gazette 6061, Notice 298 of 2003

CHANGES TO THE LAYOUT FOR THE PROPOSED URANIUM MINE ON PORTIONS OF FARM QUAGGASFONTEIN AND RYST KUIL, BEAUFORT WEST, SUBMITTED IN TERMS OF SECTION 38(8) OF THE NATIONAL HERITAGE RESOURCES ACT (ACT 25 OF 1999)

The matter above has reference.

Heritage Western Cape is in receipt of your letter dated 4th July 2017.

HWC has previously endorsed the Heritage Impact Assessment prepared by ACO Associates dated November 2015. Since there has been changes to the proposed layout of the facilities, HWC requires an amended HIA to be submitted for assessment.

The revised HIA must satisfy the provisions of Section 38(3) of the NHRA. This HIA must have specific reference to the following:

- Impacts to archaeological heritage resources
- Impacts to palaeontological heritage resources
- Visual impacts of the proposed development
- Impacts to the built environment including a detailed site development plan
- Consultation with relevant interested and affected parties

The findings of the previous HIA may be used as appendixes to the revised HIA and elaborated upon within the scope of the revised proposal.

HWC reserves the right to request additional information as required.

Should you have any further queries, please contact the official above and quote the case number.

Yours faithfully


.....
Mr. Mxolisi Dlamuka
Chief Executive Officer, Heritage Western Cape

www.westerncape.gov.za/cas

Street Address: Protea Assurance Building, Green Market Square, Cape Town, 8000 • **Postal Address:** Private Bag 29062, Cape Town, 8000
• **Tel:** +27 (0)21 483 5959 • **E-mail:** hw@westerncape.gov.za

Straatadres: Protea Assuransie gebou, Groenmarktplaas, Kaapstad, 8000 • **Posadres:** Privaatpos 29062, Kaapstad, 8000
• **Tel:** +27 (0)21 483 5959 • **E-pos:** hw@westerncape.gov.za

GLOSSARY

Archaeology: Remains resulting from human activity which is in a state of disuse and are in or on land and which are older than 100 years, including artefacts, human and hominid remains and artificial features and structures.

Eastern Cape Provincial Resources Authority: The provincial compliance authority which protects heritage in the Eastern Cape.

Heritage: That which is inherited and forms part of the National Estate (Historical places, objects, fossils as defined by the National Heritage Resources Act 25 of 1999).

Heritage Western Cape: The provincial compliance authority which protects heritage in the Western Cape.

Holocene: The most recent geological time period which commenced 10 000 years ago.

National Estate: The collective heritage assets of the Nation

Palaeontology: Any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace.

Structure (historic): Any building, works, device or other facility made by people and which is fixed to land, and includes any fixtures, fittings and equipment associated therewith. Protected structures are those which are over 60 years old.

Acronyms

DMR	Department of Mineral Resources
ECPHRA	Eastern Cape Provincial Heritage Resources Agency
GPS	Global Positioning System
HWC	Heritage Western Cape
HIA	Heritage Impact Assessment
NHRA	National Heritage Resources Act

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1. INTRODUCTION

ACO Associates cc was appointed by Ferret Mining & Environmental Services (Pty) Ltd on behalf of the client, Peninsula Energy Ltd (Tasman Pacific Minerals Limited (Tasman Pacific) and Lukisa JV Company (Pty) Ltd (Lukisa JVCo)), to undertake a Heritage Impact Assessment for the mining of uranium in the Northern, Western and Eastern Cape Provinces (Figure 1). The applications are for consolidated blocks of properties contained in the original prospecting right areas, but clustered according to geographic location in order to simplify the application areas. They are shown in (Figure 1) and are situated in different provinces and municipal areas.

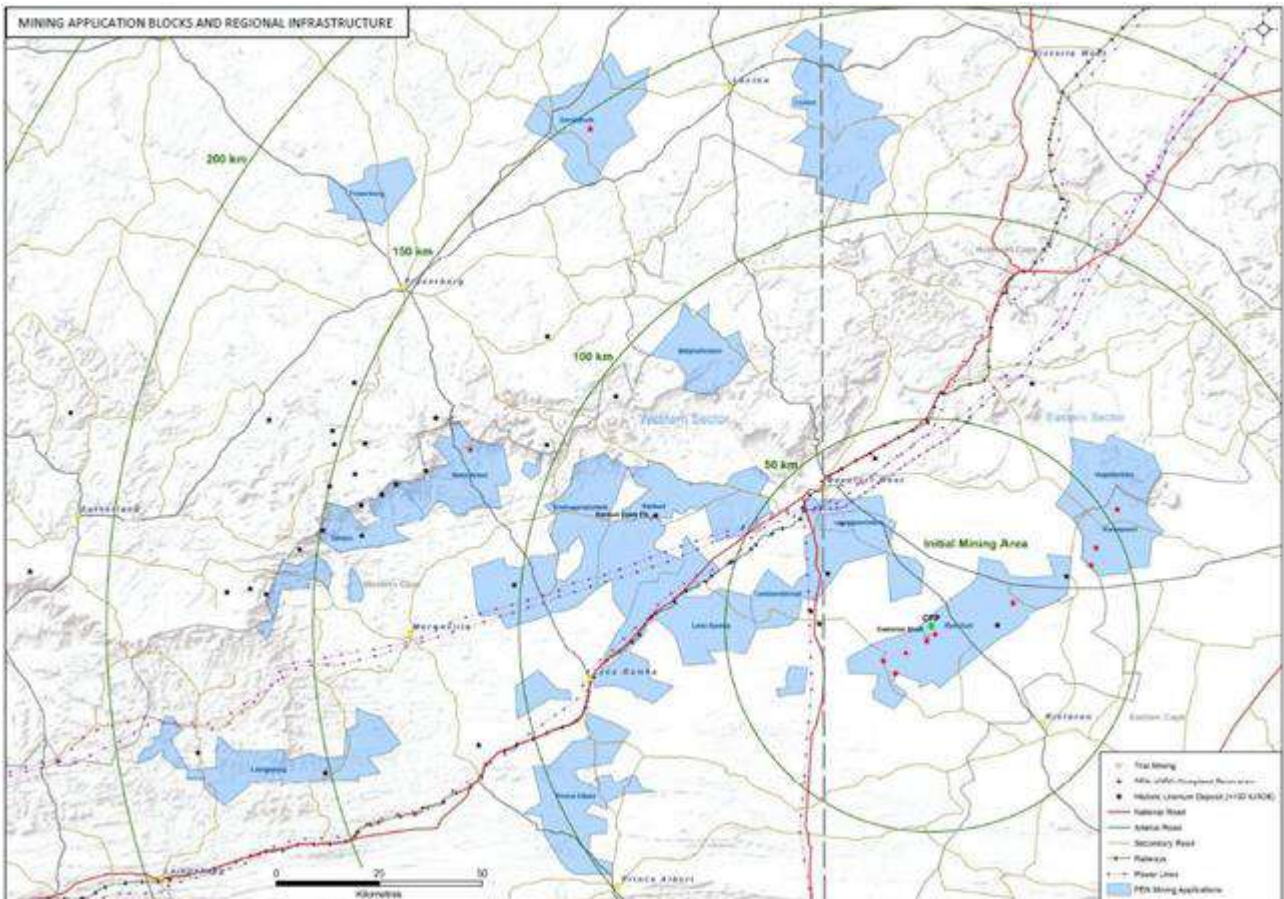


Figure 1: The location of the various mining blocks.

The Karoo Mining Infrastructure map demonstrates the phased nature of the project with the construction of the Central Processing Plant (CPP) in the Ryst Kuil block and then production areas brought into active mining from the CPP in concentric circles (Figure 1).

The first 50km circle represents the first 17 years of production. The project is focussed on the Ryst Kuil channel, a mineralised zone extending in a NE/SW direction. The initial mining area is concerned with those blocks within the central circle, and they include Quaggasfontein and Ryst Kuil in the Western Province (Figure 2):

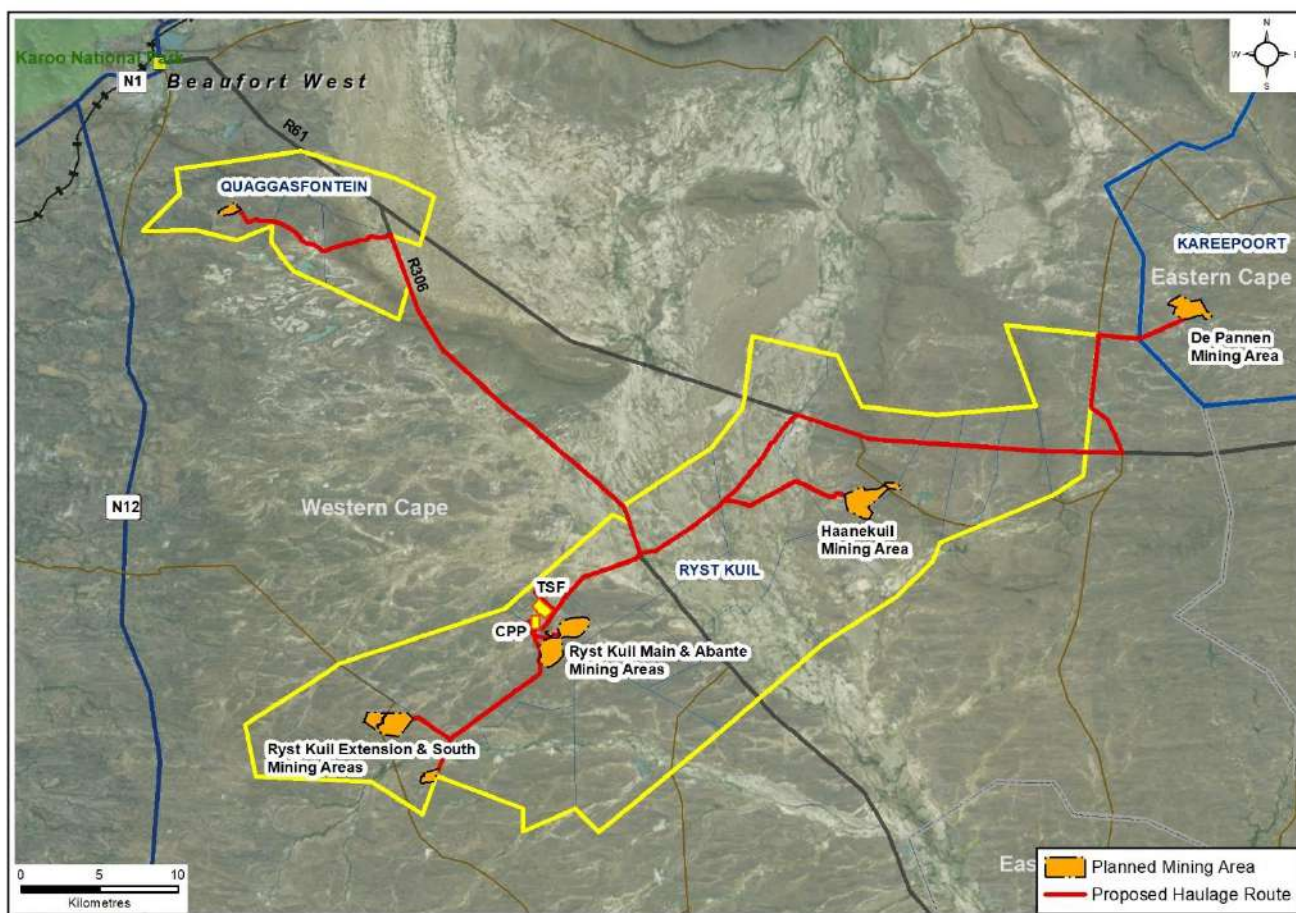


Figure 2: The location of the areas within the Quaggasfontein and Ryst Kuil blocks which will be mined during the next 17 years and form the focus of this HIA. The mining blocks are outlined in yellow and the haulage roads are shown in red.

The farm names and portions are listed below:

Table 1: Farm names and portions

Mining Block	Farm Portions
Quaggasfontein	Oude Volks Kraal 164 Quaggas Fontein 166
Ryst Kuil	Haane Kuil 335 Vlak Plaats 350 Eerste Water 349 Farm 351 Kat Doorn Kuil 359 Kant Kraal 360

1.1 Project Description

Mining Rights applications have been submitted in terms of Section 22 of the Mineral and Petroleum Development Act, 2002 (MPRDA) by Tasman Pacific Minerals Limited (Tasman Pacific) and Lukisa JV Company (Pty) Ltd (Lukisa JVCo) for uranium (U) and molybdenum (Mo) mining in the Karoo (Figure 1).

Traces of uranium occur throughout the Karoo Supergroup. Historically, uranium mineralisation in the Karoo Basin was first detected in the last 1960s. Subsequently, several international companies

began showing interest in the Karoo sequences. Drilling has taken place on the farm Ryst Kuil since the 1970s. As a result of increases in the uranium price over the past few years, a new era of uranium prospecting is currently taking place in the southern Karoo.

The uranium deposits occur in discrete pods or lenses within sandstone units. Many of these lenses tend to follow mineralized trends which coincide with the elongate direction of palaeo-flow direction of the ancient, meandering river channel courses. These "Mineralisation" areas and the "Palaeo channels" indicated in the attached maps follow this elongate pattern but do not need to be assessed. The assessments are concerned only with the open pit mines, stockpiles, processing plant, slimes dam, haulage roads and site offices.

The product will be mined using the surface (open pit) mining method. The open case surface mining will be a standard opencast to a depth of no more than 85 m. The mining method will be traditional drill, blast, load and haul using trucks to deliver the material to the processing plant. The topsoil will be removed and stored. The underground mining method will use the board and pillar method. There will be a waste stockpile, construction area, ore stockpile, slimes dam, access roads and Eskom powerlines. A single, CPP and TSF will be constructed at Ryst Kuil Main, close to the existing mine. The TSF will reach a maximum height of 25m, while the waste dump heights will be 20m. The main product will be road freighted to Beaufort West and then railed to Cape Town.

It is important to emphasise, that although the blocks are large, relatively small areas within each block will be mined.

2. SITE DEVELOPMENT PLANS FOR EACH MINING BLOCK

2.1 Quaggasfontein

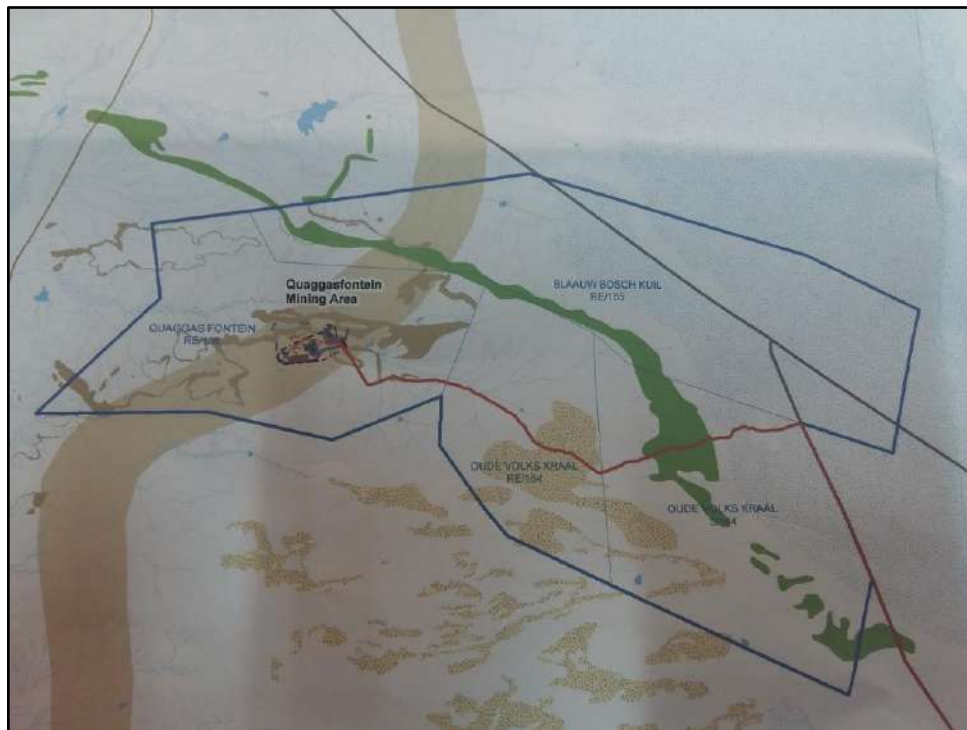


Figure 1: Map of the Quaggasfontein mining block and haulage road (in red).

2.2 Ryst Kuil

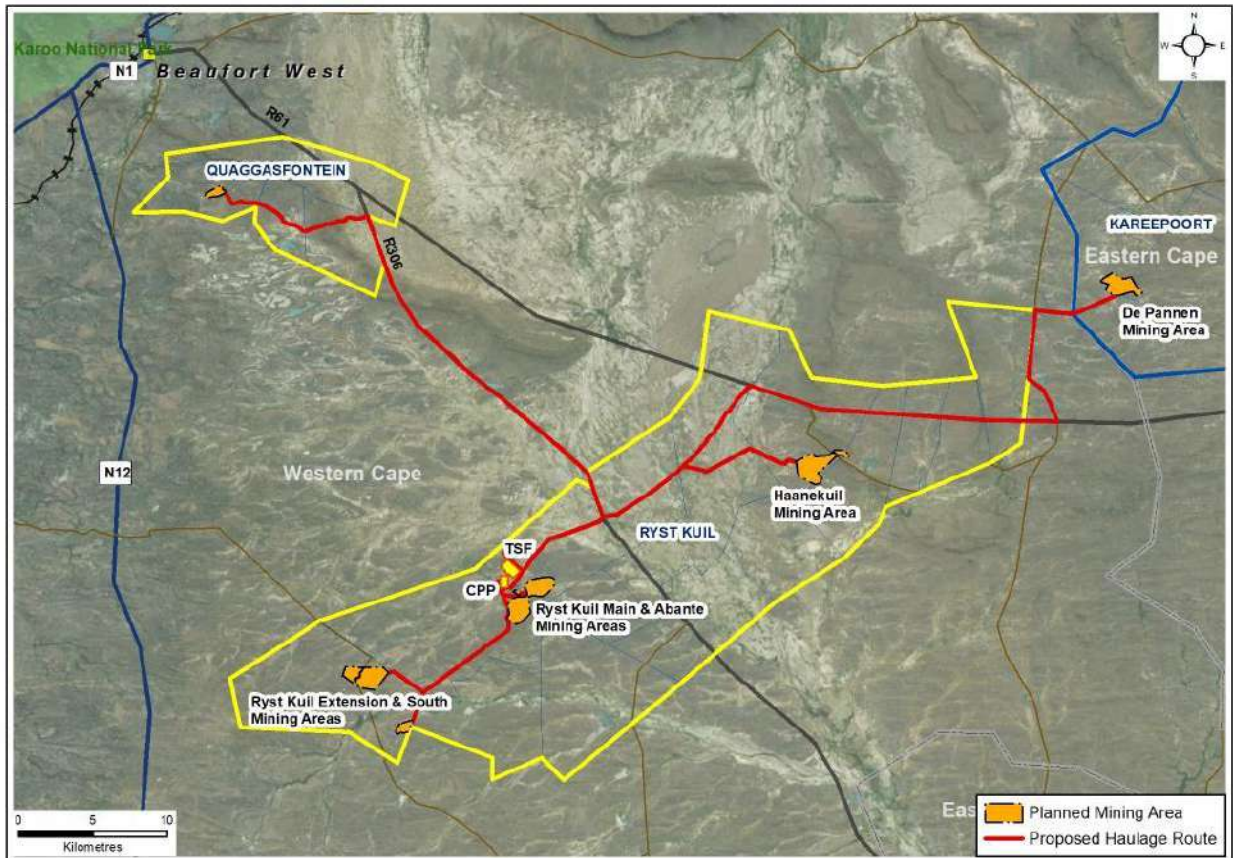


Figure 4: The Ryst Kuil mining block is comprised of a number of components, these include Haanekuul in the north-east, Ryst Kuil Main and Ryst Kuil Abante in the centre, Ryst Kuil South and Ryst Kuil Extension in the south.

2.2.1 Haanekuul

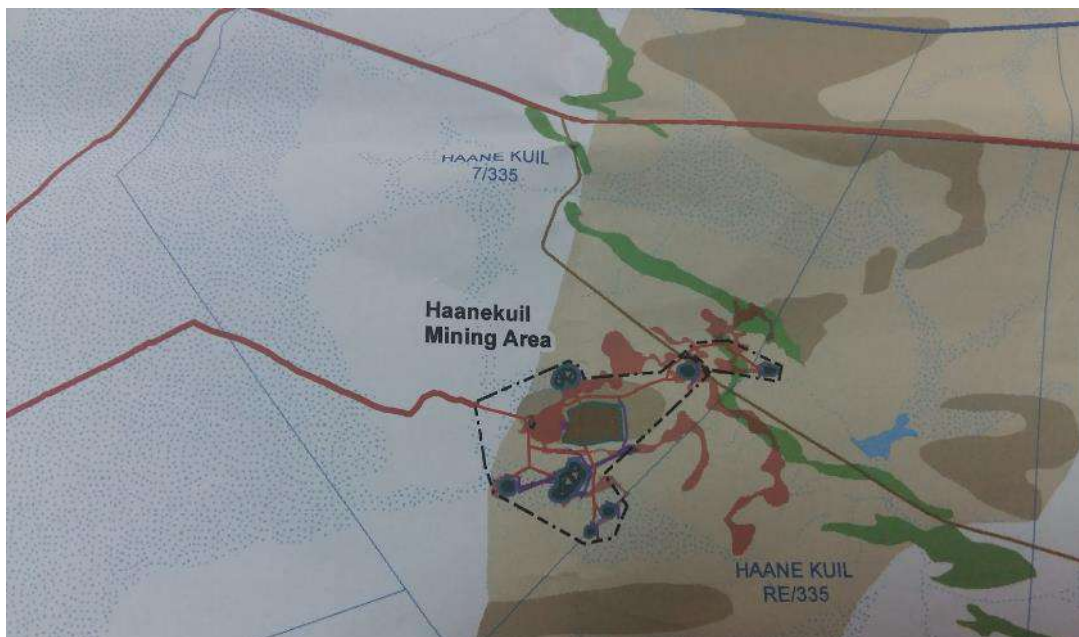


Figure 5: A map of the layout of the Haanekuul area. The haulage road runs in a westerly direction to meet up with the main haulage road.

2.2.2 Ryst Kuil Main and Ryst Kuil Abante



Figure 6: The layout for the Ryst Kuil Main and Abante mining areas, with the brown polygons indicating the pits and the purple the waste dumps. The two yellow polygons are the CPP and TSF.

2.2.3 Ryst Kuil Extension and Ryst Kuil South

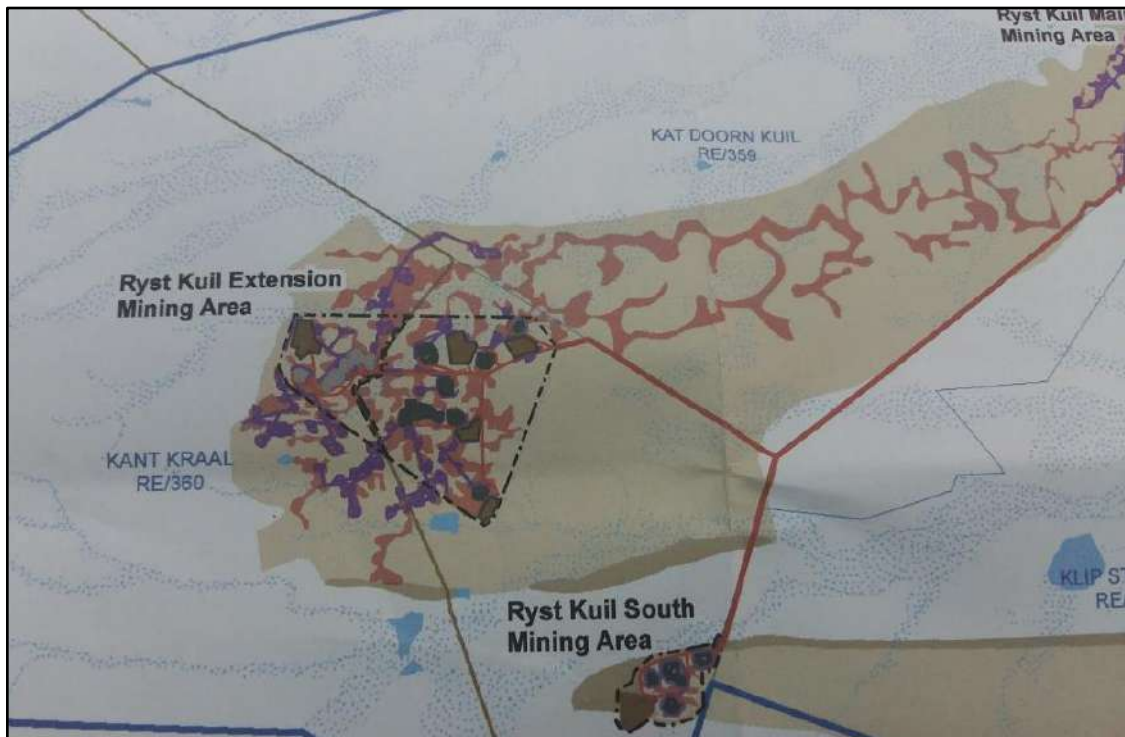


Figure 7: The layout for the Ryst Kuil Extension and the Ryst Kuil South mining areas.

3. HERITAGE LEGISLATION

This report is conducted in terms of Section 38 (8) of the National Heritage Resources Act, No 25 of 1999.

The NHRA provides protection for the following categories of heritage resources:

- Landscapes, cultural or natural (Section 3 (3))
- Buildings or structures older than 60 years (Section 34);
- Archaeological Sites, palaeontological material and meteorites (Section 35);
- Burial grounds and graves (Section 36);
- Public monuments and memorials (Section 37);
- Living heritage (defined in the Act as including cultural tradition, oral history, performance, ritual, popular memory, skills and techniques, indigenous knowledge systems and the holistic approach to nature, society and social relationships) (Section 2 (d) (xxi)).

Following Section 38(3) of the National Heritage Resources Act (No 25 of 1999), even though certain specialist studies may be specifically requested, all heritage resources should be identified and assessed.

3.1 Grading of Heritage and Scenic Resources

The South African heritage resources management system is based on grading, which provides for assigning the appropriate level of management responsibility to a heritage resource. Heritage resources were assessed according to criteria specified in the NHRA and HWC Policy & Guidelines (2015). Grading, according to Winter & Oberholzer (2014) is “generally based on the intactness, rarity and representivity of the resource, as well as its role in the larger landscape or cultural context”.

Section 3 of the NHRA suggests the following criteria for assigning heritage significance. The heritage significance of a place is based on its:

- Importance in the community or pattern in South Africa’s history;
- Possession of uncommon, rare or endangered aspects of South Africa’s natural or cultural heritage;
- Potential to yield information that will contribute to an understanding of South Africa’s natural or cultural heritage;
- Importance in demonstrating the principal characteristics of a particular class of South Africa’s natural or cultural places or objects;
- Importance in exhibiting particular aesthetic characteristics valued by a community or cultural group;
- Importance in demonstrating a high degree of creative or technical achievement during a particular period;
- Strong or special association with a particular community or cultural group for social, cultural or spiritual reasons;
- Strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa;
- Significance in relating to the history of slavery in South Africa.

Table 2: Grading of Heritage Resources

Grade	Level of significance	Description
I	National	Of high intrinsic, associational and contextual heritage value within a national context, i.e. formally declared or potential Grade 1 heritage resources.

II	Provincial	Of high intrinsic, associational and contextual heritage value within a provincial context, i.e. formally declared or potential Grade 2 heritage resources.
IIIA	Local	Of high intrinsic, associational and contextual heritage value within a local context, i.e. formally declared or potential Grade 3a heritage resources.
IIIB	Local	Of moderate to high intrinsic, associational and contextual value within a local context, i.e. potential Grade 3b heritage resources.
IIIC	Local	Of medium to low intrinsic, associational or contextual heritage value within a national, provincial and local context, i.e. potential Grade 3c heritage resources.

3.2 Winter & Oberholzer: Grading of Heritage Resources

The Western Cape Provincial Government: Heritage and Scenic resources: Inventory and Policy Framework for the Western Cape, September 2014 Version 5 by Winter & Oberholzer, identifies and grades the scenic resources within the Western Cape. The aim of the framework study was so that cultural and scenic resources of significance could be identified and rated so that they could be included in all Spatial Development Frameworks (SDF's) in order to avoid inappropriate planning applications. However, the Winter & Oberholzer (2014) study focuses on the regional level, rather than the local landscape level and is therefore of limited value to this study.

3.3 Previous Heritage Comments

A Notice of Intent to Develop (NID) was submitted to Heritage Western Cape, **on the 09 October 2015. The NID also included the Eastern, Central, Western and Southern Blocks in the Karoo.**

The NID response, dated 19th October 2015, required the following studies:

- Impacts to archaeological heritage resources
- Impacts to palaeontological heritage resources
- Visual impacts of the proposed development
- *Impacts to the built environment including a detailed site development plan*

However, after submission of the NID application, Ferret Mining & Environmental Services (Pty) Ltd indicated that the client was initially only considering mining certain sections of the Central and Eastern Blocks (Figure 2).

The HIA (with appendices) for Quaggasfontein and Ryst Kuil was submitted to Heritage Western Cape in November 2015, and the FINAL COMMENT was received 16 February 2016. It reads as follows:

“The requirements of S 38(3) have been met. The Committee endorses the recommendations of the consultants in the HIA as follows:

Palaeontology:

- A palaeontologist must show the geologists from the mining company how to recognize fossils and instruct them on the monitoring of excavations for any possible fossil discoveries;
- The Fossil Finds protocol must be implemented, and if any fossils are uncovered, they must be left in place and reported to a recognized South African Palaeontological Research centre, so that they can be excavated with and stored for future research purposes. A Work Plan for this mitigation for this mitigation work must be approved by HWC.

Archaeology:

- Site D009 on Quaggasfontein must be mitigated under a Work Plan approved by HWC before work commences and a report must be submitted to HWC for approval before destruction. A

surface collection may be sufficient as there does not appear to be any depth to the site. Mitigation must involve setting up a grid across the site and collecting and recording the archaeological material. Some sieving of sub-surface material may be required; and

- If there are any significant changes to the layout of the facilities, the new designs should be assessed by a heritage practitioner and HWC must be informed;
- If any archaeological material or evidence of burials is discovered during earth-moving activities, all work must be stopped immediately and HWC must be notified without delay.

This letter does not exonerate the applicant from obtaining any necessary approval from any other applicable statutory authority. HWC reserves the right to request additional information as required”.

Approximately 12 months after receiving the FINAL COMMENT, ACO Associates was asked to assess a number of changes to the layout of the mining areas on Quaggasfontein and Rystkuil.

Heritage Western Cape was notified of amendments to the layout and they responded with the following interim comment (attached to the HIA) dated 6 July 2017:

“HWC has previously endorsed the Heritage Impact Assessment prepared by ACO Associates dated November 2015. Since there has been changes to the proposed layout of the facilities, HWC requires an amended HIA to be submitted for assessment.

The revised HIA must satisfy the provisions of Section 38(3) of the NHRA. This HIA must have specific reference to the following:

- Impacts to archaeological heritage resources
- Impacts to palaeontological heritage resources
- Visual impacts of the proposed development
- Impacts to the built environment including a detailed site development plan
- Consultation with the relevant interested and affected parties

The findings of the previous HIA may be used as appendixes to the revised HIA and elaborated upon within the scope of the revised proposal”

4. METHODOLOGY

4.1 Background Literature Survey

Numerous impact assessments have been conducted in and around the proposed facility as reflected on the SAHRIS database. Most recently, after completion of the first draft (2015) of this report, Orton et al. (2016) produced a review of the archaeological heritage of the Karoo as part of a Shale Gas Assessment. Information from the SEA has informed this report.

Reports available for this assessment include:

- An assessment of the Ryst Kuil Section of the Eastern Block by Kinahan (2008) which was included in the Environmental and Social Baseline report (Targus Mining Consultants 2008). This report has been lodged on the SAHRIS database;
- An Archaeological Assessment of Uranium prospecting on Portions of the Farms Eerste Water 349 and Ryst Kuil 351 (Halkett & Hart 2009) on the Ryst Kuil Section;
- A Scoping Archaeological Assessment of Uranium Prospecting on Quaggasfontein 166 and Oude Volks Kraal 164 (Webley & Hart 2010) in the Quaggasfontein Section;
- A Heritage Impact Assessment conducted by Orton (2011) on Portion 1 of the farm Steenrots Fontein 168 for a proposed photo-voltaic facility, near Quaggasfontein;
- The Aberdeen – Droërivier 400 kV powerline (Hart & Schietecatte 2012) which will cross over the De Pannen (Kareepoort) and Quaggasfontein.

Background research included a review of the published material as well as unpublished reports on the SAHRIS database. The 1:50 000 maps of the area as well as Google Earth aerial images were consulted.

4.2 Field Survey

The polygon of the proposed mining development in Quaggasfontein, Ryst Kuil and De Pannen, was provided to ACO Associates. The area was surveyed by Lita Webley and David Halkett on 20-22 October 2015, and after an amended layout was received, further fieldwork was undertaken from 27-29 June 2017.

Our tracks were recorded by means of Garmin GPS devices and all sites were digitally recorded. We accessed the area by the local farm roads and drove along sections of the access roads where this was possible. Transects were walked across affected areas.

4.3 Assumptions and Limitations

Visibility was good because of the sparse vegetation of the study area. We could cover most of the study area satisfactorily. Changes to the layout cannot be really be considered a limitation as we were able to return to the study area and conduct a further survey. These did not alter our assessment of the heritage significance of the area.

5. RECEIVING ENVIRONMENT

The immediate environs of the proposed mining areas are further illustrated in the Baseline Visual Assessment by Steven Stead (Appendix 4).

The landscape between Beaufort West and Aberdeen is comprised of horizontally bedded, fossiliferous shales and mudstones of the Beaufort Series in the Karoo system. They are intersected at numerous locations by dolerite dykes which have the effect of damming up small streams resulting in small springs which often generate pans of seasonal water – another feature of the landscape. There are also small, seasonal river beds which are lined with acacia trees. However, in general the landscape to the south of the R61 is remarkably flat, with little change in elevation though occasional ridges are noted (Plates 1 and 2). The natural vegetation is predominantly knee-high with stands of acacia along river beds or at stockposts, and visibility is excellent.

Although technically all the land is characterised as agricultural, in real terms it has the appearance of a wilderness. Occasional stock posts, wire fences, wind pumps, concrete reservoirs and tracks are the only apparent elements of human modification on the landscape apart from the farmhouses. The study area is thinly inhabited and remote. Farmhouses are often located in a clump of exotic trees and are visible from a considerable distance. The evidence for past uranium mining activities in the 1970s is evident throughout the study area, in the form of prospecting hols, shafts, ventilators, head gear, roads, tailings, etc. (Plates 3 & 4).



Plate 1: View of the landscape around Quaggasfontein with the Nuweveldberge in the background. The town of Beaufort West is located behind the ridge, and there is no direct line of sight between the town and the mining area.



Plate 2: The view of the landscape at Ryst Kuil Extension showing the flat topography with little relief and good visibility.



Plate 3 & Plate 4: The existing mining infrastructure on Ryst Kuil Main dating to 1978.

6. IDENTIFICATION OF HERITAGE RESOURCES

The heritage resources described and assessed in this report include Palaeontology (Appendix 1), Archaeology (Appendix 2), Built Environment (Appendix 3) and Visual (Appendix 4).

6.1 Palaeontological Resources

A palaeontological baseline study of the Ryst Kuil Channel was undertaken by Prof S Rubidge of the Bernard Price Institute at the University of Witwatersrand in 2008 and is attached as Appendix 1.

The study area falls within the Karoo Supergroup, famous for its palaeontological wealth covering the period of almost 100 million years ago, from the Middle Permian to the Early Jurassic. This rock succession has yielded a rich fossil flora and tetrapod fauna and is internationally known for providing a window on the life of the vertebrate groups such as: fish, amphibians, herbivorous reptiles of large size known as pareia-saurids, many groups of “mammal-like reptiles” or therapsids, small lizard like animals, dinosaurs and primitive mammals.

The area that will be mined in the southern Karoo is of particular palaeontological interest for several reasons.

- Numerous authors have linked dated periods of compressional deformation in the Cape Fold Belt to sedimentary responses in the Karoo Basin. At present there is no consensus as to the cause-and-effect relationships and one of the main problems hindering development of these models is a lack of good time resolution. In this regard fossils are very useful;
- The rocks of the southern Beaufort Group host the oldest record of living fossil tetrapods in the southern hemisphere and provide one of very few records of Middle Permian continental biodiversity but have received very little research attention;
- Since the Karoo Supergroup records two of the “Big Five” mass extinction events since the Cambrian explosion of live 540 million years ago, it is an excellent place to study biological diversity patterns through time and specifically to periods prior to a mass extinction event and the recovery after it. The only place where rocks are preserved which were deposited in the continental realm during the Middle-Late Permian transition is in the Karoo and fall in the *Tapinocephalus* Assemblage Zone. These rocks could provide the key to understanding the floral and faunal changes which took place during the Permian and it is these rocks which are being targeted for uranium mining.

Geological units correspond to the Teekloof Formation, which is represented by three lithostratigraphic members: Poortjie, Hoedemaker and Oukloof. Fossils from adjoining farms are housed in collections at the Bernard Price Institute and comprise mainly dicynodonts.

Since the topography is flat and covered in alluvium, very few rock outcrops were present to examine within the Ryst Kuil block, pointing to the potential of the underlying deposits.

6.2 Archaeological Resources

The AIA was undertaken by Lita Webley and David Halkett and is attached as Appendix 2.

The authors point out that numerous archaeological reports related to uranium prospecting have been conducted in the area over the last 10 years. Surveys of these areas have been conducted by John Kinahan (2008), David Halkett and Tim Hart (2009), Lita Webley and Tim Hart (2010) and Lita Webley and David Halkett (2015) and Lita Webley and David Halkett (2017). Kinahan (2009) suggested the presence of surface Howieson's Poort assemblages but this could not be substantiated by Webley & Halkett (2015).

- Generally, archaeological material comprised small numbers of ESA artefacts, scatters of MSA and occasional LSA. The majority were manufactured on indurated shales (hornfels) although some artefacts were manufactured from a chert band which crosses Ryst Kuil. Artefact numbers are very low and are of low significance;
- No significant archaeological resources were identified, with the exception of a small ruined stockpost (Site D2017-027) on Haanekuil which has been given a Grade IIIC grading.

6.3 Built Environment Resources

The Built Environment assessment was undertaken by Lita Webley and David Halkett and is attached as Appendix 3.

- The regional road, the R61, connects Beaufort West and Aberdeen and is situated to the north of the proposed mining blocks of Quaggasfontein and Ryst Kuil. The road is not considered to carry high volumes of traffic nor is it a popular tourist route. It has not been given a significance grading by Winter & Oberholzer (2014);
- The farmhouse at Quaggasfontein is located 6km west of the proposed mine and haul roads all lie to the east of the mine;
- The farmhouse of Neverset (Field grading of IIIC) is on the R61 and one haul route passes to the west of the farmhouse;
- The farmhouse of Water Gift (Haanekuil) is located 2km north of the proposed mine and no haul route passes near the house;
- The farmhouse of Ryst Kuil is 5km north-east of the proposed mine. One haul route will pass between the house and a farm cemetery (the cemetery is addressed in Appendix 2: Archaeology);
- The farmhouse of Kat Doorn Kuil (Field grading of IIIC) lies 2km north-east of the proposed mine. The haul route will not pass near the house;
- Although technically the landscape which will be mined is characterised as agricultural, in real terms the Cultural Landscape has the character of a wilderness. Occasional stock posts, fences, wind pumps, concrete reservoirs and tracks are the only apparent elements of human modification on the landscape apart from the farmhouses. The land appears, even in prehistoric times, to have been marginally inhabited, with the only remnants of pre-colonial settlement the scatters of stone artefacts across the landscape. The landscape is almost completely flat with occasional pans and low ridges, and there are none of the typical elements of the Karoo (i.e. the iconic flat-topped koppies) found north of Beaufort West. The landscape around Ryst Kuil main has also been considerably disturbed, with old prospecting

holes, mine shafts, ventilators, head gear and other infrastructure related to uranium mining in the 1970s littering the area. Therefore, the Cultural Landscape is given a field grading of III C.

6.4 Visual Resources

The Baseline Visual study was undertaken by Steven Stead of the Ryst Kuil area and is attached as Appendix 4. No specific visual studies have been undertaken of Quaggasfontein but the view sheds which have been produced in 2017 are attached.

The area has a landscape character with endless plains on an arid plateau. The built landscape is one of isolated farmsteads and small country towns. The lack of development creates a strong wilderness sense of place. The Ryst Kuil area is located about 50km to the east of the town of Beaufort West. This region incorporates the western part of a large, flat basin between the escarpment in the north and the Cape Fold Belt Mountains in the south.

- He has identified the R61, a regional road connecting Beaufort West and Aberdeen, and runs to the north of the Quaggasfontein and Ryst Kuil mining areas as providing a view corridor potential. Viewshed maps indicate that some mining activities will be visible from the R61.
- The distance of the Ryst Kuil Block from the N1 is high and as a result of the undulating topography, visibility of potential mining impacts will be limited. Viewshed maps indicate that the mining on Ryst Kuil will not be visible from the N1 or the N12;
- There are a few Karoo farmsteads in the vicinity, and they are a unique feature of the Karoo vista. Stead indicates that as a result of their history and isolation, the receptors from these farmsteads would be highly sensitive to the landscape modifications posed by mining. Visual absorption capacity (VAC), in other words the ability of the landscape to conceal the proposed development is moderate to low.

7. ASSESSMENT OF IMPACTS

7.1 Impacts to Palaeontology

Due to the flat topography and the fact that the rocks of the Karoo Supergroup are covered in alluvium, very little opportunity exists for palaeontologists to examine the fossil potential of the area. Indeed, Rubidge (2008) stresses "because of the total lack of outcrops in the study area, these are not outcrops which would normally have been prospected for fossils by palaeontologists".

The area is of importance as it covers the contact area between the southeastern and southwestern portions of the Beaufort Basin and covers the Willowmore palaeo-topographic high.

Because of poor outcrops, both palaeontological and lithological data is poorly known and any additional information is of importance.

While mining activities will be intrusive from an environmental perspective, excavations will enhance possibilities for finding new fossil evidence in this poorly-known part of the Karoo Basin.

7.2 Impacts to Archaeology

Several surveys have assessed the impacts of the excavation of open pit mines, the stockpiling of ore on the soil surface adjacent to the mine pits, the construction of the CPP and TSF as well as the haulage roads. They have all concluded that impacts to archaeological sites are expected to be very low, with the exception of a single ruined structure:

- Site D2017_027 may be destroyed with the construction of the haulage road through this area.

7.3 Impacts to Built Environment

- Beaufort West is at least 9km from the closest mining block, that of Quaggasfontein. The view shed map for Quaggasfontein indicates that waste dumps with a height of 20m will be visible from town;
- There are no listed conservation worthy buildings or places of celebrated heritage significance in the area;
- While some of the existing farm houses contain 19th century fabric, very few have anything more than low heritage significance. Neverset on the junction of the R61 and the main haulage road, and Kat Doorn Kuil, near the Ryst Kuil Extension mine, have been given field gradings of Grade IIIIC, but both houses are unoccupied and in a derelict condition;
- No demolition of farm buildings is proposed but it is recognised that abandoned buildings may be vulnerable to vandalism when more people are on site;
- The waste dump heights will reach a maximum height of 20m while the TSF will reach a maximum height of 25m. The Cumulative Viewshed indicates that the waste dumps from Quaggasfontein will be visible from the N1;
- However, the waste dumps and TSF on Ryst Kuil Main, Ryst Kauil Abante, Ryst Kuil South and Extension as well as Haanekuil not be visible from the N1 and only marginally visible from the R61 to Aberdeen and the R306 to Rietbron;
- Due to the lack of screening in the context of wide open vistas, there is a potential for visual impact in the flat, arid Karoo landscape. However, farmsteads are sparsely located and many houses are unoccupied;
- Impacts to the Cultural Landscape are considered to include the erosion of the sense of wilderness with the addition of the mining infrastructure, particularly the tailings which may be visible for some distance. This will have a negative impact on the landscape but rehabilitation will occur at the end of the lifespan of the mine.

In general terms, the proposed activity will have a low to medium impact on the built heritage, including farm houses, roads and landscapes.

7.4 Visual Impacts

Visual impacts occur when developments exceed the visual capacity of the landscape to absorb the change and results in a radical change to the sense of place of the area or region. As a result of the flat horizontal landscape character visibility is high and the viewshed extends over a large area.

Due to the inherent lack of available screening in the context with the flatter, wide open vistas, there is a high potential for visual impact in the flat arid Karoo landscapes.

CUMULATIVE VIEWSHED

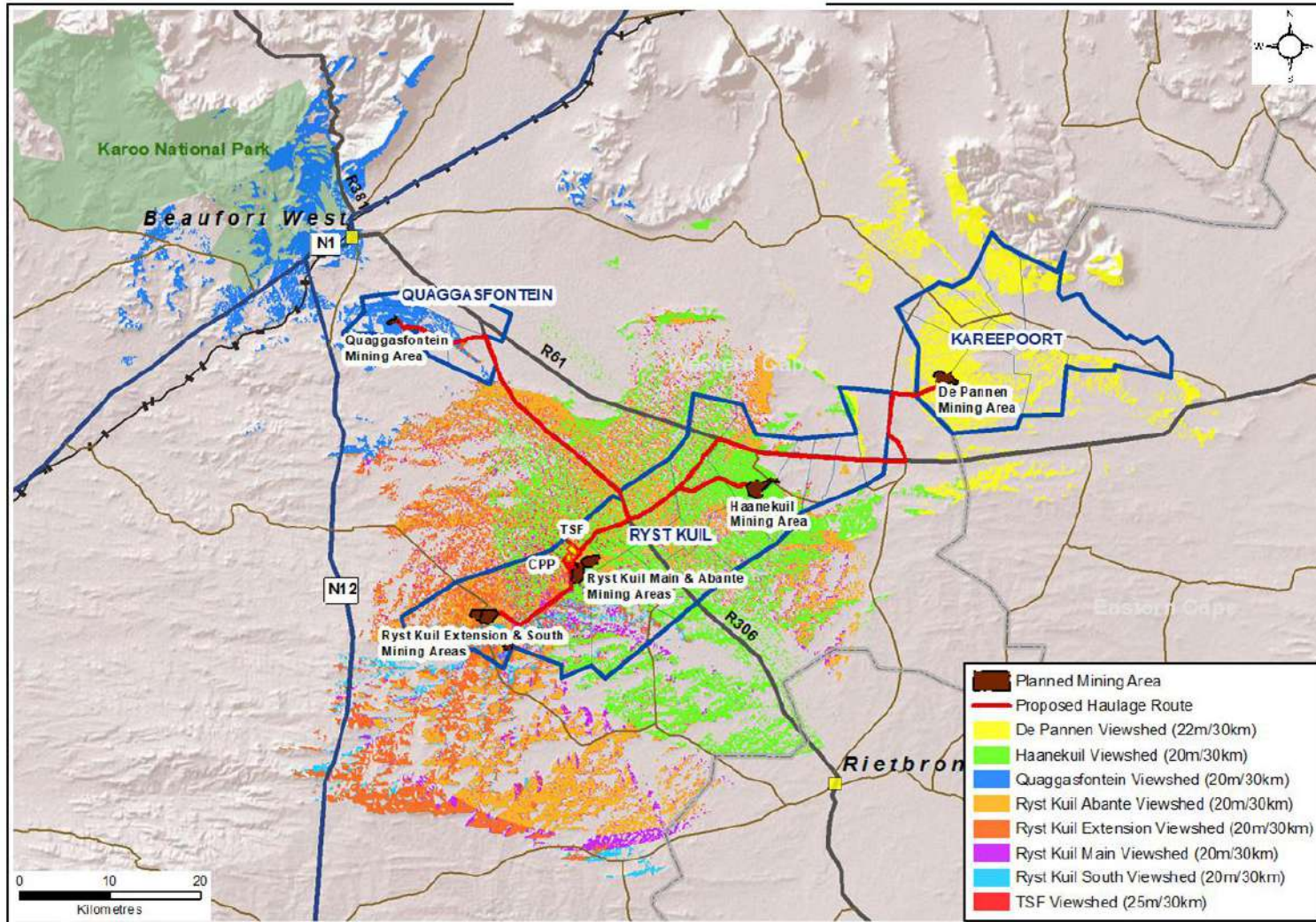


Figure 8: The Cumulative viewshed for both Quaggasfontein and Ryst Kuil, showing visual impacts from Beaufort West, the N1, N12 and R61.

- Viewsheds have been produced which indicate the distance at which the waste dumps and TSF will be visible in the landscape. They suggest that the waste dumps at Quaggasfontein will be visible from Beaufort West and the N1;
- The waste dumps and the TSF on Ryst Kuil will not be visible from the N1 or the N12, and they will be slightly visible from the R61.

Stead recognises the following Visual Triggers:

Areas with proclaimed heritage sites or scenic routes;	The R61 is a regional road which links Beaufort West with Aberdeen and the N9 and bisects the property centrally. This route has view corridor potential. Tourist related traffic on this route would be limited.
Areas with intact wilderness qualities, or pristine ecosystems;	As a result of large size of the property and the limited cultural modifications, the potential for the property to have intact wilderness qualities is good.
Areas with intact or outstanding rural or townscape qualities;	The Karoo farmsteads and openness of the great karoo landscape have outstanding rural qualities.
Areas with a recognized special character or sense of place;	The Great Karoo landscape and especially vistas associated with the great escarpment (Pienaarsrante and Nuweveld Mountains) have a heritage value.
Areas lying outside a defined urban edge line;	The proposed area is located in agricultural areas.
Areas with sites of cultural or religious significance;	The history of the Karoo settlements has a cultural value.
Areas of important tourism or recreation value;	The Karoo farmsteads and openness of the Great Karoo landscape have tourism and recreation value.
Areas with important vistas or scenic corridors;	The landscape character of the property is significant.
Areas with visually prominent ridgelines or skylines	There are visually prominent ridgelines and skylines featured on the property.

8. COMMENTS FROM INTERESTED AND AFFECTED PARTIES

At the time of the original survey in 2015, there were no conservation bodies in the vicinity of Beaufort West that were registered with Heritage Western Cape. Subsequently, in 2017, the Simon van der Stel Foundation had extended their area of interest to the south-west of Beaufort West.

A series of Public Participation meetings were held in June and July 2015 and the minutes of these meetings are attached. There were no questions relating to heritage at any of the meetings.

Comments to the Draft EIA/EMPr were made by SAFCEI and those specifically addressed to Heritage by an independent reviewer, Dr Jayson Orton:

There is no provision for an independent mechanism to spot, identify and collect fossils as they might become accessible through open pit or underground mining. To rely on the company is not sufficient.	Noted. The Palaeontological Impact Assessment (PIA) did not request regular monitoring by an independent palaeontologist. The ultimate responsibility for the monitoring programme lies with the consultant palaeontologist (see HWC: Fossil Finds Protocol). A continuous monitoring presence over the period of the development may not be practical. The Fossil Protocol will be implemented. This will include a protocol for
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	identifying and reporting possible fossils by mine staff as part of the induction training.
It is evident that several areas were not surveyed and these must be surveyed prior to development to confirm whether archaeological remains are present or not.	Noted. Changes to the layout of the pits, tailings and haulage roads after completion of the draft EIA in 2015 required further field work in June 2017. In general the nature of the archaeological resource is fairly homogenous over the various sites and generally of low significance. Not every pit, dump or road could be examined. The archaeologists feel confident that this is not a major issue. The results of the survey are included in this amended report which will go out for public comment with the WC DEIA's.
The recommendation ("avoid visual impacts to Karoo farmsteads and Karoo landscapes that have outstanding rural qualities") is meaningless without the reader being told which landscapes have outstanding rural qualities and how to avoid such degradation. The company documentation does not mention the planned height of the tailings dams.	Noted. The amended report has considered field gradings for the Karoo landscape in proximity to the proposed mining areas and indicated the potential impacts to the landscape.
An unpublished study by the company itself shows the huge extent of visual impact of a 25m high tailing dam on a typical Karoo day with good visibility of up to 50 km radius.	Noted. The maximum height of the tailings will be 25m and view shed maps will be provided for public comment in the WC DEIA's. The view shed utilises a cut-off of 50km however visual acuity is dependent on weather conditions, clarity of the air, physical obstructions, reflectiveness of the TSF surface, etc.
The more far-reaching concerns expressed in the Strategic Environmental Assessment on Shale Gas Development in the Karoo (SEA) compiled by the CSIR have relevance also for the proposed uranium mining site, but have not been considered in this context.	Noted. The SEA on shale gas development in the Karoo was only available to consult in 2016, after the Heritage Impact Assessment (HIA) had been completed in mid-2015 and submitted to Heritage Western Cape in November 2015. This amended report has considered the SEA and taken on board some of its recommendations.

9. RECOMMENDATIONS AND CONCLUSIONS

9.1 Palaeontological Recommendations

- The first phase of the mining operations at Quaggasfontein and Ryst Kuil will occur over a 17year period, thus ongoing monitoring by a palaeontologist will not be possible;
- Rubidge (2008) recommends that a palaeontologist show the geologists from the mining companies how to recognize fossils and that they monitor excavations for any possible fossil discoveries;
- Although not specifically requested by Rubidge, it is recommended that the Fossil Protocol is implemented and a copy of the latest HWC Fossil Protocol is attached to this HIA;
- If any fossils are uncovered, they should be reported to a recognized South African Palaeontological Research Centre, so that they can be excavated and stored for future research purposes.

9.2 Archaeological Recommendations

- It is recommended that a small section of the haulage road linking Haanekuil with the main haulage road, should be moved slightly to avoid impact on a ruined stone building at a stockpost (Site D2017-027);
- No impacts are expected to the Ryst Kuil cemetery as the proposed haulage road runs some 100m to the south;
- If any human remains are uncovered during construction, the ECO should have the area fenced off and contact HWC (Tel: 021 483 5959) immediately;

- If there are any significant changes to the layout of the facilities, the new designs should be assessed by a heritage practitioner.

9.3 Built Environment Recommendations

- The EMP must ensure that there are no indirect impacts to the Neverset farm house which is situated next to a haul road. This will include making the farm houses off limits to mining crews to prevent vandalism;
- No demolition or modification of any farm buildings older than 60 years may be undertaken without an assessment of the significance of the buildings by the heritage authority;
- If farm buildings of Neverset or Kat Doorn Kuil are used for mining accommodation, then the approval of the relevant heritage compliance authority is necessary if any building alterations are undertaken.

9.4 Visual Recommendations

Stead (2008) makes no specific recommendations with respect visual mitigation in his Baseline Assessment and the following recommendations are extracted from his report:

- Avoid visual impacts to the R61 which runs to the north of the Quaggasfontein and Ryst Kuil mining blocks. While the route will have a potential view corridor across the mining operations, it is important to note that the R61 is not rated as having scenic qualities and is commonly used as a short cut to the N1;
- “Avoid visual impacts to Karoo farmsteads and Karoo landscapes that have outstanding rural qualities”. However, only two farmsteads of potential Grade IIIC significance were identified within the study area. They are Kat Doorn Kuil, at least 2km from the Ryst Kuil Extension mining area, and Neverset on the junction of the R61 and the haulage roads. Both of these farm houses are abandoned;
- Avoid impacts on visually prominent ridgelines and skylines on the property. However, the flat nature of the landscape means that there are no prominent ridges to avoid.

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PALAEONTOLOGICAL HERITAGE: COMBINED DESKTOP & FIELD-BASED STUDY

Proposed Lusika Uranium Mine project on various farm portions near Beaufort West, Beaufort West Magisterial District, Western Cape Province

Dr John E. Almond
Natura Viva cc
76 Breda Park
Breda Street
Oranjezicht
CAPE TOWN 8001, RSA

June 2025

EXECUTIVE SUMMARY

Lusika Invest 100 (Pty) Ltd is applying for a Mining Right in terms of Section 22 of the Mineral and Petroleum Resources Development Act (MPRDA, Act 28 of 2002) for uranium and molybdenum ores for a period of 30 years on various properties within the Beaufort West Magisterial District, situated in the Aberdeen *Vlakte* subregion of the Great Karoo c. 50 km southeast of Beaufort West, Western Cape Province.

The Lusika Mine project area is underlain by continental sediments of the Abrahamskraal and Teekloof Formations (Lower Beaufort Group, Karoo Supergroup) of Late Middle Permian to (possibly) earliest Permian age. These bedrocks contain sparse but important fossil remains of a range of terrestrial and aquatic vertebrates (mainly therapsids), trace fossils and occasional fragmentary plant material which are of considerable research and conservation value, confirming the occurrence of *Tapinocephalus* Assemblage Zone bedrocks within the project area. Bedrock exposure levels here are generally very poor indeed.

A small number of fossil sites (dinocephalian, therocephalian and dicynodont therapsids, unidentified bone chunks, plant impressions, invertebrate burrows) have been recorded at surface within or close to the mining project area during the recent 4-day palaeontological site visit as well as a previous field study by Rubidge and Abdala (2008). None of the recorded sites lies within or close to ($\leq 30\text{m}$) of the proposed mine footprint and no mitigation is proposed with regard to them. No palaeontological No-Go areas or buffer zones have been identified within the mine project area.

Based on desktop data as well as a 4-day palaeontological field study the great majority of the mining project area is, in practice, of LOW Palaeosensitivity but with sparse, small and largely unpredictable areas of HIGH to VERY HIGH sensitivity, notably due to the occurrence here of vertebrate fossil remains within the Permian bedrocks. The overlying Late Caenozoic superficial sediments are generally of Low Palaeosensitivity but might also contain important fossil remains (e.g. Pleistocene mammals, trace fossils); however none were recorded during the site visit. The provisional palaeosensitivity mapping shown on the DFFE Screening Report is accordingly *contested* here. The season of the field study has no substantial influence on the data collected and conclusions reached.

Inferred impacts on local palaeontological heritage resources during the Construction and Operational Phases of the mine are assessed as being of Moderate (negative) significance before mitigation, falling to Low (negative) following mitigation. This analysis refers primarily to potential disturbance / damage to or loss of scientifically valuable fossil sites at or near the ground surface that are of research and conservation value. Further significant impacts during the De-commissioning Phase of the mine are not anticipated. Given the very small number of recorded fossil sites within the Aberdeen *Vlakte* subregion of the Great Karoo, cumulative impacts on palaeontological heritage here are estimated to be Low (negative) before mitigation and Very Low (negative) following mitigation. Anticipated cumulative impacts fall within acceptable limits. The No-Go alternative would probably have a *neutral* impact on palaeontological heritage.

Recommended palaeontological heritage mitigation for the Lusika Mine project principally involves (1) A Pre-Construction palaeontological survey of Farm Kat Doorn Kuil RE/359; (2) Instruction by a professional palaeontologist of Mining Geologist(s) and ECO / ESO regarding the recognition and safeguarding of relevant fossil material; (3) Application of a Chance Finds Procedure during Construction and Operational Phases (see Appendix 2) including: (4) On-going monitoring for fossil material by ECO / ESO; (5) Safeguarding of new fossil finds by ECO / ESO; (6) Professional mitigation (recording / sampling) of new fossil finds by palaeontological specialist; and (7) Professional curation of fossils collected in approved repository. The specialist palaeontologist responsible for any professional mitigation will need to submit a Work Plan for approval by Heritage Western Cape. These mitigation recommendations must be included within the EMP for the Lusika Mine project.

Provided that the recommendations are implemented in full, *including* a Pre-Construction palaeontological heritage survey of the Farm Kat Doorn Kuil RE/359, there are no objections on palaeontological heritage grounds to the granting of Mining Rights and Environmental Authorisation for the Lusika Mining Project near Beaufort West.

1. PROJECT OUTLINE & BRIEF

The company Lusika Invest 100 (Pty) Ltd is applying for a Mining Right in terms of Section 22 of the Mineral and Petroleum Resources Development Act (MPRDA, Act 28 of 2002) for uranium and molybdenum ores for a period of 30 years on various properties within the Beaufort West Magisterial District situated in the Aberdeen *Vlakte* subregion of the Great Karoo (Figures 1 & 2). The proposed mining operation will be operated as a single entity but with multiple production centres (open pit and underground mining) feeding into a Central Production Plant (CPP) to be located near the main ore body of the initial mining stages (Figures 3 & 4).

The properties directly affected by the proposed Lusika Mine Project are situated some 50 km to the southeast of Beaufort West. They are listed in Table 1 and mapped in Figure 2 below.

The applicant has appointed Aquatox Consulting (Pty) Ltd (Aquatox) as the independent Environmental Assessment Practitioner to assist with the required authorisation processes including the Mining Right Application as well as Environmental Authorisation in accordance with the National Environmental Management Act (NEMA, Act No. 107 of 1998, as amended) and the 2014 Environmental Impact Assessment (EIA) Regulations (2014 as amended).

In palaeontological heritage terms the project area is relevant to on-going academic research projects on the end-Middle Permian Extinction Event and Lower Beaufort Group biostratigraphy so any new data from impact studies here are of scientific interest. The present combined desktop and field-based palaeontological heritage study for the Lusika Mine Project has been commissioned on behalf of the Applicant by Aquatox as part of the wider-ranging Heritage Impact Assessment for the development. It builds upon a previous field-based study covering an originally much more extensive prospecting area in the Aberdeen *Vlakte* which was conducted by Rubidge and Abdala (2008; revised 2017).

The author, Dr John Almond, is a specialist palaeontologist who has over 40 years of experience in palaeontological research and teaching in Europe, South Africa, the USA, Middle East and elsewhere. He also has more than 20 years of experience in the palaeontological heritage impact assessment sector in the RSA and has been involved with numerous PIAs in the Karoo region and elsewhere (Please see Appendix 5 for a short Specialist CV).

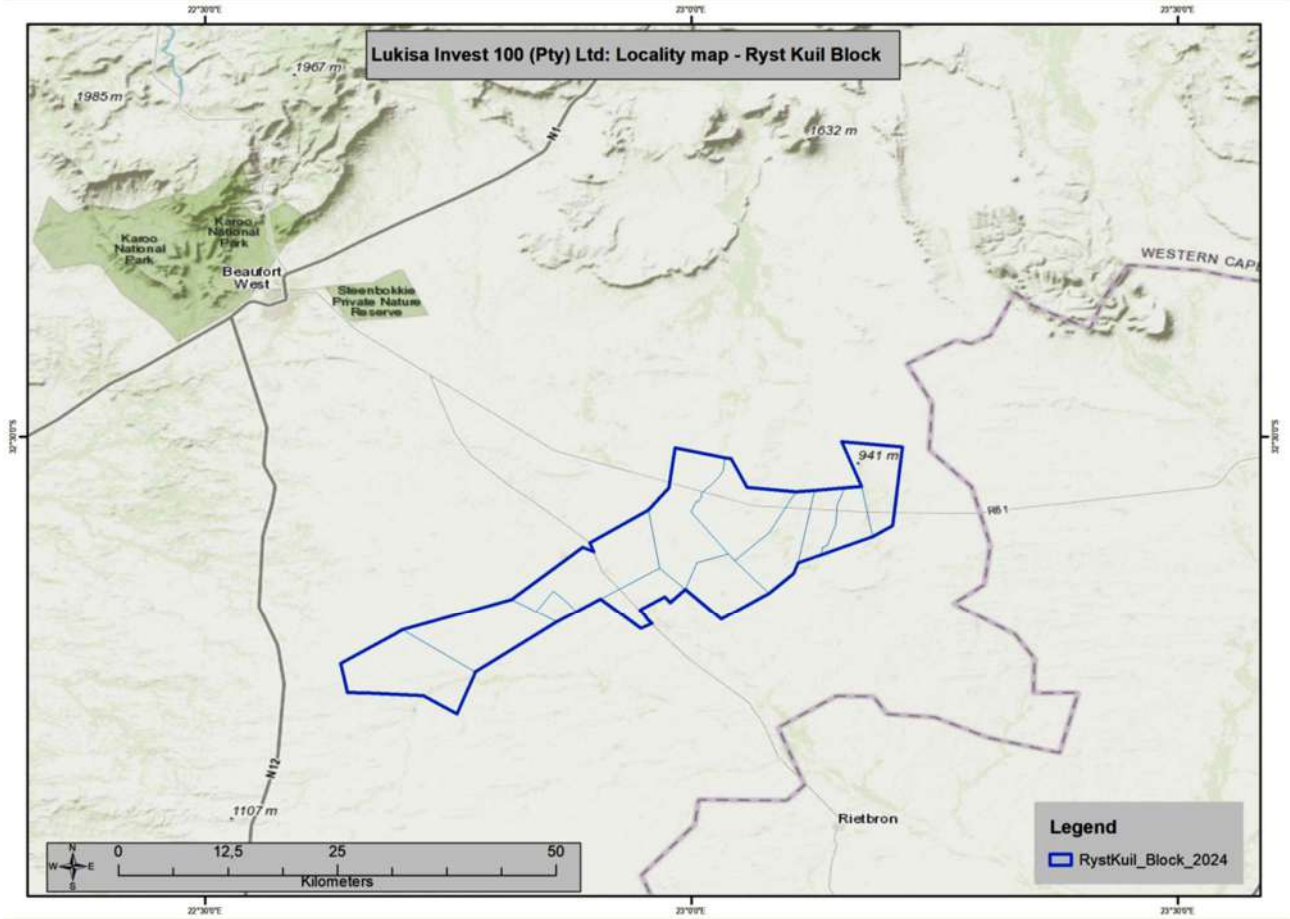


Figure 1: Map showing the location of the Lusika Mine Project area (Ryst Kuil Block) located in the Aberdeen Vlakes some 50 km southeast of Beaufort West, Western Cape.

Table 1: Farm portions directly concerned with the proposed Lusika Mine Project near Beaufort West

MAP LABEL	FARMNAME	FARMNO	SUBDIVNO	21-DIGIT SG CODE	TITLE DEED	SG DIAGRAM	MAGISDISTR	PROVINCE	AREA (ha)
4/349	EERSTE WATER	349	4	C00900000000034900004	T70261/2008	T90685/1995	BEAUFORT WEST	Western Cape	2430,3807
RE/394	FARM (NEVERSET)	394	R	C00900000000039400000	T66477/2013	T7577/1976	BEAUFORT WEST	Western Cape	6846,5709
1/335	HAANE KUIL	335	1	C00900000000033500001	T34244/2009	T9112/1909	BEAUFORT WEST	Western Cape	2002,0837
4/335	HAANE KUIL	335	4	C00900000000033500004	T34244/2009	T10599/1947	BEAUFORT WEST	Western Cape	2002,0834
7/335	HAANE KUIL	335	7	C00900000000033500007	T7575/1976	T7575/1976	BEAUFORT WEST	Western Cape	5572,0900
RE/335	HAANE KUIL	335	R	C00900000000033500000	T21639/2012	BFQ14-5/1890	BEAUFORT WEST	Western Cape	4007,9273
RE/360	KANT KRAAL	360	R	C00900000000036000000	T49636/1995	BFQ11-22/1875	BEAUFORT WEST	Western Cape	6905,8035
RE/359	KAT DOORN KUIL	359	R	C00900000000035900000	T86415/2003	BFQ16-2/1895	BEAUFORT WEST	Western Cape	6033,6398
1/340	NIEUW JAARS FONTEIN	340	1	C00900000000034000001	T49560/2012	T1601/1913	BEAUFORT WEST	Western Cape	3642,6451
2/351	RYST KUIL	351	2	C00900000000035100002	T68098/2008	T26885/1983	BEAUFORT WEST	Western Cape	698,2151
RE/351	RYST KUIL	351	R	C00900000000035100000	T68099/2008	BFQ10-4/1873	BEAUFORT WEST	Western Cape	7251,9003
1/350	VLAK PLAATS	350	1	C00900000000035000001	T43229/2005	T5687/1898	BEAUFORT WEST	Western Cape	3426,1280
Total Area									50819,4678

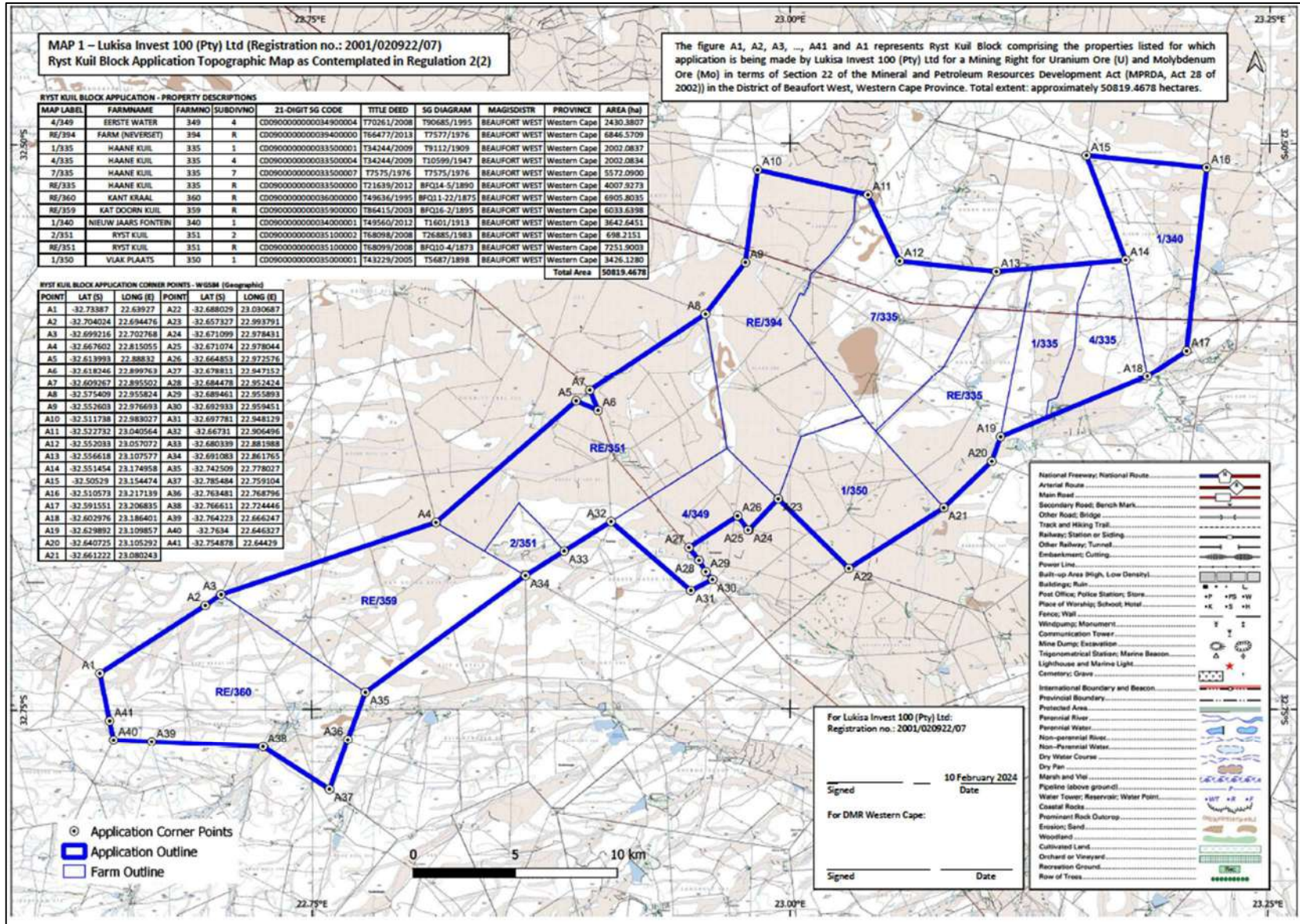


Figure 2: Map showing the land parcels directly concerned with the Lusika Mine Project near Beaufort West.

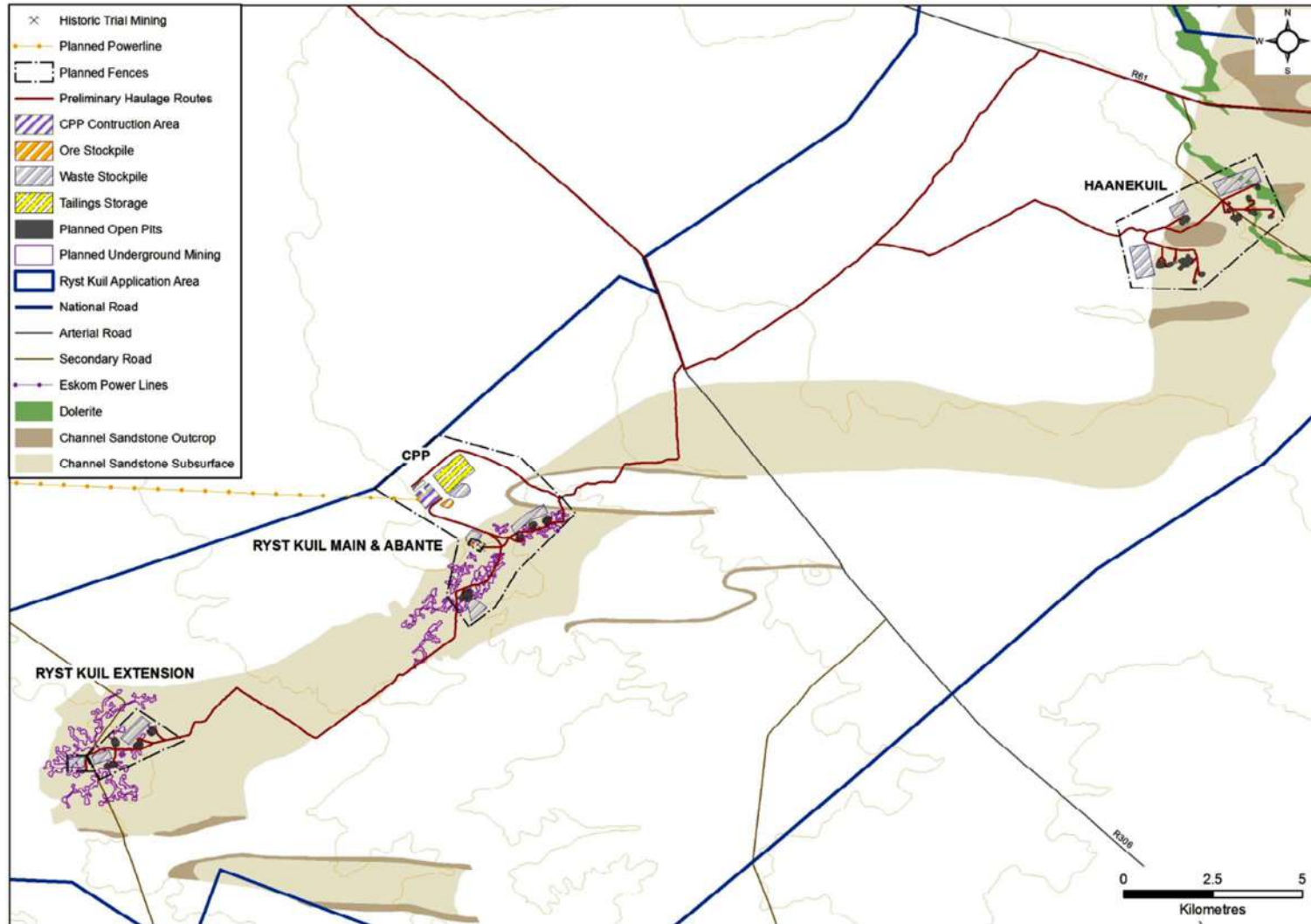


Figure 3: Map showing the main infrastructural components and layout of the proposed Lusika Mine near Beaufort West.

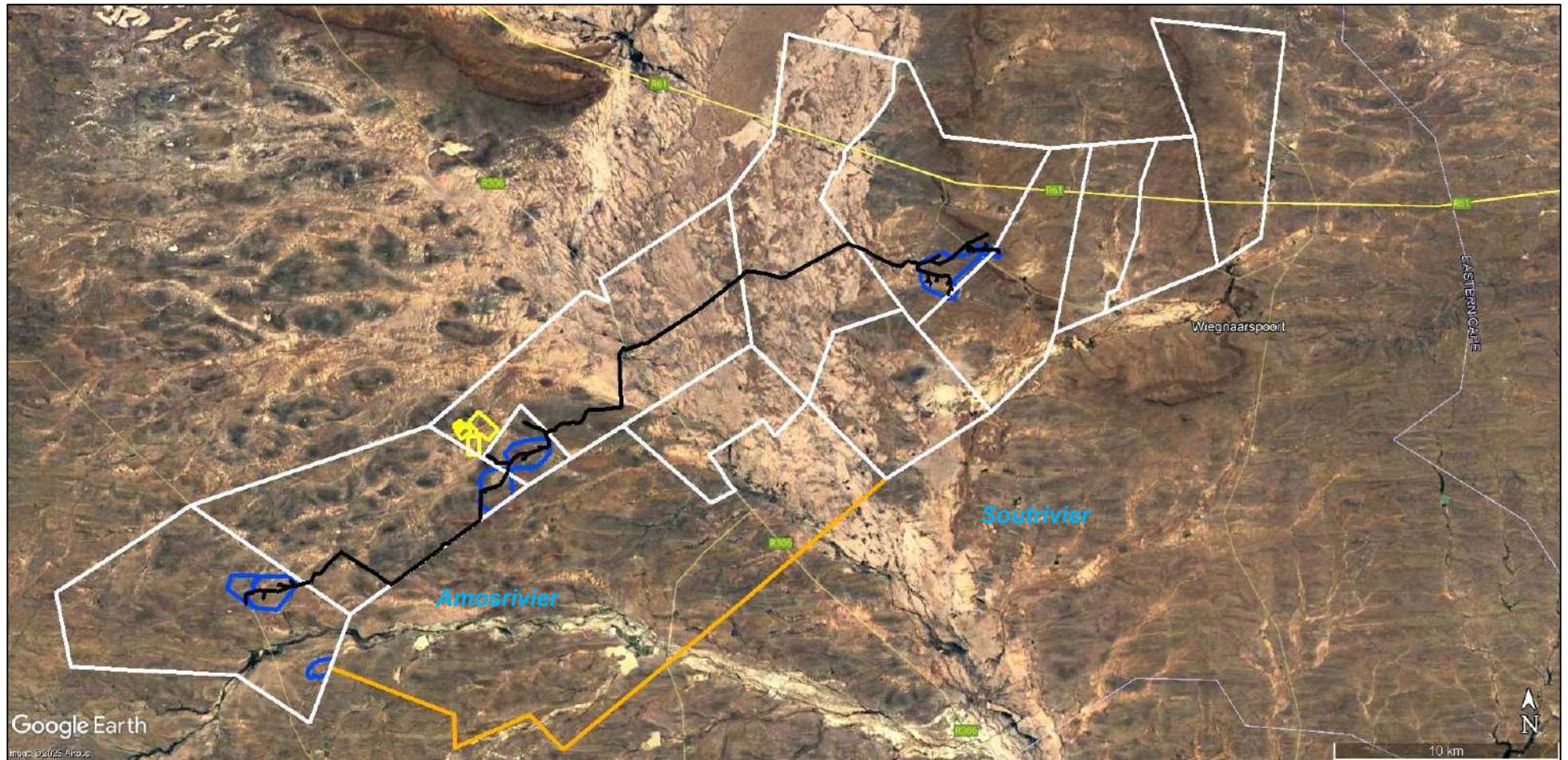


Figure 4: Google Earth© satellite image showing the terrain within the Lusika Mining project area on the Aberdeen Vlakte near Beaufort West (white polygons). Please see previous figure to key to the layout components. The orange polygon shows land parcels which have subsequently been excluded from the project area.

2. STUDY APPROACH & METHODOLOGY

The present combined desktop and field-based palaeontological heritage study (including Site Sensitivity Verification Report) of the Lusika Mine project area near Beaufort West is based on the following information resources:

1. Project description, kmz files, additional documents including maps provided by Aquatox;
2. A desktop review of:
 - (a) the relevant 1:50 000 scale topographic maps (3223CA Wiegnaarspoort, 3222DA Moerbeifontein, 3222DB Ryskuil, 3222DC Amandelhoogte & 3222DD Klipkrans) as well as the 1:250 000 scale topographic map 3222 Beaufort West;
 - (b) Google Earth© satellite imagery;
 - (c) published geological and palaeontological literature, including 1:250 000 geological maps (3222 Beaufort West) and the relevant sheet explanation (Johnson & Keyser 1979) as well as
 - (d) palaeontological heritage assessments (PIAs) for several alternative energy facilities in the Aberdeen Vlakte region of the Great Karoo region between Aberdeen and Beaufort West (See References e.g. Almond 214, 2022b, 2023), and
 - (e) previous palaeontological fieldwork by Rubidge and Abdala (2008) within a more extensive prospecting area on the Aberdeen Vlakte which included most portions of the Lusika Mine project area;
3. The author's field experience with the formations concerned and their palaeontological heritage (cf Almond & Pether 2008 and PIA reports listed in the References); and
4. A four-day palaeontological heritage site visit (9 to 12 June 2025) to the Lusika Mine project area, including most - but *not* all - of the land parcels involved, by the author and an experienced field assistant (Madelon Tusenius, *Natura Viva* cc). Access permission for farms Neverset RE/394 and Kat Doorn Kuil RE/359 was not received.

Fieldwork, carried out by vehicle and on foot, focused on a substantial number of small areas potentially featuring comparatively good exposure of potentially fossiliferous Lower Beaufort Group mudrocks and sandstones that were previously identified within the mining project area using satellite imagery. A representative number of exposures of Late Caenozoic cover sediments were also examined.

The **season** within which the palaeontological fieldwork was carried out does not have a substantial bearing on the results obtained or the conclusions reached in this report.

Confidence levels for this assessment are rated as Medium, given the geological uniformity of the project area. However, lack of access to one of the key land parcels concerned in the mining project (*viz.* Kat Doorn Kuil RE/359) represents a serious limiting factor for this palaeontological heritage assessment.

3. LEGISLATIVE CONTEXT

The present combined desktop and field-based palaeontological heritage report falls under Sections 35 and 38 (Heritage Resources Management) of the South African Heritage Resources Act (Act No. 25 of 1999), and it will also inform the EMPr for this project.

The various categories of heritage resources recognised as part of the National Estate in Section 3 of the National Heritage Resources Act include, among others:

- geological sites of scientific or cultural importance;
- palaeontological sites;
- palaeontological objects and material, meteorites and rare geological specimens.

According to Section 35 of the National Heritage Resources Act, dealing with archaeology, palaeontology and meteorites:

- (1) The protection of archaeological and palaeontological sites and material and meteorites is the responsibility of a provincial heritage resources authority.
- (2) All archaeological objects, palaeontological material and meteorites are the property of the State.
- (3) Any person who discovers archaeological or palaeontological objects or material or a meteorite in the course of development or agricultural activity must immediately report the find to the responsible heritage resources authority, or to the nearest local authority offices or museum, which must immediately notify such heritage resources authority.
- (4) No person may, without a permit issued by the responsible heritage resources authority—
 - (a) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;
 - (b) destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;
 - (c) trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or
 - (d) bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites.
- (5) When the responsible heritage resources authority has reasonable cause to believe that any activity or development which will destroy, damage or alter any archaeological or palaeontological site is under way, and where no application for a permit has been submitted and no heritage resources management procedure in terms of section 38 has been followed, it may—
 - (a) serve on the owner or occupier of the site or on the person undertaking such development an order for the development to cease immediately for such period as is specified in the order;
 - (b) carry out an investigation for the purpose of obtaining information on whether or not an archaeological or palaeontological site exists and whether mitigation is necessary;
 - (c) if mitigation is deemed by the heritage resources authority to be necessary, assist the person on whom the order has been served under paragraph (a) to apply for a permit as required in subsection (4); and
 - (d) recover the costs of such investigation from the owner or occupier of the land on which it is believed an archaeological or palaeontological site is located or from the person proposing to undertake the development if no application for a permit is received within two weeks of the order being served.

Minimum standards for the palaeontological component of heritage impact assessment reports (PIAs) that are relevant to this study have been published by SAHRA (2013) and by Heritage Western Cape (2021).

This PIA report meets the requirements of Appendix 6 of the EIA Regulations, 2014 (as amended) since no specific protocols apply to the discipline of palaeontological heritage.

4. ASSUMPTIONS AND LIMITATIONS

The accuracy and reliability of palaeontological specialist studies as components of heritage impact assessments are generally limited by the following constraints:

1. Inadequate database for fossil heritage for much of the RSA, given the large size of the country and the small number of professional palaeontologists carrying out fieldwork here. Most development study areas have never been surveyed by a palaeontologist.
2. Variable accuracy of geological maps which underpin these desktop studies. For large areas of terrain these maps are largely based on aerial photographs alone, without ground-truthing. The maps generally depict only significant (“mappable”) bedrock units as well as major areas of superficial “drift” deposits (alluvium, colluvium) but for most regions give little or no idea of the level of bedrock outcrop, depth of superficial cover (soil *etc*), degree of bedrock weathering or levels of small-scale tectonic deformation, such as cleavage. All of these factors may have a major influence on the impact significance of a given development on fossil heritage and can only be reliably assessed in the field.

3. Inadequate sheet explanations for geological maps, with little or no attention paid to palaeontological issues in many cases, including poor locality information.
4. The extensive relevant palaeontological “grey literature” - in the form of unpublished university theses, impact studies and other reports (e.g. of commercial mining companies) - that is not readily available for desktop studies.
5. Absence of a comprehensive computerised database of fossil collections in major RSA institutions which can be consulted for impact studies.

In the case of palaeontological desktop studies without supporting Phase 1 field assessments these limitations may variously lead to either:

- a) *underestimation* of the palaeontological significance of a given study area due to ignorance of significant recorded or unrecorded fossils preserved there, or
- b) *overestimation* of the palaeontological sensitivity of a study area, for example when originally rich fossil assemblages inferred from geological maps have in fact been destroyed by tectonism or weathering, or are buried beneath a thick mantle of unfossiliferous “drift” (soil, alluvium etc).

Since most areas of the RSA have not been studied palaeontologically, a palaeontological desktop study usually entails *inferring* the presence of buried fossil heritage within the study area from relevant fossil data collected from similar or the same rock units elsewhere, sometimes at localities far away. Where substantial exposures of bedrocks or potentially fossiliferous superficial sediments are present in the study area, the reliability of a palaeontological impact assessment may be significantly enhanced through field assessment by a professional palaeontologist, as in the case of the present study.

In the case of the land parcels concerned with the Lusika Mine project area bedrock exposure is usually very limited to entirely absent due to the extensive cover by superficial deposits in areas of low relief, as well as, to a lesser extent, due to shrubby karroid vegetation (See numerous field images provided in Section 5).

Lack of access to one of the key land parcels concerned in the mining project (*viz.* Kat Doorn Kuil RE/359) represents a serious limiting factor for this palaeontological heritage assessment.

5. GEOLOGICAL CONTEXT

The Lusika Mine project area (Figure 4) for the most part comprises monotonous, very low relief, flat to undulating, sandy to gravelly *vlaktes* at ~800-900m amsl. carpeted with karroid *bossieveld* typical for the Aberdeen Vlaktes subregion of the Great Karoo between Beaufort West and Aberdeen (Figures 6 to 9). There are occasional low sandstone ridges and *koppies* or *bulte* (~825 – 945 m amsl.) related to the target channel sandstone body (largely buried in the subsurface), especially where reinforced by dolerite intrusion. Karoo dolerite intrusions and their adjoining metamorphic aureoles in the north-eastern portion of the project area also generate higher ground. Drainage networks are poorly developed and shallow, with numerous, more open pan-like areas. An extensive NNW-SSE drainage system related to the Soutrivier traverses the central project area with numerous shallow feeders on its western side. The only deeply incised drainage line is the course of the Amosrivier which runs eastwards along the southern edge of the project area. Sedimentary bedrock exposure within the project area is mostly limited to occasional low sandstone ridges and *bulte*, riverine / stream beds and banks, occasional borrow pits, road cuttings along the R61 and the margins of farm dams.

The geology of the project area is shown in map Figure 5, based on the 1: 250 000 geology sheet 3222 published by the Council for Geoscience, Pretoria, and is also discussed in the previous palaeontological report by Rubidge and Abdala (2008). There is an extensive geological literature on the distribution and setting of uranium / molybdenum mineralisation in the Karoo (e.g. Stuart-Williams 1981, Turner 1985, Duane

et al. 1989, Cole 1980, Le Roux & Brynard 1994, Cole & Wipplinger 2001, Cole 2009, Maree 2020, among others).

The proposed mining for the Lusika project will target secondary uranium / molybdenum ore bodies within multi-storey fluvial channel sandstones of late Middle Permian (Capitanian) age. According to the published geological map, the channel sandstones within the project area lie largely or entirely within the sandstone-dominated lowest part of the Teekloof Formation (Lower Beaufort Group, Adelaide Subgroup) *viz.* the Poortjie Member (Figure 40). However, mineralised channel sandstones are also mapped in the wider Beaufort West region within the upper Abrahamskraal Formation or along the Abrahamskraal – Teekloof contact zone (*N.B.* some of these may represent synclinal outliers of the Poortjie Member). While bedrock exposure is generally very poor regionally, due to the pervasive mantle of Late Caenozoic cover sediments (alluvium, colluvium, calcrete pedocretes, eluvial gravels, sheetwash and pan deposits, residual soils *etc*), satellite imagery as well as the geological map indicate multiple, closely-spaced fold axes with broadly W-E trends within the Lower Beaufort Group. The current mapping of the Abrahamskraal – Teekloof boundary is likely to be schematic while individual members of the latter formation are not differentiated. Given the current stratigraphic ambiguities in the Aberdeen Vlakte region, largely due to poor bedrock exposure and sparse palaeontological data, it is likely that the Lusika Mine project area (including all land parcels directly concerned) spans at least the uppermost Abrahamskraal Formation as well as the lower Poortjie Member. It might extend upwards - especially in the NE - into the upper Poortjie Member and perhaps also the mudrock-dominated Hoedemaker Member but there is currently inadequate biostratigraphic data to test this.

Representative exposures of the various bedrock and superficial sediments encountered within the Lusika Mine project area are illustrated in Figures 10 to 37 below with explanatory figure legends.

A range of Teekloof Formation channel sandstone facies – provisionally assigned here to the Poortjie Member – are seen in low ridge and *kranz* exposures, for example on Kant Kraal 360 and Farm Haane Kuil RE/335. They include grey-green to yellowish-brown, fine- to medium-grained, massive, thick- to thin-bedded, tabular to lenticular wackes some of which locally show medium- to large-scale scale cross-sets and barcode-like heavy mineral lamination. Low ridges of well-jointed channel and crevasse-splay sandstone are encountered in the intervening *vlaktes*. Thicker channel sandstone packages commonly contain irregular, lenticular to sheet-like bodies of dark brown *koffieklip* (often patinated with pale grey lichens). Impersistent basal channel breccio-conglomerate lenses, often secondarily ferruginised, are composed of mudflake intraclasts, reworked calcrete glaebules and may occasionally contain reworked bones, teeth, petrified wood or woody axis impressions (Section 6).

Good exposures of Lower Beaufort Group overbank mudrock facies are very limited within the project area; the best examples are seen along the banks of the Amosrivier in the southwest (Kant Kraal 360) and on low hillslopes in the northeast (Nieuw Jaars Fontein 340). They include crumbly to hackly-weathering grey-green and subordinate maroon / purple-brown siltstone facies which commonly contain lenses and horizons of pale greyish to dark, brown-patinated, cobble to boulder-sized concretions of pedogenic carbonate; fields of downwasted pedocrete concretions may be extensive and are an important focus for palaeontological surveys. In the vicinity of dolerite intrusions (*e.g.* Nieuw Jaars Fontein 340) the overbank mudrocks and enclosed palaeosol concretions are baked, secondarily mineralised (*e.g.* ferruginised palaeocalcrete concretions) and locally develop vugs (empty hollows).

Laterally-persistent horizons of pale yellowish-green, well-jointed cherty tuffite up to a few dm thick, typically associated with intensely orange-brown weathering eluvial gravel aprons, occur locally within mudrock as well as sandstone packages, as well-known from the upper Abrahamskraal – Poortjie Member interval elsewhere. Tuffite exposures are sometimes affected by small-scale folding and may appear to be multiple. Internally the tuffites may show small-scale current (and perhaps wave) ripple cross-lamination and are clearly water-lain.

The wide spectrum of semi-consolidated to unconsolidated superficial sediments represented within the mine project area are of Late Caenozoic (probably Pleistocene – Holocene) age. Rubbly colluvium of wacke, vein quartz and *koffieklip* mantles low ridge and bulge. Sandy to gravelly alluvium up to several meters thick

occurs along active and relict water courses. Subsurface to near-surface calcrete pedocretes occur widely in the *vlaktes* where they are exposed along farmtracks and in trenches, borrow pits and road cuttings, but may be especially thickly developed in spring areas and along ancient drainage lines (e.g. Haane Kuil RE/335). Weathered bedrocks beneath calcrete hardpans are often calcrete-veined and saprolitic. A horizon of coarse, gritty, brownish, semi-consolidated sandstone showing distinctive polygonal weathering overlies calcrete-veined mudrocks on Haane Kuil 7/335. Eluvial surface gravels cover large areas of the *vlaktes* where they are dominated by angular to subrounded clasts of wacke, metaquartzite, hornfels, vein quartz, dolerite, palaeocalcrete concretions and tuffite. Shallow, unvegetated pan-like areas feature sheetwash gravels or resistant facies, often patinated and moderately well-rounded.

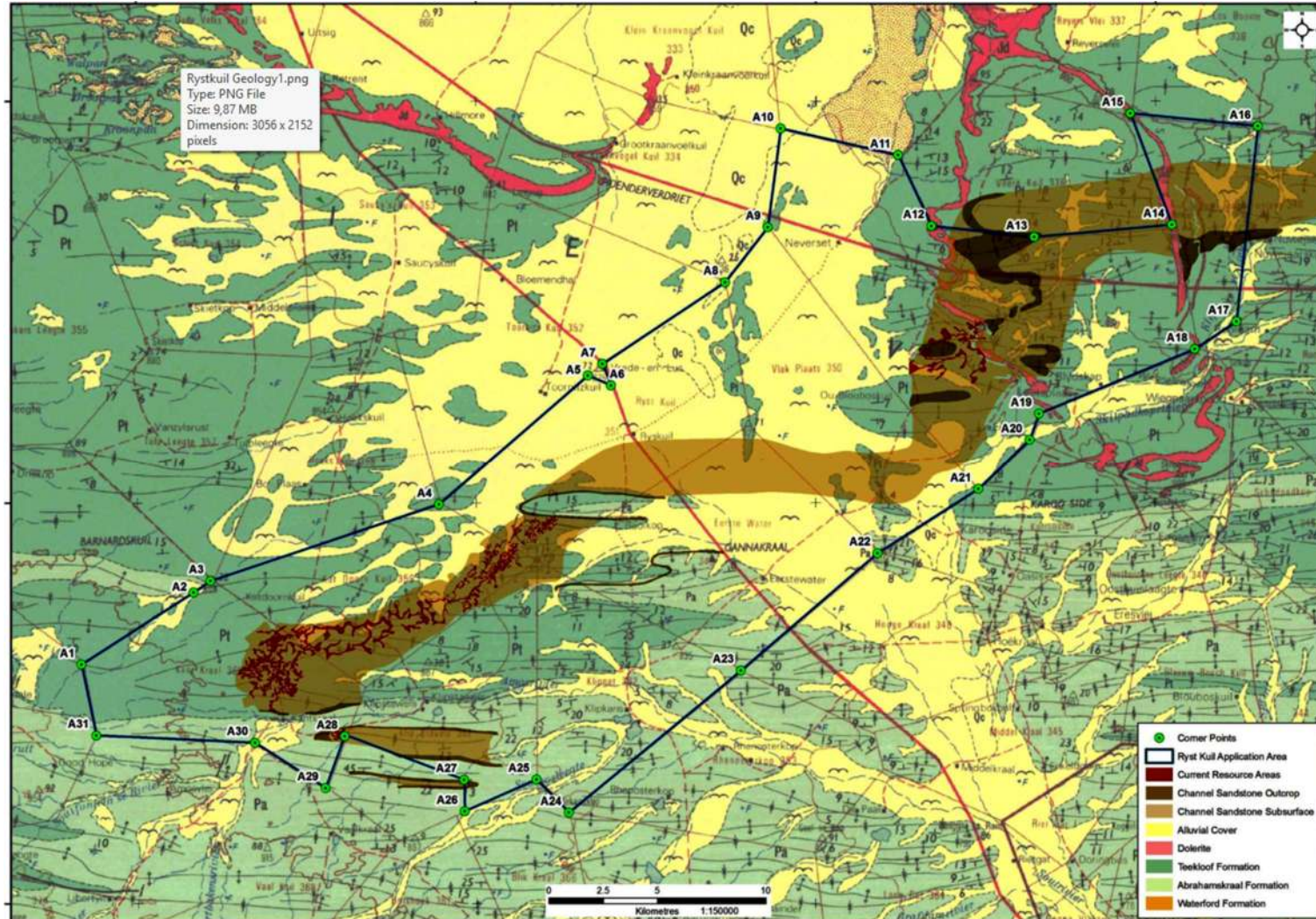


Figure 5: Geological map (based on the published 1: 250 000 geology sheet 3222 Beaufort West, Council for Geoscience, Pretoria) showing the outline of the original Lusika Mine project area (dark blue polygon - since reduced, as shown in Figures 1 & 2) as well as the outcrop and subcrop of the target channel sandstone zone (brown). Image provided by Aquatox (Pty) Ltd.



Figure 6: Typical low-relief terrain of the Aberdeen *Vlaktes* region of the Great Karoo, here on Haane Kuil 7/355. Note the absence of bedrock exposure, pervasive mantle of fine alluvial soils and sparse *bossieveld* vegetation.



Figure 7: Featureless *bossieveld* terrain in the proposed CPP infrastructure development area on Ryst Kuil RE/351, looking northwards towards the Great Escarpment.

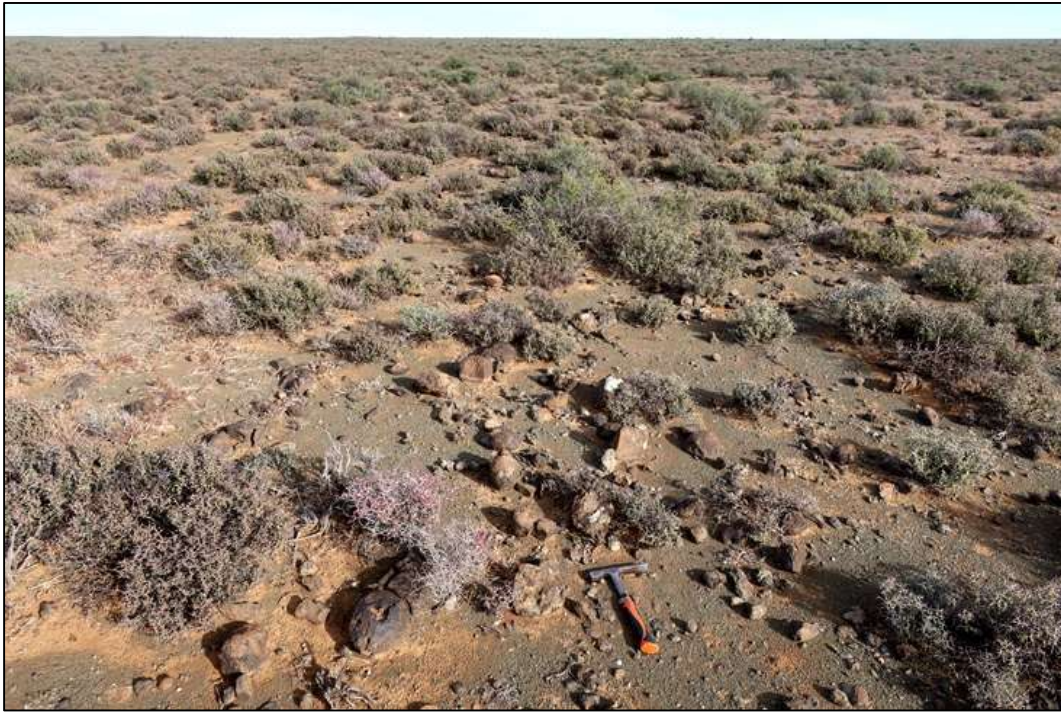


Figure 8: Typical flat terrain in the proposed Rystkuil Extension development area on Kant Kraal RE/360. Weathering-out pedogenic calcrete concretions in the foreground are a focus for palaeontological prospecting (hammer = 30 cm).



Figure 9: View towards the NNE on Farm Nieuw Jaars Fontein 1/340 showing the prominent-weathering channel sandstone body which in this area has been intruded by Karoo Dolerite.



Figure 10: Large-scale current cross-bedding within the channel sandstone body on Farm Nieuw Jaars Fontein 1/340.



Figure 11: Elongate, lenticular body of dark rusty-brown *koffiekliip* (ferruginous carbonate) embedded within channel sandstone facies on Haane Kuil 7/335 (hammer = 30 cm).



Figure 12: Rubbly, low sandstone ridge forming part of the target channel sandstone body on Farm Haane Kuil RE/335. Aprons of coarse colluvial gravels along the channel body margins may occasionally contain dispersed blocks of fossil bone reworked from channel sandstone or breccia facies (*cf* Figure 43).



Figure 13: Low, dipping exposure of well-jointed, greyish wacke on Haane Kuil 4/335. Thin wacke bodies might represent minor channels or crevasse splay deposits. Note the carpet of angular eluvial gravels of wacke in the adjoining *vlaktes*.



Figure 14: Thinly tabular-bedded channel sandstone exposed in a N-facing kranz near the Amosrivier on Kant Kraal RE/360 (hammer = 30 cm). This unit is mapped within the lower Poortjie Member (Teekloof Formation).



Figure 15: Thick-bedded facies of the same channel sandstone body illustrated above.



Figure 16: Rubbly, laterally extensive exposure of ferruginous *koffieflip* on Ryst Kuil RE/351. Such occurrences are checked-out for possible plant fossils.



Figure 17: Float block of ferruginous channel breccio-conglomerate packed with well-rounded intraclasts of greyish pedogenic calcrete. This facies is the host for several weathered-out bone chunks recorded in the vicinity (*cf* Figures 44 to 46). The block is *c.* 30 cm across.



Figure 18: Road-cutting along the R61 on Haane Kuil 4/335 showing horizontally-bedded Lower Beaufort Group grey-green overbank mudrocks and thin crevasse-splay sandstones, mapped within the Teekloof Formation.



Figure 19: R61 road cutting through grey-green and purple-brown mudrocks of the Teekloof Formation on Haane Kuil 7/335 (hammer = 30 cm). Note pale, laterally-persistent, subsurface calcrete hard pan of Late Caenozoic age.



Figure 20: Good exposure of Teekloof Formation overbank mudrocks in a dam overflow channel on Nieuw Jaars Fontein 1/340.



Figure 21: Good exposures of purple-brown overbank mudrocks and thin sandstones of the Lower Beaufort Group on the northern banks of the Amosrivier on Kant Kraal RE/360. These beds are mapped within the uppermost Abrahamskraal Formation.



Figure 22: Thin-bedded, grey-green tabular overbank mudrocks at the same locality illustrated above (hammer = 30 cm).



Figure 23: Further good bedrock exposure of the upper Abrahamskraal Formation on the southern banks of the Amosrivier on Kant Kraal RE/360. These beds have yielded sparse invertebrate trace fossils (Figure 49).



Figure 24: Weathering-out, brown-patinated palaeocalcrete concretions from a palaeosol horizon within the Teekloof Formation outcrop area on Haane Kuil 1/335. Several small dicynodont skulls enclosed within concretions were recorded from this locality (Figures 47 & 48).



Figure 25: Extensive horizon of ferruginous carbonate concretionary material exposed in the *vlaktes* on Haane Kuil 4/335.



Figure 26: Well-developed, jointed horizon of cherty, pale yellowish-green tuffite (volcanic ash mixed with terrigenous sediment) exposed on a Poortjie Member sandstone ridge on Kant Kraal RE/360 (hammer = 30 cm). Such flinty beds have been an important local source of raw material for stone artefacts in Stone Age times.



Figure 27: Gently-inclined dolerite sheet intruded into Teekloof Formation beds, R61 road cutting on Haane Kuil 4/335. This is the most substantial dolerite intrusion within the northern sector of the study area.



Figure 28: Baked mudrock and sandstone facies within the thermal aureole of the dolerite intrusion illustrated above, seen here on Nieuw Jaars Fontein 1/340. Note the prominent-weathering horizon of pedocrete concretions exposed on the LHS.



Figure 29: Friable, weathered Teekloof Formation mudrocks exposed in a shallow borrow pit on Haane Kuil 7/335 (hammer = 30 cm). The bedrocks are cut by a network of near-surface calcrete veins and capped by a horizon of semi-consolidated, polygonally-cracked, gritty brownish sands of possible Pleistocene age.



Figure 30: Substantial deposit of Late Caenozoic creamy-hued calcrete due south of the large farm dam on Haane Kuil RE/335. These deposits are probably associated with an ancient spring and / or drainage line. Numerous flaked stone artefacts occur in the vicinity.



Figure 31: The widespread occurrence of an extensive calcrete hardpan in the subsurface is indicated by calcrete surface gravels in the vlaktes on Ryst Kuil RE/351.



Figure 32: Thick development of fine silty to sandy alluvial deposits with subordinate gravelly lenses exposed in a roadside trench near the farmstead on Ryst Kuil RE/351. The area lies within an extensive drainage line that is clearly visible on satellite imagery.



Figure 33: Modern unconsolidated sandy alluvium along a shallow incised drainage line on Haane Kuil RE/335.



Figure 34: One of many open pan-like areas within the study area, seen here on Ryst Kuil RE/351.



Figure 35: Pan area with eluvial gravels of Lower Beaufort Group wacke on Ryst Kuil 2/351. Such areas were prospected for reworked chunks of petrified wood, but without success.



Figure 36: Many sectors of the wider project area are mantled with angular to subrounded, pebble to cobble-sized eluvial gravels of Beaufort Group wacke, as here on Haane Kuil 4/335.



Figure 37: Cherty, deeply orange-patinated surface gravels associated with nearby exposures of tuffite beds, Kant Kraal RE/360 (see also Figure 26).

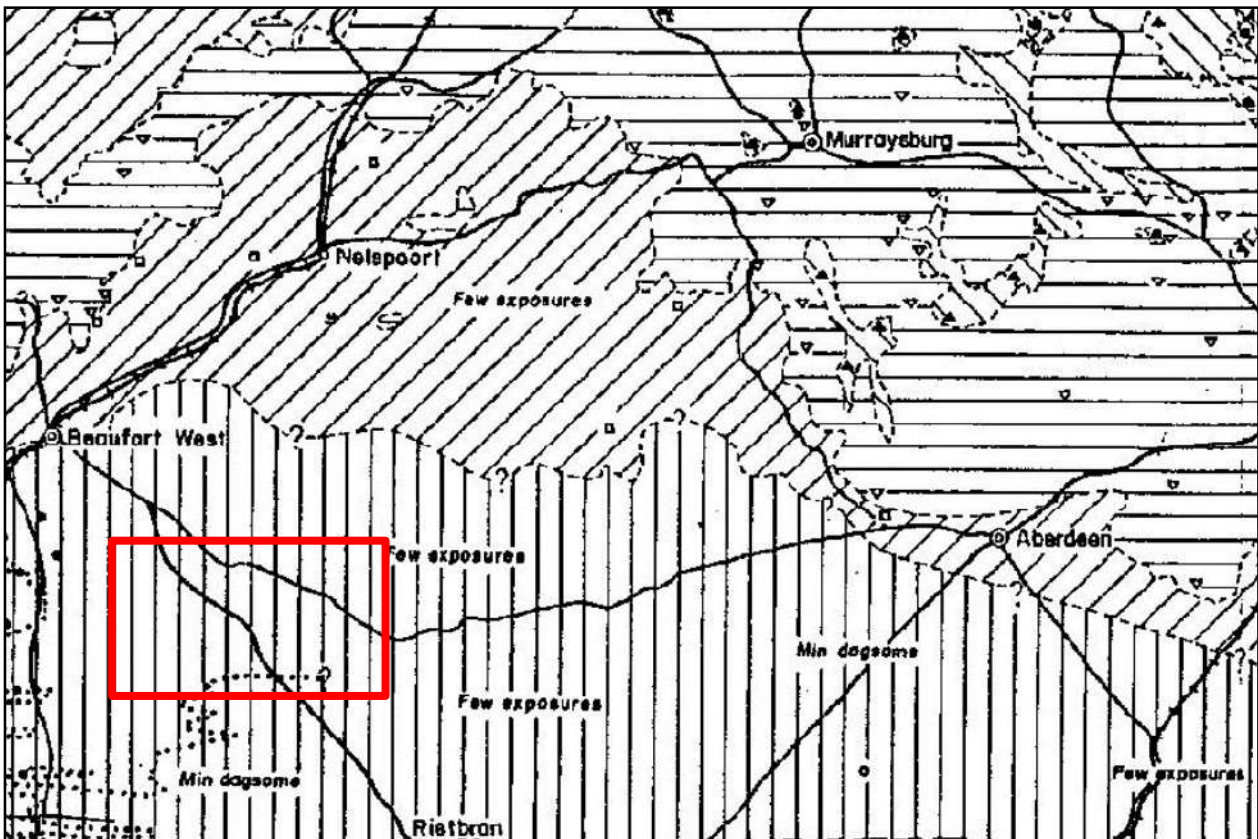
6. PALAEOLOGICAL HERITAGE

As discussed in recent PIA reports for the region by Almond (2022, 2023), the Aberdeen *Vlakte* subregion of the Main Karoo Basin are largely *Terra Incognita* in palaeontological terms due to the exceedingly poor levels of bedrock exposure in the region (See fossil vertebrate site maps presented by Keyser & Smith (1977-1978) (Figure 38), Nicolas (2007) as well as the 1: 250 000 geological map in Figure 5 which shows no historical sites mapped within the Lusika Mine project area). Early palaeontological prospecting by Roger Smith focused on very limited exposures along incised drainage lines traversing the region (pers., comm., 2025). Rubidge and Abdala (1988) recorded a modest number of unidentified bone chunks, small dicynodont skulls, large therapsid postcranial remains, fossil wood and plant impressions from a series of farms extending across the Karoo *vlakte* to the south-west of Oorlogspoortberge. Several of their fossil sites - mapped on the satellite images in Figures A1.1 to A1.2 (Appendix 1) - lie within the present project area (Kat Doorn Kuil RE/359, Kant Kraal RE/360 and Haane Kuil 7/335) while a couple are situated just outside the present project area on Nieuw Jaars Fontein 340. The tetrapod remains were generally preserved within pedogenic concretions while the plant material (and perhaps some of the isolated bones) were associated with pebbly channel lags towards or at the base of the Poortjie Member (Teekloof Formation). These fossils were provisionally assigned to the formerly recognised *Pristerognathus* Assemblage Zone (AZ) but it was considered that occurrences towards the southwest (Kant Kraal RE/36) might belong, at least in part, to the upper *Tapinocephalus* AZ.

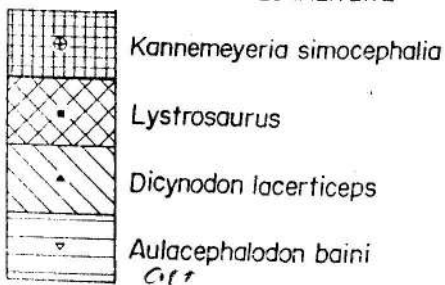
The presence of Middle Permian *Tapinocephalus* AZ beds beneath the Aberdeen *Vlakte* some 40km east of the present study area is demonstrated by the recent discovery of fragmentary tapinocephalid dinocephalian remains (elements of the skull and girdle) there by Almond (2022, 2023) as well as local concentrations of less diagnostic petrified wood associated with channel sandstones. This supports the most recent fossil biozonation mapping of the Main Karoo Basin by Day & Rubidge (2020a) which shows an unconfirmed tongue of “Tap Zone” outcrop extending into the Aberdeen *Vlakte* region from the south (Figure 39) (contrast the earlier account by Almond 2014, now outdated). The present new records of dinocephalian postcranial remains – notably an incomplete scapula (shoulder blade) as well as several unidentified bone chunks – on Farm Rystkuil 2/351 within the Lusika Mine project area (see below) confirms the occurrence here of the *Tapinocephalus* Assemblage Zone, as originally proposed by Rubidge and Abdala (2008) and as to be expected within the lower part of the Poortjie Member succession. The provisional assignment of this region to the *Endothiodon* Assemblage Zone, as mapped by Day and Smith (2020, their Figure 2) is therefore incorrect.

Continental (terrestrial / lacustrine / fluvial) fossil biotas within the upper part of the Abrahamskraal Formation (Moordenaars and Karelskraal Members) as well as within the lowermost portion of the Poortjie Member of the Teekloof Formation are now assigned to the ***Diictodon – Styraucocephalus* Subzone** of the revised ***Tapinocephalus* Assemblage Zone** (AZ) that is of Late Capitanian age (c. 262-260 Ma) (Day & Rubidge 2020a) (Figures 40 to 42). The highly impoverished, post-extinction vertebrate fauna represented in the uppermost part of the *Diictodon – Styraucocephalus* Subzone (lowermost Poortjie Member) includes – or is inferred to include – only a few representatives of several tetrapod subgroups. These include amphibians, parareptiles (pareiasaurs, *Eunotosaurus*), dinocephalians (e.g. *Criocephalosaurus*, perhaps also *Styraucocephalus*), dicynodonts (e.g. *Diictodon*), therapsids (e.g. *Pristerognathus*) and gorgonopsians (Retallack *et al* 2006, Smith *et al.* 2012, Day *et al.* 2015a, 2015b, Day & Rubidge 2020a).

The fossil record of the Abrahamskraal – Teekloof contact zone is of special scientific interest because of its record of environmental and palaeobiological events related to the major **Middle Permian Mass Extinction Event** of 262-260 million years ago (= Capitanian or Guadalupian Mass Extinction Event) (Day *et al.* 2015b). Since vertebrate fossils are generally rare within this interval, any new records of well-preserved, identifiable material here are of considerable scientific value (*cf* ongoing research project on this extinction event conducted by Professor Bruce Rubidge of Wits University and colleagues elsewhere).



ASSEMBLAGE ZONE AND LOCALITIES
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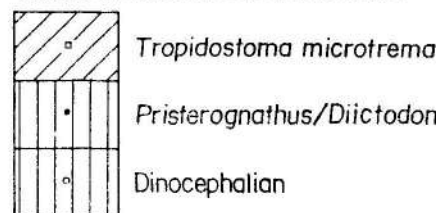


Figure 38: Early, and now outdated, biostratigraphical map of the Lower Beaufort Group in the Great Karoo between Beaufort West and Aberdeen showing the distribution of the various palaeontological Assemblage Zones, mainly based on tetrapod fossils (Keyser & Smith 1977-78). According to this map the Lusika Mine project area c. 50 km southeast of Beaufort West (very *approximately* indicated by the red rectangle) lies in a region of limited bedrock exposure (*min dagsome* / *Few Exposures*) within which no tetrapod fossils have been recorded.

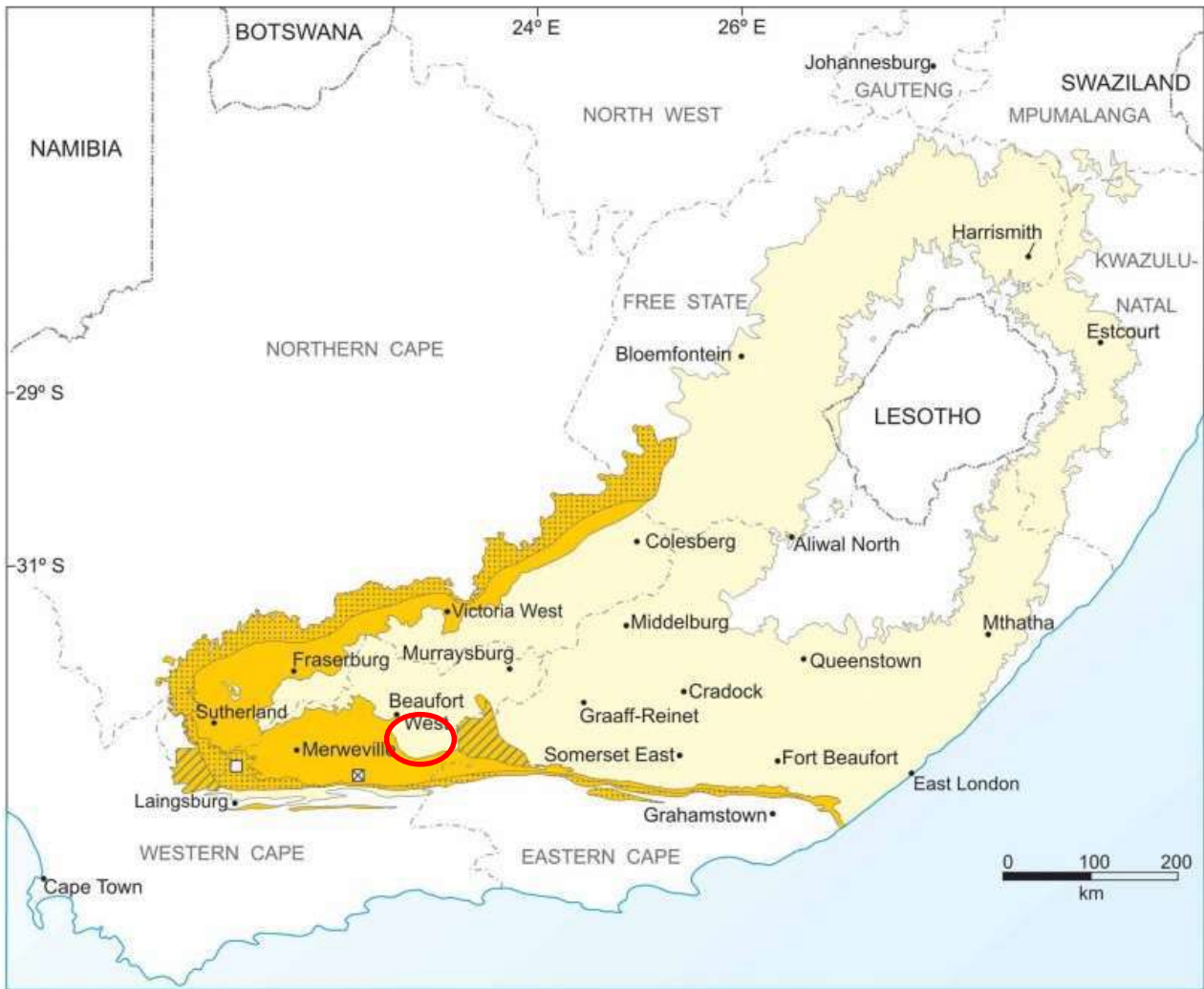


Figure 2. Distribution of the *Tapinocephalus* Assemblage Zone (dark yellow) in the Beaufort Group (yellow), showing the distribution of the Eosimops – Glanosuchus Subzone (dotted), Diictodon – Styracocephalus Subzone (not dotted), and uncertain presence (diagonal hatched). Positions of Type localities for the Eosimops – Glanosuchus Subzone (empty square) and Diictodon – Styracocephalus Subzone (crossed square) are indicated.

Figure 39: The most recent fossil biozonation mapping of the *Tapinocephalus* Assemblage Zone in the Main Karoo Basin by Day and Rubidge (2020a). Note that the Lusika Mine project area (red ellipse) is currently mapped *outside* the Tap Zone outcrop area and is referred instead to the younger *Endothiodon* AZ by Day & Smith (2020). Fragmentary dinocephalian remains recorded recently from the Aberdeen *Vlakte* near Aberdeen as well as within the Lusika Mine project area support the extension of the *Tapinocephalus* Assemblage Zone further to the east (cross-hatched area on map).

Age	Gp	West of 24° E	East of 24° E	Free State / KwaZulu-Natal	Vertebrate Assemblage Zones	Vertebrate Subzones	Radiometric dates			
JURASSIC	STORMBERG		Drakensberg Gp	Drakensberg Gp			← 183.0 Ma (A)			
			Clarens Fm	Clarens Fm	Massospondylus		← <187.5 Ma (B)			
			upper Elliot Fm	upper Elliot Fm			← <191.9 Ma (B)			
			lower Elliot Fm	lower Elliot Fm		Scalenodontoides				
			Molteno Fm	Molteno Fm			← <199.9 Ma (B)			
TRIASSIC	Tarkastad Subgrp		Burgersdorp Fm	Driekoppen Fm	Cynognathus	Cricodon-Ufudocyclops Trirachodon-Kannemeyeria Langbergia-Gargainia	← <204 Ma (B)			
			Katberg Fm	Verkykerskop Fm	Lystrosaurus declivis		← <219 Ma (B)			
			Balfour Fm	Palingkloof M.	Harrismith M.	Daptocephalus	Lystrosaurus maccaigi-Moschorhinus	← 252.24 Ma (G)		
				Elandsberg M.	Schoondraai M.			← 251.7 Ma (C)		
Ripplemead M.	Rooinekke M.	Dicynodon-Therapsid		← 253.02 Ma (D)						
PERMIAN	BEAUFORT	Adelaidie Subgrp	Teekloof Fm	Daggaboersnek M.	Frankfort M.	Cistecephalus				
				Oudeberg M.						
			Steenkampsvlakte M.	Middleton Fm	Volksrust Fm	Tapinocephalus	Eosimops-Glanosuchus			
								Oukloof M.		← 255.2 Ma (E)
								Hoedemaker M.		← 256.247 Ma (E)
			Poortjie M.	Abrahamskraal Fm	Koonap Fm	Eodicyonodon		← 259.262 Ma (E)		
										← 260.200 Ma (F)
ECCA		Tierberg/Fort Brown	Waterford Fm	Fort Brown		← 260.407 Ma (E)				
								← 261.241 Ma (E)		

Figure 40: Stratigraphic subdivision of the Karoo Supergroup with the rock units and fossil biozones most relevant to the present PIA study outlined in green (Modified from Smith *et al.* 2020). Recent dinocephalian fossil finds in the Aberdeen *Vlakte*s suggest that the Lower Beaufort Group bedrocks underlying the Lusika Mine project area can be assigned to the upper part of the *Tapinocephalus* Assemblage Zone (green rectangle) associated with the upper Abrahamskraal Formation as well as the basal Teekloof Formation (lower part of the Poortjie Member). Unequivocal representatives of the *Endothiodon* Assemblage Zone have not been recorded within the project area but they certainly do occur within the upper Poortjie and Hoedemaker Members in the Beaufort West area.

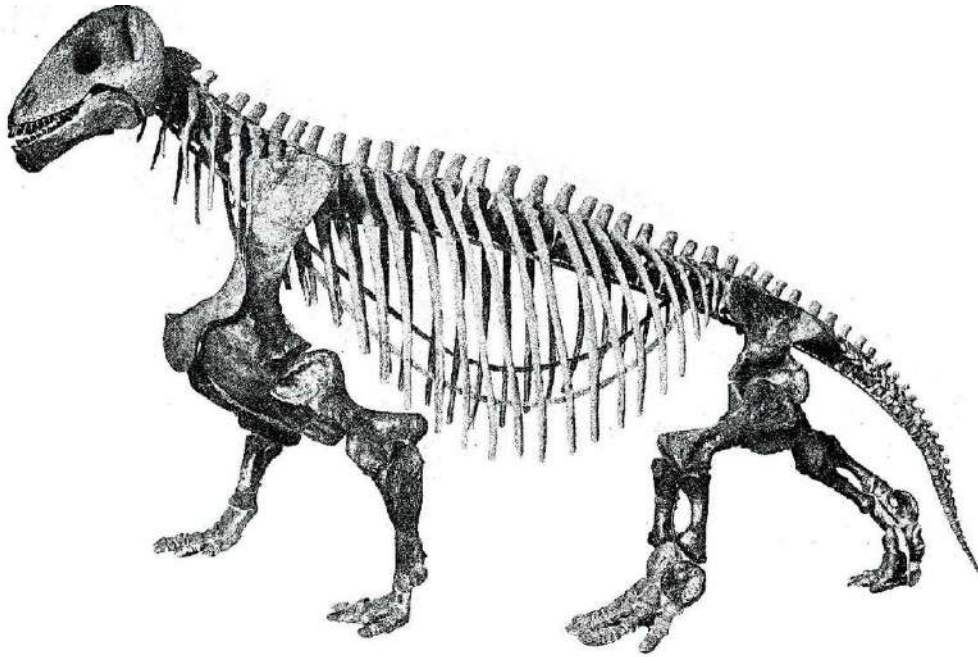


Figure 41: Reconstructed skeleton of the tapinocephalid (thick-skulled) dinocephalian *Moschops*, a rhino-sized herbivorous therapsid that reached lengths of 2.5 to 3 m and may have lived in small herds. Dinocephalian postcranial remains, including portions of a small scapula (shoulder blade), are reported here from the Lusika Mine project area while cranial and girdle fragments of a tapinocephalid dinocephalian have recently been recorded within the Aberdeen *Vlaktes* c. 40km further to the east.

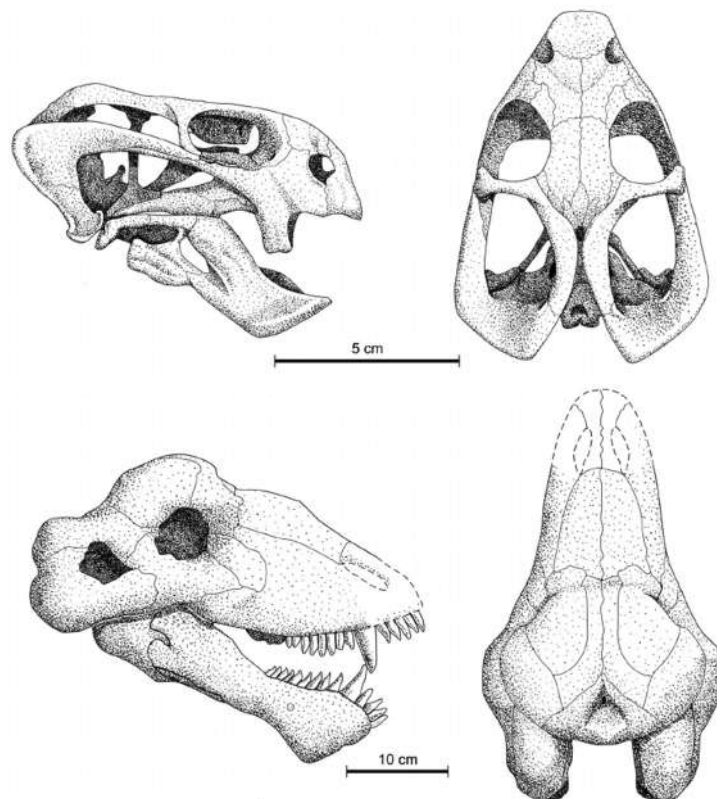


Figure 42: Skulls of therapsid index taxa for the upper *Tapinocephalus* Assemblage Zone (*Diictodon* – *Styracocephalus* Subzone) (from Day & Rubidge 2020): the small-bodied dicynodont *Diictodon* and the large dinocephalian *Styracocephalus*. Members of both these therapsid subgroups have been recorded from the Lusika Mine project area.

6.1. Palaeontological field data from Lusika Mine project area

Only a handful of new fossil sites were recorded during the recent palaeontological site visit to the Lusika Mine project area, supplementing the few sites previously reported here by Rubidge and Abdala (2008). As discussed previously, the paucity of fossil finds is probably due, in large part, to the generally very poor levels of bedrock exposure. Other contributory factors include near-surface weathering, local dolerite intrusion as well as the end-Middle Permian Extinction Event.

Several of the new fossil finds are illustrated below in Figures 43 to 50. All recorded fossil sites, including relevant earlier records by Rubidge and Abdala (2008), are listed and mapped on a satellite image in relation to the provisional mine infrastructure layout in Appendix 1, Figures A1.1 to A1.3 (red numbered squares, yellow labelled circles).

The new fossil material includes the following:

- Isolated, sparse to very sparse scatters of **robust bone chunks of large tetrapods** (Figures 43 to 46) as well occasional poorly-preserved (possibly partially decomposed) blocks of **petrified wood** recorded as float within surface gravels. These have probably been downwasted from nearby channel sandstone bodies, especially breccia lenses of reworked palaeocalcrete and mudrock clasts. Some bone blocks show adherent breccia matrix and embedded pyrite crustal pseudomorphs suggesting accumulation in anoxic setting such as a stagnant lake or pond in a river channel (Figure 46). Most of the bone specimens are probably unidentifiable but they do include fragments of a **dinocephalian scapula** (Figure 45).
- Local concentrations of **small dicynodont skulls** (Figures 47 & 48), disarticulated **small postcranial bones** enclosed within dark brown-patinated pedoconcrete / palaeocalcrete concretionary horizons (fossil palaeosols).
- Low-diversity **invertebrate trace fossil assemblages** within siltstone and wacke facies (Figure 49).
- Concentrations of reworked **woody plant material** within channel sandstone bodies (Figure 50).

Occasional *equivocal* tetrapod burrow casts were observed but are not recorded here. Sheetwash surface gravels in pan areas were searched for reworked blocks of petrified wood and koffiekliip lenses were examined for fossil plants but none were observed in this context. Thick calcrete hardpans (e.g. along older drainage lines) showed mottled textures but no discrete traces or other fossils (e.g. plant root casts / termitaria or other invertebrate borrows) were seen.

The dinocephalian postcranial remains on Ryst Kuil RE/351 indicate bedrocks of the *Tapinocephalus* AZ here. Pooling the new tetrapod fossil records together with those made by Rubidge and Abdala (2008), the comparatively small body size of the dinocephalian, the presence of the small dicynodonts *Diictodon* and *Robertia* (Haane Kuil 1/335, Kat Doorn Kuil RE/359) as well as the large therocephalian (Neuwe Jaars Fontein) are all consistent with an assignment to the **upper Tapinocephalus AZ (Diictodon-Styracocephalus Subzone)**, as would be expected from bedrocks spanning the uppermost Abrahamskraal Formation and lower portion of the Poortjie Member (Teekloof Formation). As discussed earlier, this contradicts current mapping of *Endothiodon* Assemblage Zone biotas in this region of the Main Karoo Basin (Day & Smith 2020).

It is not possible to comment with confidence on palaeontological resources on Kat Doorn Kuil RE/359 where dicynodont fossils were previously recorded by Rubidge & Abdala 2008 since access permission could not be obtained.



Figure 43: Two adjoining weathered chunks of a substantial large tetrapod bone (dinocephalian or, less likely, pareiasaur) in float within surface gravels adjacent to a channel sandstone ridge, Haane Kuil 7/335 (Loc. 1800). Specimen is 10cm across as shown.

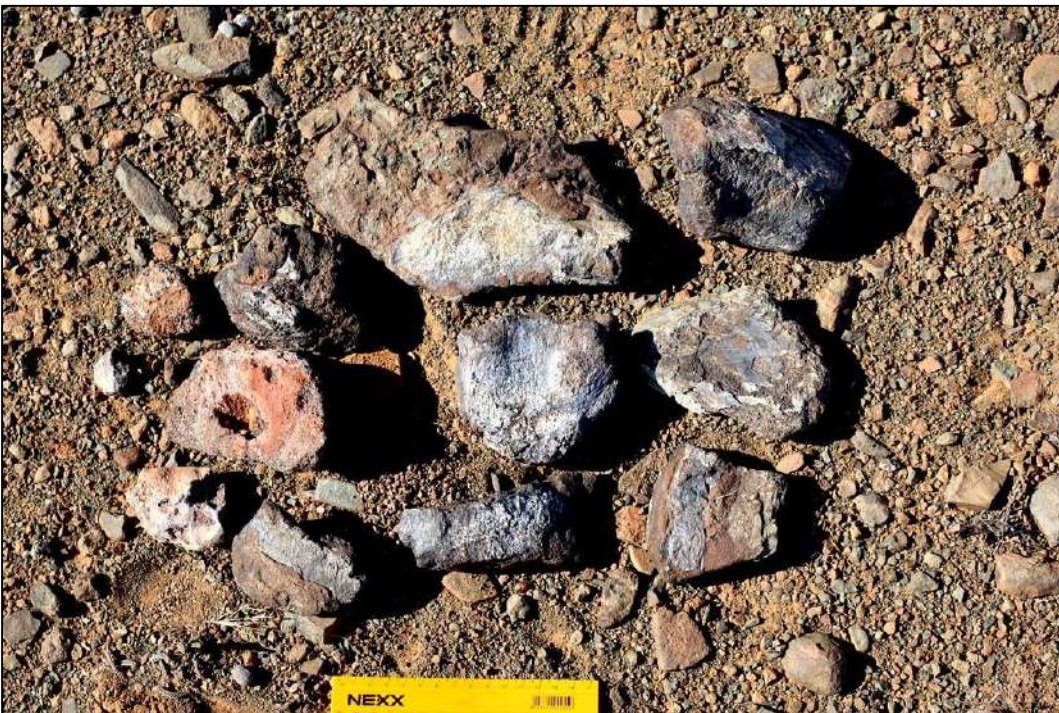


Figure 44: Surface scatter of robust postcranial bone fragments of one or more large-bodied tetrapods – probably dinocephalian - weathering-out of locally ferruginised channel breccia facies (calcrete and mudflake intraclasts), Ryst Kuil RE/351 (Loc. 1839). Scale = 15 cm. See also following two figures.

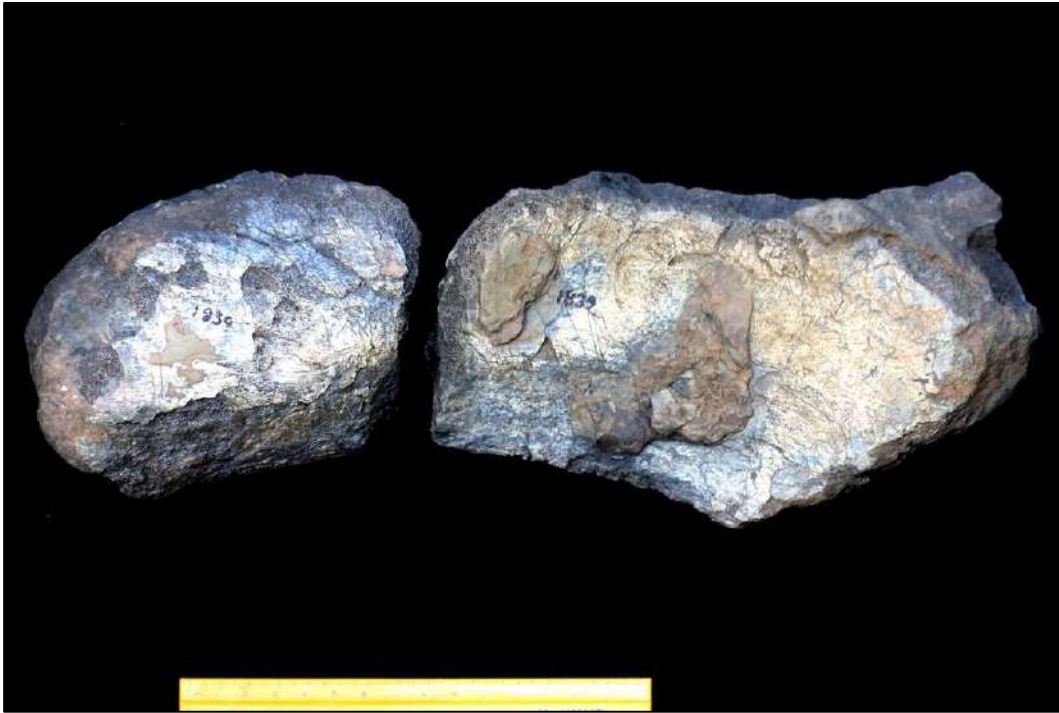


Figure 45: Two fragments of a fairly small dinocephalian scapula (shoulder blade) among the bone scatter illustrated above. Scale in cm.



Figure 46: Detail of one of the highly weathered bone chunks illustrated in Figure 44 above (10.5 cm across) showing small cubical pseudomorphs of pyrite embedded within the bone and palaeocalcrete matrix.



Figure 47: Cluster of 4 partial to complete skulls of small-bodied dicynodonts (probably *Diictodon*) preserved within pedogenic calcrete concretions. At least three of the skulls have canine tusks. Farm Haane Kuil 1/335 (Loc. 1820). The largest skull specimen (top right) is c. 12 cm long.



Figure 48: Close-up of the most complete dicynodont skull shown above (c. 12 cm long) which has tusks and an articulated lower jaw.



Figure 49: Poorly-preserved assemblage of horizontal invertebrate burrows (c. 5-6mm wide) on a sandstone upper bedding plane, Kant Kraal RE/360 (Loc. 1862). Scale in cm.



Figure 50: Impression or mould of longitudinally striated woody plant stem fragment (c. 2 cm wide) within a thin purplish-brown wacke unit, Kant Kraal RE/360 (Loc. 1857a).

7. SITE SENSITIVITY VERIFICATION

Provisional palaeosensitive mapping of the Lusika Mine project area near Beaufort West (SAHRIS palaeomap, DFFE Screening Tool) indicates that the bedrocks here (Lower Beaufort Group) are potentially of Very High palaeosensitivity, Late Caenozoic alluvial deposits are of Medium sensitivity while dolerite intrusions in the northeast are insensitive (Figure 51).

Based on desktop information, previous palaeontological reports by the author (Almond 2022, 2023) as well as Rubidge and Abdala (2008) and the recent 4-day site visit, the Lusika Mine project area is for the most part assessed as being of **Low Palaeosensitivity** because (1) very few significant fossil sites have been recorded here and (2) the potentially fossiliferous Permian bedrocks are largely mantled by Late Caenozoic Superficial deposits and *bossieveld* vegetation. **The palaeosensitivity mapping shown by the DFFE Screening Tool is accordingly contested in this report.** However, the possible occurrence of occasional unrecorded fossil sites of High palaeosensitivity at of beneath the ground surface cannot be excluded.

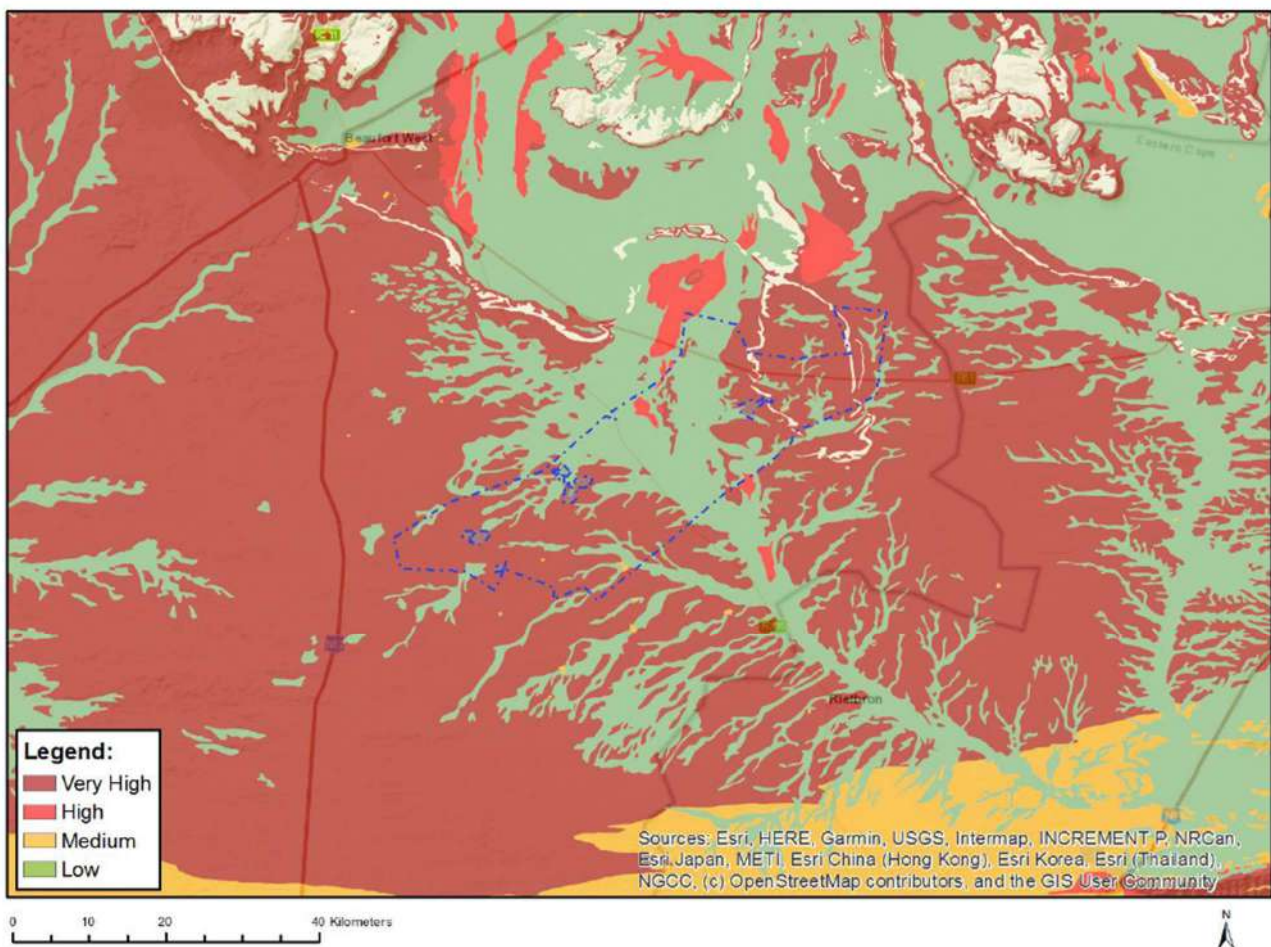


Figure 51: Provisional palaeosensitivity mapping of the Lusika Mine project area (blue dashed polygon) using the DFFE Mapping Tool (December 2023). (*N.B.* The project area has since shrunk considerably – see Figures 1 & 2). Most of the project area is in practice of Low Palaeosensitivity, so the mapping shown here is contested in this report. However, the possible occurrence of occasional unrecorded fossil sites of High palaeosensitivity at of beneath the ground surface cannot be excluded.

8. PALAEOLOGICAL HERITAGE IMPACT ASSESSMENT

Existing impacts on palaeontological heritage within the Lusika Mine project area include the following: (1) very low-level disturbance and damage / destruction of fossils exposed at surface due to current small stock farming activities; and (2) natural weathering and erosion processes that continually expose and eventually destroy fossils originally embedded within sedimentary bedrocks and superficial sediments here. Impacts due to illegal or legal fossil collection are probably very minor.

The present combined desktop and field-based palaeoheritage study indicates that the mining project area is generally of Low palaeosensitivity, with only very sparse fossil sites recorded at surface. None of the recorded fossil sites lie within or close to ($\leq 30\text{m}$) of the project footprint. It is noted that although mining will directly impact subsurface bedrocks (e.g. Poortjie Member channel sandstone bodies), scientifically important palaeontological remains (notably fossil tetrapods) are comparatively rare in these beds due to the late Middle Permian Extinction Event. No Very High sensitivity / No-Go areas have been identified within the mine project area. However, the recent site visit did *not* include farm Kat Doorn Kuil RE/359, for which access permission was not obtained; fossil sites have been reported on this farm by Rubidge and Abdala (2008).

Potential impacts to local palaeontological heritage resources as a consequence of the proposed Lusika Mining Project near Beaufort West are assessed in Table 2 below. Impacts are limited to the Construction and Operational Phases of the mine. No significant further impacts are anticipated during the Decommissioning Phase.

Given the very small number of recorded fossil sites within the Aberdeen *Vlakte* subregion of the Great Karoo (cf PIA reports for alternative energy projects here by Almond 2014, 2022b, 2023, SAHRIS Cases and Reports mapping), **cumulative impacts** on palaeontological heritage here are estimated to be Low (negative) before mitigation and Very Low (negative) following mitigation. Anticipated cumulative impacts fall within acceptable limits.

The **No-Go Option** (i.e. no mining) will probably have a neutral impact on palaeontological heritage. Potential loss of local heritage resources through construction and mining activities (negative impacts) would be avoided while potential improvements in palaeontological understanding through professional mitigation - i.e. recording and collection of palaeontological material and data (positive impacts) - would be lost. The slow destruction of fossils exposed at the surface through natural weathering and erosion would continue, but at the same time new fossils are revealed for scientific study.

Table 2: Palaeontological heritage impact assessment for the proposed Lusika Mining project near Beaufort West (Construction & Operational Phases)

Issue	Loss or degradation of local, legally-protected palaeontological heritage resources of scientific and / or conservation value within the mining project footprint	
Description of Impact		
Potential damage, disturbance, destruction or sealing-in of legally-protected and scientifically valuable fossil heritage at or beneath the ground surface within the mining project areas, mainly due to ground clearance, bedrock excavations (open pit / underground), access roads, CPP, stock piles, tailings store		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction and Operational Phases	
Criteria	Without Mitigation	With Mitigation
OCCURRENCE		

Probability	Medium (3)	Low (2)
Duration	Permanent (5)	Permanent (5)
SEVERITY		
Magnitude	Low (4)	Minor (2)
Scale / Extent	Local (2)	Local (2)
SIGNIFICANCE		
Significance	Moderate -ve (33)	Low -ve (18)
Additional Assessment Criteria		
Degree to which impact can be reversed	Impacts to palaeontological heritage are generally irreversible.	
Degree to which impact may cause irreplaceable loss of resources	Moderate to Low. Most fossils recorded from the broader project area are of widely occurring forms within the outcrop areas of the formations concerned but a few are very rare.	
Degree to which impact can be avoided	Moderate. The occurrence of subsurface fossils is unpredictable and therefore these are impossible to avoid. Recorded fossil sites at surface can be avoided, if necessary, but are best mitigated.	
Degree to which impact can be mitigated	Moderate to High. Most recorded fossil sites at surface can be effectively mitigated by a professional palaeontologist in the Pre-construction Phase (recording / collection). Newly exposed fossils can be mitigated through a Chance Fossil Finds Procedure during the Construction and Operational Phases. However, residual impacts following mitigation may be locally high, given the unavoidable logistical difficulties of identifying and sampling fossils from on-going Construction and Operational Phase excavations and site clearance. Improvement to the palaeontological database as a result of professional mitigation is a potential positive outcome.	

9. INPUT INTO THE ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPR)

In response to the previous Heritage Impact Assessment for the Quaggasfontein and Ryst Kuil Mining Projects by ACO Associates, with palaeontological reporting by Rubidge & Abdala (2008), Heritage Western Cape issued the following Final Comments relevant to palaeontological heritage (HWC Case Number 15100705WD1009M, letter dated 16 February 2016):

FINAL COMMENT

The requirements of S 38(3) have been met. The Committee endorses the recommendations of the consultants in the HIA as follows:

Paleontology:

- A paleontologist must show the geologists from the mining company how to recognize fossils and instruct them on the monitoring of excavations for any possible fossil discoveries;
- The Fossil Finds protocol must be implemented, and if any fossils are uncovered, they must be left in place and reported to a recognized South African Palaeontological Research Centre, so that they can be excavated with and stored for future research purposes. A Work Plan for this mitigation work must be approved by HWC.

Following the recent follow-up palaeontological site visit to the Lusika Mine project area, recommended mitigation measures regarding palaeontological heritage resources during the Construction and Operational Phases of the mine are summarized in Table 3. These recommendations must be included within the EMPR for the mining project. A Chance Fossil Finds Procedure, to be implemented by the responsible ECO in collaboration with a professional palaeontologist, is provided in Appendix 2 to this report.

Please note that:

- A Pre-Construction palaeontological survey of Farm Kat Doorn Kuil RE/359, where fossil sites are already known to occur, should be made a condition for granting of a Mining Right as well as Environmental Authorisation for the Lusika Mine project. The professional palaeontologist concerned should make recommendations for mitigation of any new fossil sites (if any) recorded here.
- No mitigation is recommended with respect to any of the recorded fossil sites (see Appendix 1) since none of these lies within 30m of the proposed mine footprint and / or the material has already been sampled.
- The professional palaeontologist concerned with any mitigation will need to submit a Work Plan and Mitigation Report for approval by Heritage Western Cape.
- Any fossil material collected must be professionally curated with full documentation in an approved institution (*i.e.* museum or university collection).

Table 3: Palaeontological heritage input into the EMPr for the Lusika Mine Project

ACTIVITY	POTENTIAL IMPACT	MITIGATION TYPE	POTENTIAL FOR RESIDUAL RISK
Surface clearance and bedrock excavations (mining, access roads, building foundations), sealing-in of bedrock areas (<i>e.g.</i> stock piles, tailings store) during the Construction and Operational Phases	Damage or destruction of scientifically-important, legally-protected fossil material within mine footprint	<ol style="list-style-type: none"> 1. Pre-Construction palaeontological survey of Farm Kat Doorn Kuil RE/359. 2. Instruction by professional palaeontologist of Mining Geologist(s) and ECO / ESO regarding the recognition and safeguarding of relevant fossil material. 3. Application of Chance Finds Procedure during Construction and Operational Phases. 4. On-going monitoring for fossil material by ECO / ESO. 5. Safeguarding of new fossil finds by ECO / ESO. 6. Professional mitigation (recording / sampling) of new fossil finds by palaeontological specialist. 7. Professional curation of fossils collected in approved repository. 	Some loss of fossil material during the Construction and Operational Phases is unavoidable for logistical reasons.

10. CONCLUSIONS AND RECOMMENDATIONS

- The Lusika Mine project area near Beaufort West is underlain by continental sediments of the Lower Beaufort Group of Late Middle Permian to (possibly) earliest Permian age. These bedrocks contain sparse but important fossil remains of a range of terrestrial and aquatic vertebrates (mainly therapsids), trace fossils and occasional fragmentary plant material which are of considerable research and conservation value, confirming the occurrence of *Tapinocephalus* Assemblage Zone bedrocks within the project area. Bedrock exposure levels here are generally very poor indeed.
- A small number of fossil sites (dinocephalian, therocephalian and dicynodont therapsids, unidentified bone chunks, plant impressions, invertebrate burrows) have been recorded at surface within or close to the mining project area during the recent site visit as well as a previous field study by Rubidge and Abdala (2008) (Appendix 1). None of the recorded sites lies within or close to ($\leq 30\text{m}$) of the proposed mine footprint and no mitigation is proposed with regard to them. **No palaeontological No-Go areas or buffer zones** have been identified within the mine project area.
- Based on desktop data as well as a 4-day palaeontological field study the great majority of the mining project area is, in practice, of **LOW Palaeosensitivity** but with sparse, **small and largely unpredictable areas of HIGH to VERY HIGH sensitivity**, notably due to the occurrence here of vertebrate fossil remains within the Permian bedrocks. The overlying Late Caenozoic superficial sediments are generally of Low Palaeosensitivity but might also contain important fossil remains (e.g. Pleistocene mammals, trace fossils); however none were recorded during the site visit. **The provisional palaeosensitivity mapping shown on the DFFE Screening Report is accordingly contested here.** The season of the field study has no substantial influence on the data collected and conclusions reached here.
- Inferred impacts on local palaeontological heritage resources during the Construction and Operational Phases of the mine are assessed as being of **Moderate (negative) significance before mitigation, falling to Low (negative) following mitigation.** This analysis refers primarily to potential disturbance / damage to or loss of scientifically valuable fossil sites at or near the ground surface that are of research and conservation value. Further significant impacts during the De-commissioning Phase of the mine are not anticipated.
- Given the very small number of recorded fossil sites within the Aberdeen *Vlakte* subregion of the Great Karoo, **cumulative impacts** on palaeontological heritage here are estimated to be Low (negative) before mitigation and Very Low (negative) following mitigation. Anticipated cumulative impacts fall within acceptable limits. The **No-Go alternative** would probably have a *neutral* impact on palaeontological heritage.
- Recommended **palaeontological heritage mitigation** principally involves (1) A Pre-Construction palaeontological survey of Farm Kat Doorn Kuil RE/359; (2) Instruction by a professional palaeontologist of Mining Geologist(s) and ECO / ESO regarding the recognition and safeguarding of relevant fossil material; (3) Application of a Chance Finds Procedure during Construction and Operational Phases (see Appendix 2) including: (4) On-going monitoring for fossil material by ECO / ESO; (5) Safeguarding of new fossil finds by ECO / ESO; (6) Professional mitigation (recording / sampling) of new fossil finds by palaeontological specialist; and (7) Professional curation of fossils collected in approved repository. The specialist palaeontologist responsible for any professional mitigation will need to submit a Work Plan for approval by Heritage Western Cape. These mitigation recommendations must be included within the EMPr for the Lusika Mine project.

Provided that the recommendations are implemented in full, *including* a Pre-Construction palaeontological heritage survey of the Farm Kat Doorn Kuil RE/359, there are no objections on palaeontological heritage grounds to the granting of Mining Rights and Environmental Authorisation for the Lusika Mining Project near Beaufort West.

10.2. Impact statement

Impacts on local palaeontological heritage resources during the Construction and Operational Phases of the Lusika Mine Project near Beaufort West are inferred to be of Medium (negative) significance before mitigation, falling to Low (negative) following mitigation. The No-Go alternative would probably have a *neutral* impact on palaeontological heritage. Cumulative impacts on palaeontological heritage are estimated to be Low (negative) before mitigation and Very Low (negative) following mitigation, falling within acceptable limits. The proposed mining project area is **not fatally flawed** from a palaeontological heritage viewpoint. **There are no objections on palaeontological heritage grounds to the granting of Mining Rights and Environmental Authorisation for the proposed mining development, provided that the recommended palaeontological mitigation / monitoring recommendations are fully implemented.**

Table 4: Impact summary table: CONSTRUCTION & OPERATIONAL PHASES

Reference	Activity	Identified / possible Environmental Impact	Mitigation	Significance Points
Impacts on local palaeontological heritage (fossils)	Construction and operation of mine	Damage or destruction to legally-protected, scientifically important fossils within mine footprint	<ol style="list-style-type: none"> 1. Pre-Construction palaeontological survey of Farm Kat Doorn Kuil RE/359. 2. Instruction by professional palaeontologist of Mining Geologist(s) and ECO / ESO regarding the recognition and safeguarding of relevant fossil material. 3. Application of Chance Finds Procedure during Construction and Operational Phases. 4. On-going monitoring for fossil material by ECO / ESO. 5. Safeguarding of new fossil finds by ECO / ESO. 6. Professional mitigation (recording / sampling) of new fossil finds by palaeontological specialist. 7. Professional curation of fossils collected in approved repository. 	33

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13. SHORT CV OF AUTHOR

Dr John Almond has an Honours Degree in Natural Sciences (Zoology) as well as a PhD in Palaeontology from the University of Cambridge, UK. He has been awarded post-doctoral research fellowships at Cambridge University and the University of Tübingen in Germany, and has carried out palaeontological research in Europe, North America, the Middle East as well as North and South Africa and Madagascar. For eight years he was a scientific officer (palaeontologist) for the Geological Survey / Council for Geoscience in the RSA. His current palaeontological research focuses on fossil record of the Precambrian - Cambrian boundary and the Cape Supergroup of South Africa. He has recently written palaeontological reviews for several 1: 250 000 geological maps published by the Council for Geoscience and has contributed educational material on fossils and evolution for new school textbooks in the RSA.

Since 2002 Dr Almond has also carried out numerous palaeontological impact assessments for developments and conservation areas in the Western, Eastern and Northern Cape, Limpopo, Northwest Province, Mpumalanga, Gauteng, KwaZulu-Natal and the Free State under the aegis of his Cape Town-based company *Natura Viva* cc. He has served as a member of the Archaeology, Palaeontology and Meteorites Committee for Heritage Western Cape (HWC) and an advisor on palaeontological conservation and management issues for the Palaeontological Society of South Africa (PSSA), HWC and SAHRA. He is currently compiling technical reports on the provincial palaeontological heritage of Western, Northern and Eastern Cape for SAHRA and HWC. Dr Almond is an accredited member of PSSA and APHP (Association of Professional Heritage Practitioners – Western Cape).

Declaration of Independence

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



Dr John E. Almond
Palaeontologist
Natura Viva cc

APPENDIX 1: LUSIKA MINE PROJECT AREA NEAR BEAUFORT WEST - FOSSIL SITE DATA – JUNE 2025

All GPS readings were taken in the field using a hand-held Garmin GPSmap 65s instrument. The datum used is WGS 84. Please note that:

- Locality data for South African fossil sites in *not* for public release, due to conservation concerns.
- The table does *not* represent all potential fossil sites within the project area but those sites recorded during the field survey. The absence of recorded fossil sites in any area therefore does *not* mean that no fossils are present there.
- The stratigraphic data for each site has yet to be confirmed. All recorded sites are currently mapped within the Teekloof Formation (probably Poortjie Member) but some might fall within the uppermost Abrahamskraal Formation.

The recorded fossil sites are mapped on a Google Earth© satellite image in relation to the provisional infrastructure layout in Figures A1.1 to A1.3 (red numbered squares).

LOC	GPS DATA	COMMENTS
1800	-32.567256° 23.090737°	Haane Kuil 7/335 Two adjoining weathered chunks of a substantial large tetrapod bone (dinocephalian or pareiasaur) in float within surface gravels adjacent to a channel sandstone ridge. Also possible but <i>equivocal</i> blocks of poorly-preserved (perhaps decomposed) petrified wood. Proposed Field Rating IIIC. No mitigation necessary.
1808	-32.597779° 23.164882°	Haane Kuil 4/335 Snout (beak tips) of small-bodied dicynodont with tusks (probably <i>Diictodon</i>) within surface float among weathering out pedogenic calcrete concretions. Proposed Field Rating IIIC. No mitigation necessary.
1814	-32.560289° 23.167483°	Haane Kuil 4/335 Small unidentifiable bone fragment embedded within pedogenic calcrete concretion in surface float. Proposed Field Rating IIIC. No mitigation necessary.
1819	-32.566527° 23.125448°	Haane Kuil 1/335 Skeletal fragments of small-bodied tetrapod embedded within a pedogenic calcrete concretion in surface float. Proposed Field Rating IIIC. No mitigation necessary.
1820	-32.566479° 23.125541°	Haane Kuil 1/335 Cluster of 4 partial to complete small-bodied dicynodont skulls (probably <i>Diictodon</i>) preserved within pedogenic calcrete concretions. At least three of skulls have canine tusks. Largest example (c. 12 cm long) with articulated lower jaw. Proposed Field Rating IIIB. No mitigation necessary.
1839	-32.668322° 22.874476°	Ryst Kuil RE/351 Surface scatter of robust postcranial bone fragments of one or more large-bodied tetrapods weathering-out of locally ferruginised channel breccia facies (calcrete and mudflake intraclasts). Most blocks are weathered and probably unidentifiable but they include substantial fragments of a small dinocephalian scapula (shoulder blade). Small cubical pseudomorphs of pyrite embedded locally, with some bones showing adherent channel breccia. Proposed Field Rating IIIB. No mitigation necessary (key material sampled and site is c. 50 m outside project footprint).
1857a	-32.744778° 22.761611°	Kant Kraal RE/360 Impressions / moulds of longitudinally striated woody plant stem fragments within thin purplish-brown wacke unit. Proposed Field Rating IIIC. No mitigation necessary.
1862	-32.759695° 22.740040°	Kant Kraal RE/360 Riverine exposure of Lower Beaufort Group mudrocks and thin wackes. Low diversity ichnoassemblages of poorly-preserved horizontal invertebrate burrows (c. 5-6mm wide) on sandstone upper bedding planes.

	Proposed Field Rating III C. No mitigation necessary.
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The following fossil sites within or close to the Lusika Mine project area that were documented by Rubidge and Abdala (2008) are also mapped in Figures A1.1 to A1.3 (yellow labelled circles):

Farm	Fossil type	Grid reference
Kareeport	<i>Diictodon</i> skull	S 32° 27.661'/E 23° 21.113'
	<i>Diictodon</i> skull	S 32° 27.714'/E 23° 21.061'
	Wood	S 32° 27.667'/E 23° 21.118'
	Wood	S 32° 30.795'/E 23° 14.773'
	Plant fragments	S 32° 27.763'/E 23° 21.130'
Nuwejaarsfontein	Therocephalian postcranium	S 32° 33.033'/E 23° 13.637'
Haanekuil	Wood	S 32° 37.467'/E 23° 02.563'
Kat Doorn Kuil	<i>Diictodon</i> skull	S 32° 41.412'/E 22° 48.554'
	<i>Diictodon</i> skull	S 32° 41.451'/E 22° 48.563'
Kant Kraal	<i>Diictodon</i> skull (3)	S 32° 44.618'/E 22° 44.452'
	<i>Robertia?</i> skull	S 32° 44.599'/E 22° 45.080'

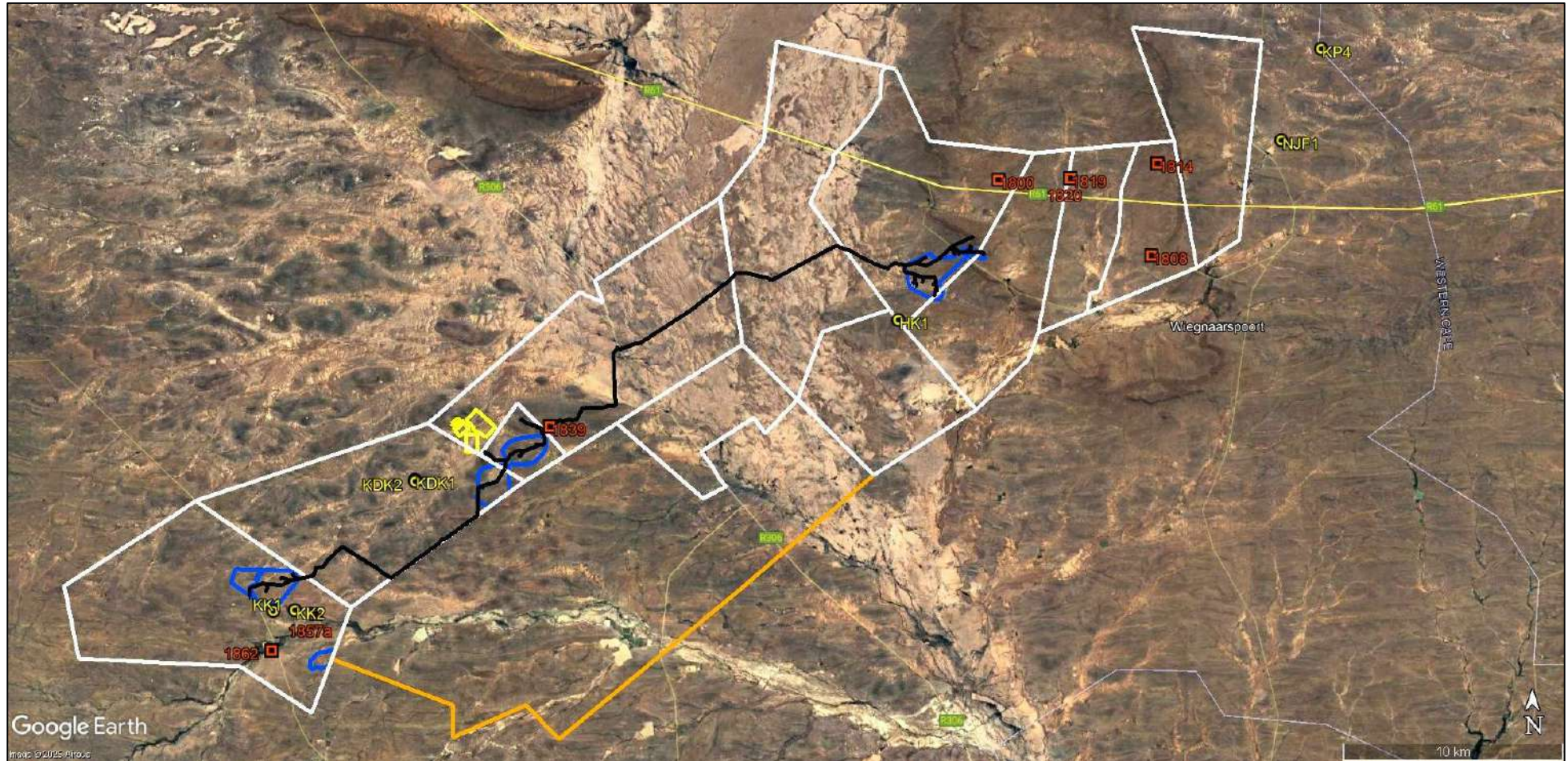


Figure A1.1: Google Earth© satellite image showing recorded fossil sites (yellow circles = previous study by Rubidge & Abdala 2008; red squares = this study) with reference to the Lusika Mining project area near Beaufort West (white polygons) and the proposed mine layout. Please see following two figures for more detail. None of the recorded fossil sites lies within or close to ($\leq 30\text{m}$) of the proposed mine footprint and no mitigation is recommended with regard to them.

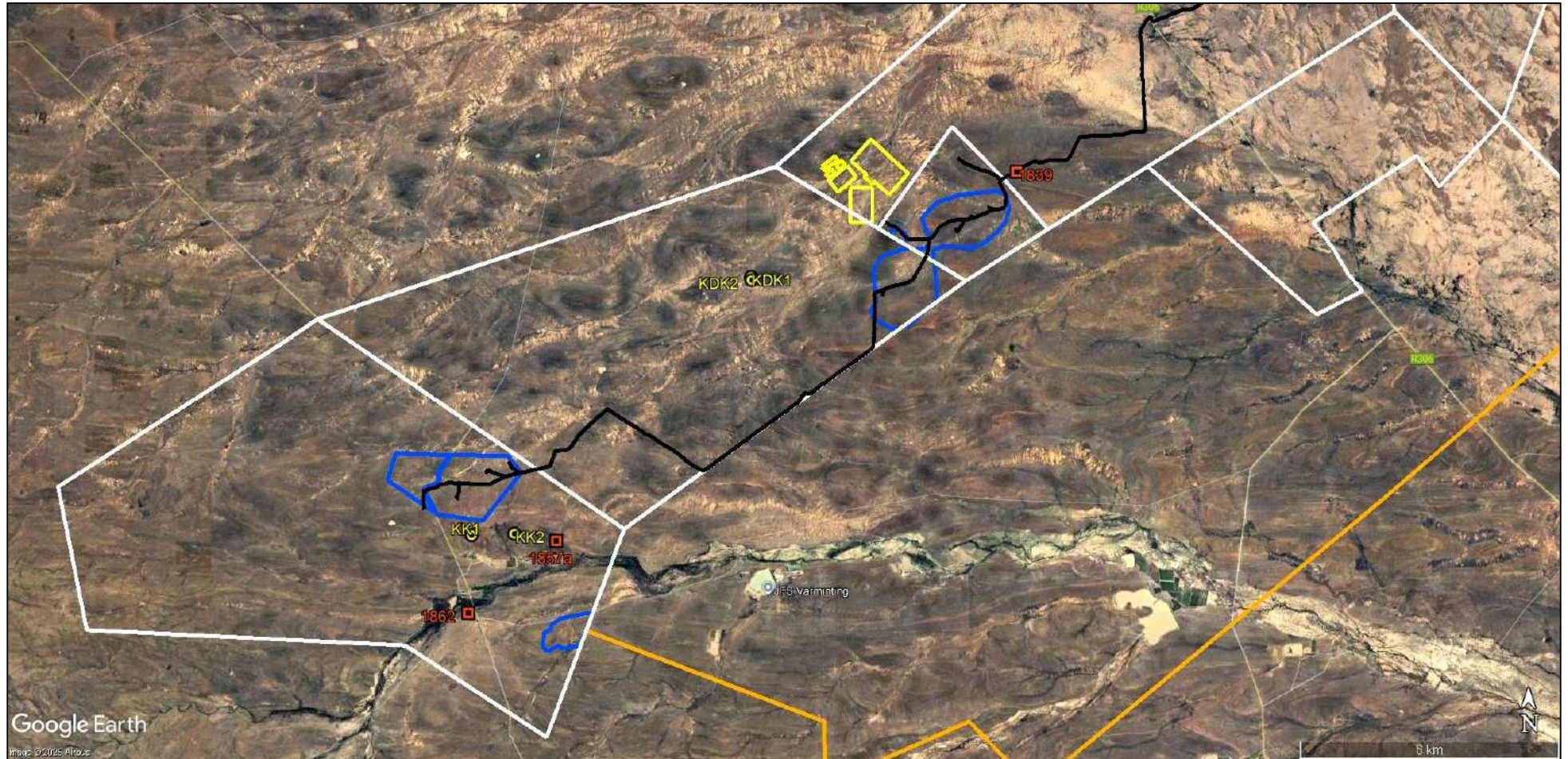


Figure A1.2: Google Earth© satellite image showing recorded fossil sites (yellow circles = previous study by Rubidge & Abdala 2008; red squares = this study) in the south-western sector of the Lusika Mining project area near Beaufort West. None of the recorded fossil sites lies within or close to ($\leq 30\text{m}$) of the proposed mine footprint and no mitigation is recommended with regard to them.

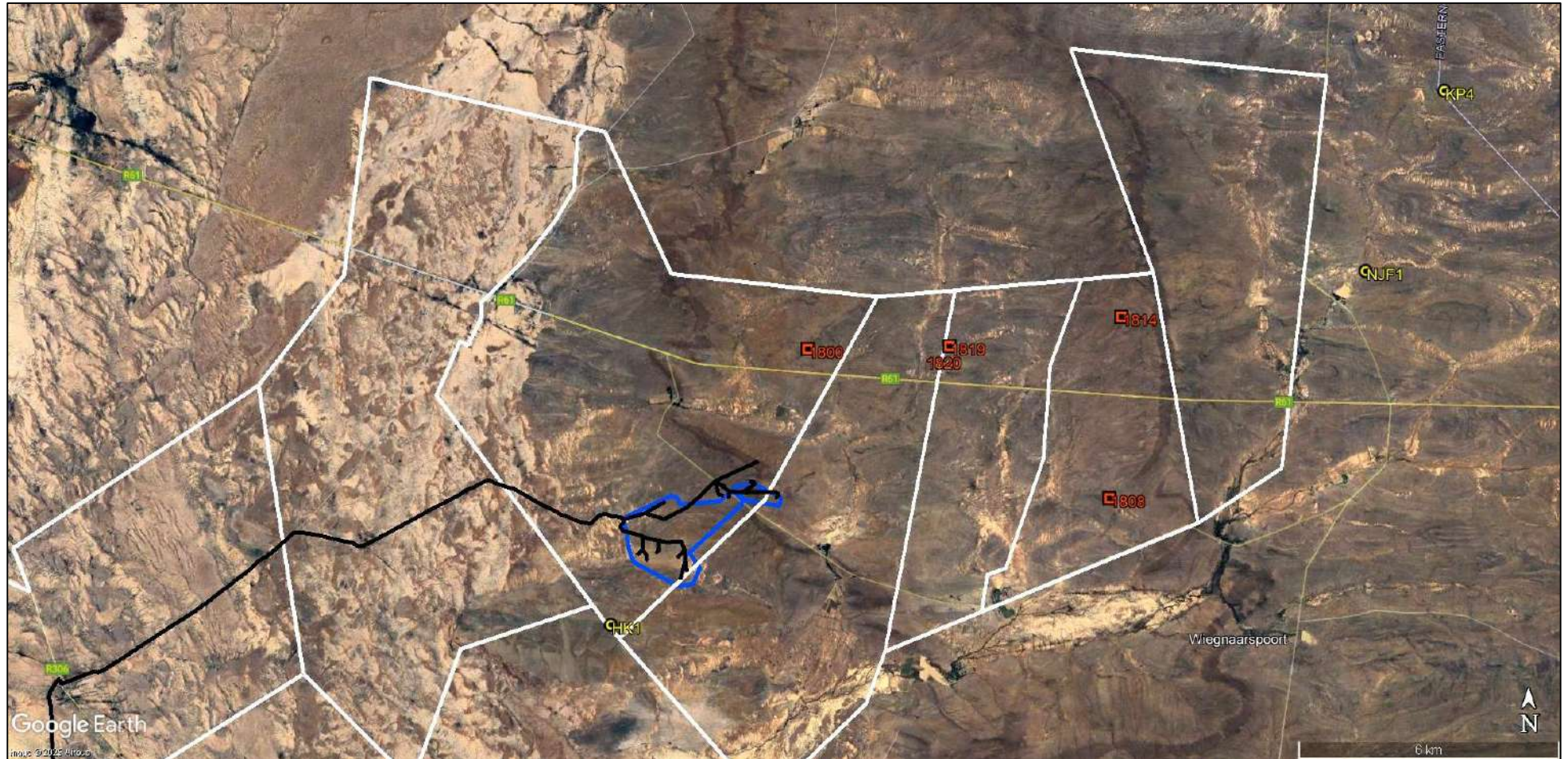


Figure A1.3: Google Earth© satellite image showing recorded fossil sites (yellow circles = previous study by Rubidge & Abdala 2008; red squares = this study) in the north-eastern sector of the Lusika Mining project area near Beaufort West. None of the recorded fossil sites lies within or close to ($\leq 30\text{m}$) of the proposed mine footprint and no mitigation is recommended with regard to them.

APPENDIX 2: CHANCE FOSSIL FINDS PROTOCOL

LUSIKA MINE PROJECT NEAR BEAUFORT WEST, WESTERN CAPE PROVINCE		
Province & region:	Western Cape: Beaufort West Magisterial District	
Responsible Heritage Resources Agency	HERITAGE WESTERN CAPE. Contact details: Heritage Western Cape. 3 rd Floor Protea Assurance Building, 142 Longmarket Street, Green Market Square, Cape Town 8000. Private Bag X9067, Cape Town 8001. Tel: 021 483 5959 Email: ceoheritage@westerncape.gov.za)	
Rock unit(s)	Abrahamskraal & Teekloof Formations (Lower Beaufort Group) Late Caenozoic alluvium, colluvium, calcrete pedocretes, pan sediments, surface gravels & soils	
Potential fossils	Fossil vertebrate bones, teeth, trace fossils (e.g. vertebrate and invertebrate burrows), trackways, petrified wood, plant-rich beds in the Lower Beaufort Group bedrocks. Fossil mammal bones, teeth, horn cores, freshwater molluscs, calcretised trace fossils (e.g. termitaria, rhizoliths), plant material in Late Caenozoic alluvium, calcretes.	
ECO protocol	1. Once alerted to fossil occurrence(s): alert site foreman, stop work in area immediately (<i>N.B.</i> safety first!), safeguard site with security tape / fence / sand bags if necessary.	
	2. Record key data while fossil remains are still <i>in situ</i> : <ul style="list-style-type: none"> • Accurate geographic location – describe and mark on site map / 1: 50 000 map / satellite image / aerial photo • Context – describe position of fossils within stratigraphy (rock layering), depth below surface • Photograph fossil(s) <i>in situ</i> with scale, from different angles, including images showing context (e.g. rock layering) 	
	3. If feasible to leave fossils <i>in situ</i> : Alert Heritage Resources Agency and project palaeontologist (if any) who will advise on any necessary mitigation Ensure fossil site remains safeguarded until clearance is given by the Heritage Resources Agency for work to resume	3. If <i>not</i> feasible to leave fossils <i>in situ</i> (emergency procedure only): <i>Carefully</i> remove fossils, as far as possible still enclosed within the original sedimentary matrix (e.g. entire block of fossiliferous rock) Photograph fossils against a plain, level background, with scale Carefully wrap fossils in several layers of newspaper / tissue paper / plastic bags Safeguard fossils together with locality and collection data (including collector and date) in a box in a safe place for examination by a palaeontologist Alert Heritage Resources Agency and project palaeontologist (if any) who will advise on any necessary mitigation
	4. If required by Heritage Resources Agency, ensure that a suitably-qualified specialist palaeontologist is appointed as soon as possible by the developer.	
	5. Implement any further mitigation measures proposed by the palaeontologist and Heritage Resources Agency	
Specialist palaeontologist	Record, describe and judiciously sample fossil remains together with relevant contextual data (stratigraphy / sedimentology / taphonomy). Ensure that fossils are curated in an approved repository (e.g. museum / university / Council for Geoscience collection) together with full collection data. Submit Work Plan and Palaeontological Mitigation report to Heritage Resources Agency. Adhere to best international practice for palaeontological fieldwork and Heritage Resources Agency minimum standards.	

APPENDIX 2

ARCHAEOLOGICAL IMPACT ASSESSMENT (AMENDMENT): PROPOSED URANIUM MINING AND ASSOCIATED INFRASTRUCTURE ON PORTIONS OF THE FARMS QUAGGASFONTEIN AND RYSTKUIL NEAR BEAUFORT WEST IN THE WESTERN CAPE

(Assessment conducted under Section 38 (8) of the
National Heritage Resources Act No 25 of 1999)

Case Number: 15100705WD1009E

Prepared for:

Ferret Mining & Environmental Services (Pty) Ltd



November 2015
Amended July 2017

Prepared by:

Lita Webley & David Halkett
ACO Associates cc
8 Jacobs Ladder
St James

Email: lita.webley@aco-associates.com
Tel: 0217064104
Fax: 0866037195

EXECUTIVE SUMMARY

ACO Associates cc was appointed by Ferret Mining & Environmental Services (Pty) Ltd on behalf of the client, Lukisa, to undertake an Archaeological Impact Assessment for the mining of uranium in a number of mining blocks in the Karoo.

The NID application, submitted on the 09 October 2015, included the Eastern, Central, Western and Southern Blocks in the Karoo.

The NID response, dated 19 October 2015, required the following studies:

- Impacts to Archaeological heritage resources
- Impacts to Palaeontological heritage resources
- Visual impacts of the proposed development
- Impacts to the Built Environment including a detailed site development plan

However, after submission of the NID application, Ferret Mining & Environmental Services (Pty) Ltd indicated that the client was only considering mining certain sections of the Eastern and Central Blocks.

The HIA (with appendices) for Quaggasfontein and Ryst Kuil was submitted to Heritage Western Cape in November 2015, and the FINAL COMMENT was received 16 February 2016. It reads as follows:

“The requirements of S 38(3) have been met. The Committee endorses the recommendations of the consultants in the HIA as follows:

Palaeontology:

- A palaeontologist must show the geologists from the mining company how to recognize fossils and instruct them on the monitoring of excavations for any possible fossil discoveries;
- The Fossil Finds protocol must be implemented, and if any fossils are uncovered, they must be left in place and reported to a recognized South African Palaeontological Research centre, so that they can be excavated with and stored for future research purposes. A Work Plan for this mitigation for this mitigation work must be approved by HWC.

Archaeology:

- Site D009 on Quaggasfontein must be mitigated under a Work Plan approved by HWC before work commences and a report must be submitted to HWC for approval before destruction. A surface collection may be sufficient as there does not appear to be any depth to the site. Mitigation must involve setting up a grid across the site and collecting and recording the archaeological material. Some sieving of sub-surface material may be required¹; and
- If there are any significant changes to the layout of the facilities, the new designs should be assessed by a heritage practitioner and HWC must be informed.
- If any archaeological material or evidence of burials is discovered during earth-moving activities, all work must be stopped immediately and HWC must be notified without delay.

This letter does not exonerate the applicant from obtaining any necessary approval from any other applicable statutory authority. HWC reserves the right to request additional information as required”.

¹ Changes to the layout of the mining block at Quaggasfontein means that this site is no longer threatened by development and these provisions fall away.

Approximately 12 months after receiving the FINAL COMMENT, ACO Associates was asked to assess several changes to the layout of the mining areas on Quaggasfontein and Rystkuil.

Heritage Western Cape was notified of amendments to the layout and they responded with the following interim comment (attached to the HIA) dated 6 July 2017:

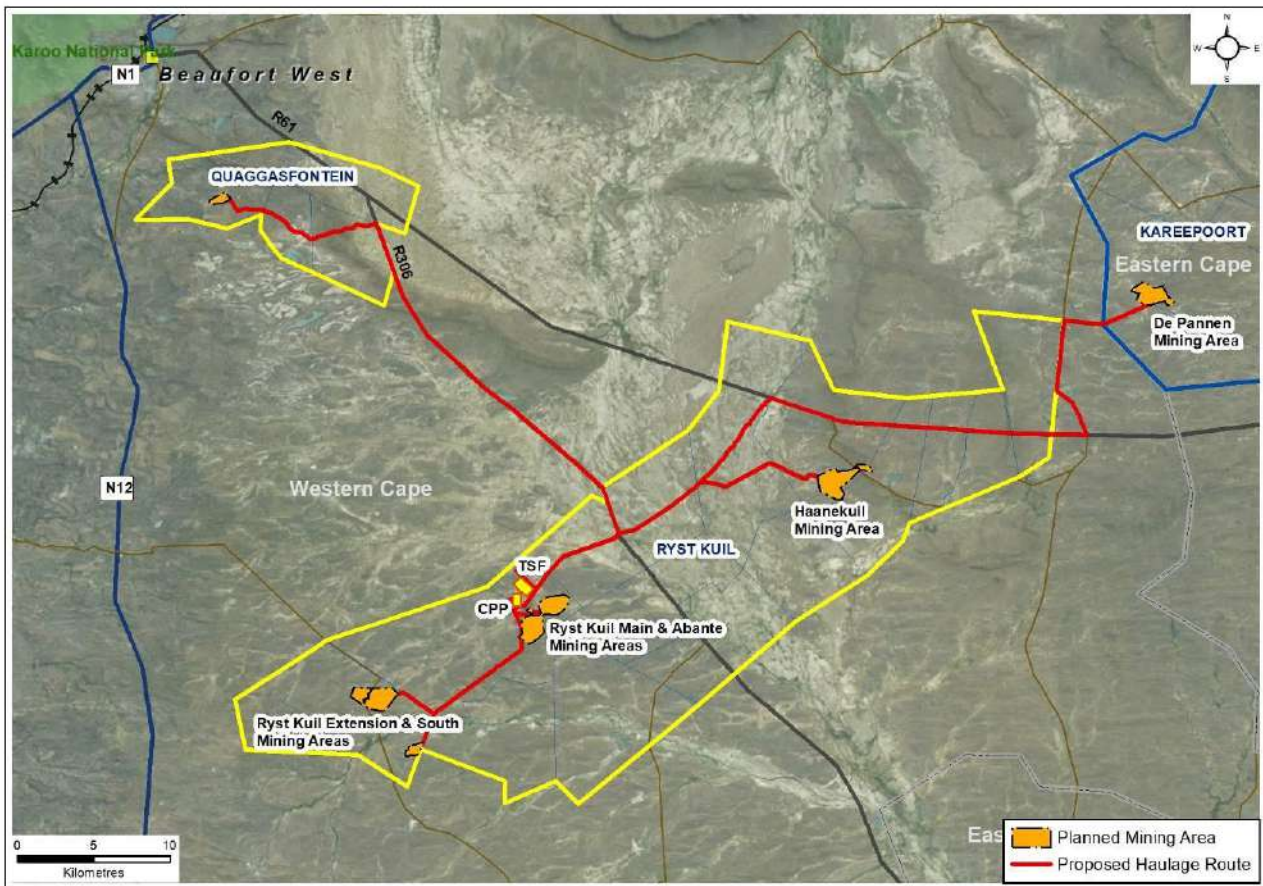
“HWC has previously endorsed the Heritage Impact Assessment prepared by ACO Associates dated November 2015. Since there has been changes to the proposed layout of the facilities, HWC requires an amended HIA to be submitted for assessment.

The revised HIA must satisfy the provisions of Section 38(3) of the NHRA. This HIA must have specific reference to the following:

- Impacts to archaeological heritage resources
- Impacts to palaeontological heritage resources
- Visual impacts of the proposed development
- Impacts to the built environment including a detailed site development plan
- Consultation with the relevant interested and affected parties

The findings of the previous HIA may be used as appendixes to the revised HIA and elaborated upon within the scope of the revised proposal”

This AIA amended submission is only concerned with the following areas indicated in the figure below:



The Mining Blocks include Quaggasfontein and Rystkuil and proposed haulage roads in the Western Cape.

Uranium prospecting and mining has been actively pursued in this area of the Karoo for the last forty years and there is an existing mine on Ryst Kuil Main dating to 1978. The uranium deposits occur in discrete pods or lenses following ancient, meandering river channel courses.

Nature of the Impact

The open cast surface mining will be a standard opencast to a depth of no more than 85 m. The average size of the open pits will be around 200m². Associated with each mining pit is a waste dump height reaching a maximum height of 20m. This assessment is concerned with the open pit mines, stockpiles, the haulage roads and site offices. A single, Central Processing Plant (CCP) and tailing storage facility (TSF) with a maximum height of 25m will be constructed at Ryst Kuil Main, close to the existing mine.

It is important to emphasise, that although the blocks are large, relatively small areas within each block will be mined.

Heritage Resources Identified

This archaeological assessment draws on a number of reports related to uranium prospecting in the area conducted over the last 10 years. In 2008, Dr John Kinahan was approached to undertake an archaeological survey the Ryst Kuil Section as part of a Baseline Assessment; in 2009, David Halkett and Tim Hart of ACO Associates conducted an archaeological survey of the Ryst Kuil Section prior to the initiation of prospecting on the property; in 2010, Lita Webley and Tim Hart of ACO Associates undertook an archaeological assessment of portions of the Quaggasfontein Section prior to prospecting. Fieldwork at Quaggasfontein and Ryst Kuil was undertaken by Webley & Halkett between 20-22 October 2015 and the revised layout was assessed from 27-29 June 2017. This involved walking transects across the areas identified for mining as well as stockpile locations.

- Generally, archaeological material comprised small numbers of ESA artefacts, scatters of MSA and occasional LSA. The majority were manufactured on indurated shales (hornfels) although some artefacts were manufactured from a chert band which crosses Ryst Kuil. Artefact numbers are very low and are of low significance;
- No significant archaeological resources were identified, with the exception of a small ruined stockpost (Site D2017-027) on Haanekuul which has been given a Grade IIIC grading.

Anticipated Impacts on Heritage Resources

- Site D2017_027 may be destroyed with the construction of the haulage road through this area.

Recommendations:

- It is recommended that a small section of the haulage road linking Haanekuul with the main haulage road, should be moved slightly to avoid impact on a ruined stone building at a stockpost (Site D2017-027);
- No impacts are expected to the Ryst Kuil cemetery as the proposed haulage road runs some 100m to the south;
- If any human remains are uncovered during construction, the ECO should have the area fenced off and contact HWC (Tel: 021 483 5959) immediately;
- If there are any significant changes to the layout of the facilities, the new designs should be assessed by a heritage practitioner.

Indications are that in terms of archaeological heritage the proposed activity is viable; impacts are expected to be very limited and controllable.

GLOSSARY

Archaeology: Remains resulting from human activity which is in a state of disuse and are in or on land and which are older than 100 years, including artefacts, human and hominid remains and artificial features and structures.

Early Stone Age: The archaeology of the Stone Age between 700 000 and 2500 000 years ago.

Fossil: Mineralised bones of animals, shellfish, plants and marine animals. A trace fossil is the track or footprint of a fossil animal that is preserved in stone or consolidated sediment.

Heritage: That which is inherited and forms part of the National Estate (Historical places, objects, fossils as defined by the National Heritage Resources Act 25 of 1999).

Heritage Western Cape: The compliance authority which protects national heritage in the Western Cape.

Holocene: The most recent geological time period which commenced 10 000 years ago.

Late Stone Age: The archaeology of the last 20 000 years associated with fully modern people.

Middle Stone Age: The archaeology of the Stone Age between 20-300 000 years ago associated with early modern humans.

National Estate: The collective heritage assets of the Nation

Palaeontology: Any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace.

Pleistocene: A geological time period (of 3 million – 20 000 years ago).

Structure (historic): Any building, works, device or other facility made by people and which is fixed to land, and includes any fixtures, fittings and equipment associated therewith. Protected structures are those which are over 60 years old.

Acronyms

DEA	Department of Environmental Affairs
ESA	Early Stone Age
GPS	Global Positioning System
HIA	Heritage Impact Assessment
LSA	Late Stone Age
MSA	Middle Stone Age
NHRA	National Heritage Resources Act
SAHRA	South African Heritage Resources Agency

1. INTRODUCTION

ACO Associates cc was appointed by Ferret Mining & Environmental Services (Pty) Ltd on behalf of the client, Lukisa, to undertake an Archaeological Impact Assessment for the mining of uranium in the Northern Western and Eastern Cape Provinces (Figure 1). The applications are for consolidated blocks of properties contained in the original prospecting right areas, but clustered according to geographic location in order to simplify the application areas. They are shown in Figure 1 and are situated in different provinces and municipal areas.

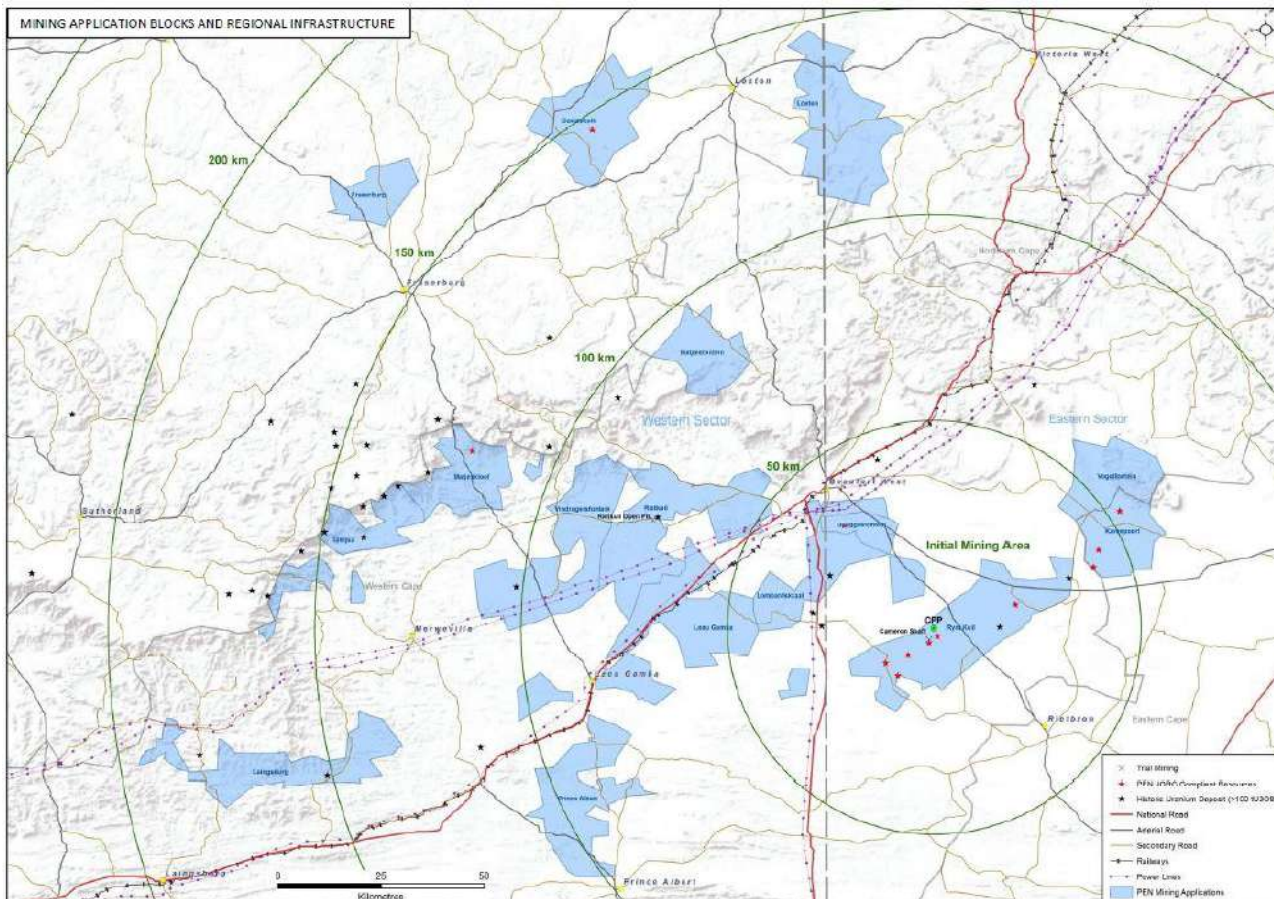


Figure 1: The location of the various mining blocks

The Karoo Mining Infrastructure map demonstrates the phased nature of the project with the construction of the Central Processing Plant (CPP) in the Ryst Kuil block and then production areas brought into active mining from the CPP in concentric circles (Figure 2).

The first 50km circle represents the first 17 years of production (Figure 1). The project is focussed on the Ryst Kuil channel, a mineralised zone extending over 90 km in a NE/SW direction and between 10 km and 40 km wide. It is the largest of the sandstone bodied and contains major clusters of uranium mineralization.

The initial mining area is concerned with those blocks within the central circle, and they include two (2) areas of the Western (Figure 2):

Mining Block	Farm Portions
Quaggasfontein Section of the Central Block (Western Cape)	Oude Volks Kraal 164 Quaggas Fontein 166
Ryst Kuil Section of the Eastern Block (Western Cape)	Haane Kuil 335 Vlak Plaats 350

Eerste Water 349
Farm 351
Kat Doorn Kuil 359
Kant Kraal 360

2. DEVELOPMENT PROPOSALS

Mining Rights applications have been submitted in terms of Section 22 of the Mineral and Petroleum Development Act, 2002 (MPRDA) by Tasman Pacific Minerals Limited (Tasman Pacific) and Lukisa JV Company (Pty) Ltd (Lukisa JVCo) for uranium (U) and molybdenum (Mo) mining in the Karoo (Figure 1).

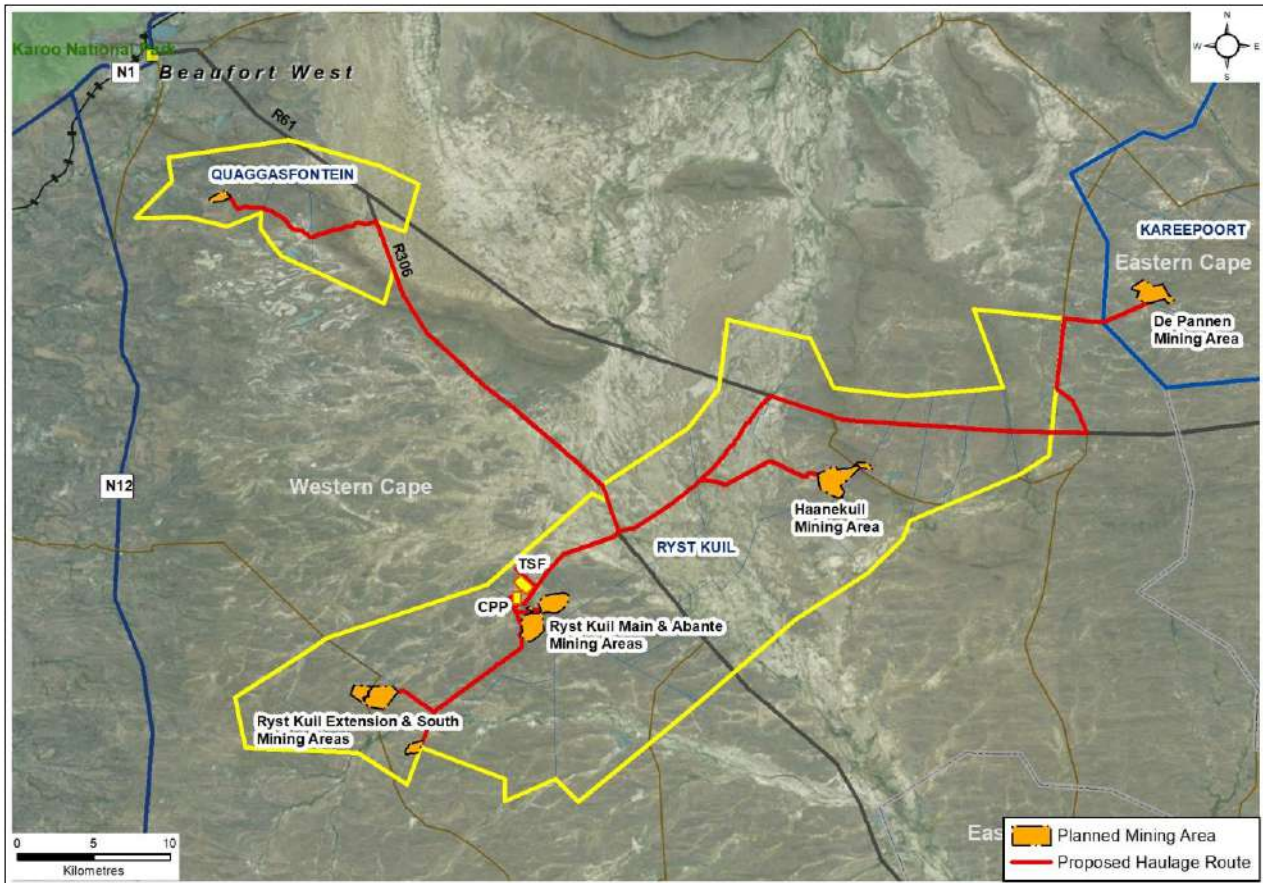


Figure 2: The location of the Ryst Kuil Section of the Eastern Block and the Quaggasfontein Section of the Central Block which will be mined during the next 17 years and form the focus of this AIA. Farms are outlined in yellow, and the haulage roads are shown in red.

Traces of uranium occur throughout the Karoo Supergroup. Historically, uranium mineralisation in the Karoo Basin was first detected in the late 1960s. Subsequently, several international companies began showing interest in the Karoo sequences. Drilling has taken place on the farm Ryst Kuil since the 1970s (Figure 2). As a result of increases in the uranium price over the past few years, a new era of uranium prospecting is currently taking place in the southern Karoo.

The uranium deposits occur in discrete pods or lenses within sandstone units. Many of these lenses tend to follow mineralized trends which coincide with the elongate direction of palaeo-flow direction of the ancient, meandering river channel courses. These "Mineralisation" areas and the "Palaeo channels" indicated in the attached maps follow this elongate pattern but do not need to be assessed. The assessments are concerned with the open pit mines, the roads and site offices.

The product will be mined using the surface (open pit) mining method. The open cast surface mining will be a standard opencast to a depth of no more than 85 m. The mine pits vary in size but are on average approximately 200m². The mining method will be traditional drill, blast, load and haul using trucks to deliver the material to the processing plant. The topsoil will be removed and stored. There will be a waste stockpile, ore stockpiles, slimes dam, access roads and Eskom powerlines. The waste dump heights will reach a maximum height of 20m. A single, CPP and a TSF with a height of 25m will be constructed at Ryst Kuil Main, close to the existing mine (Figure 5). The main product will be road freighted to Beaufort West and then railed to Cape Town.

It is important to emphasise, that although the blocks are large, relatively small areas within each block will be mined.

The following areas within each block will be impacted and are subject to assessment:

2.1 Quaggasfontein

The areas encircled in black is part of the infrastructure which was assessed in 2015, while the areas in royal blue represent new infrastructure assessed in 2017. Magenta tracks relate to our survey in 2009; Green tracks relate to the 2015 survey and yellow tracks to the 2017 survey.

The GPS tracks in Figure 3 show that the area was fairly comprehensively assessed for archaeological material and that we are therefore confident of our assessment.

2.2 Ryst Kuil

The Ryst Kuil Block includes Haanekuil to the north (Figure 4) and Ryst Kuil Main and Ryst Kuil Abante in the centre, Ryst Kuil South and Ryst Kuil Extension toward the southern end (Figure 5).

The areas encircled in black is part of the infrastructure which was assessed in 2015, while the areas in royal blue represent new infrastructure assessed in 2017. Magenta tracks relate to our survey in 2009; Green tracks relate to the 2015 survey and yellow tracks to the 2017 survey. The turquoise line represents the preferred route of the new haulage road which will run predominantly along existing fence lines.

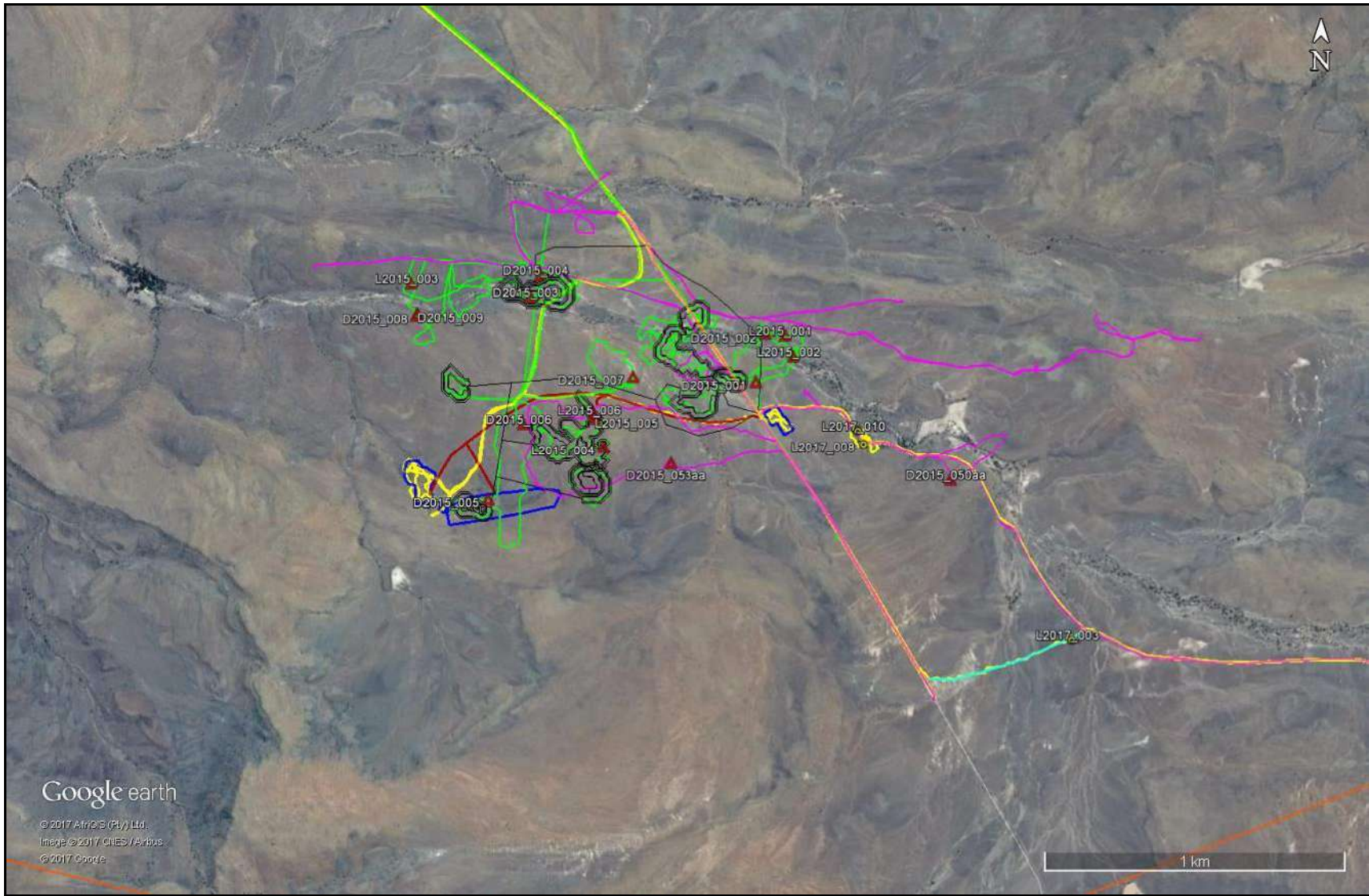


Figure 3: The extent of mining and mining related infrastructure on Quaggasfontein, Central Block.

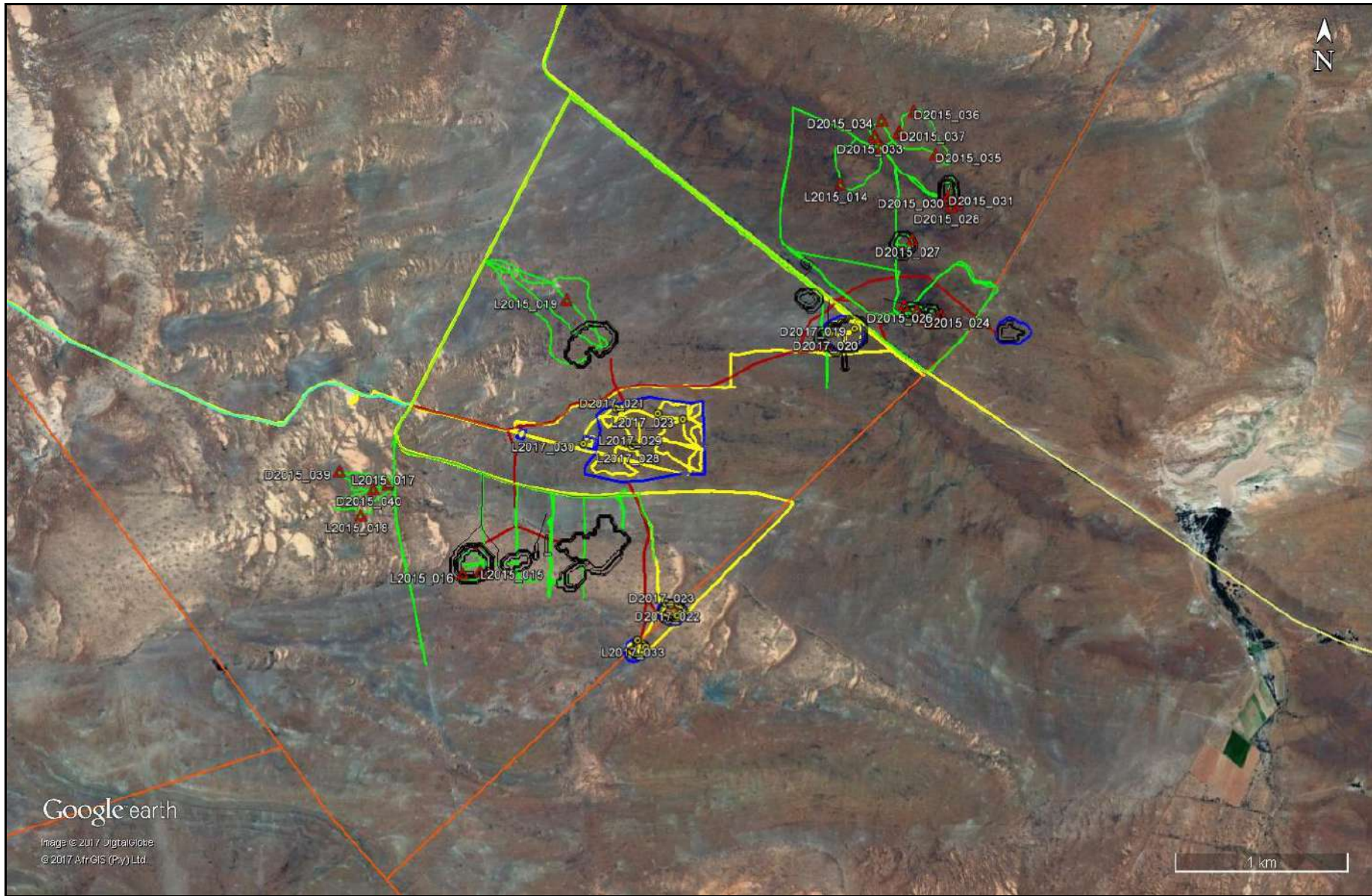


Figure 4: The Haanekuil area on the northern edge of the Ryst Kuil Block. Areas outlined in blue represent new infrastructure.

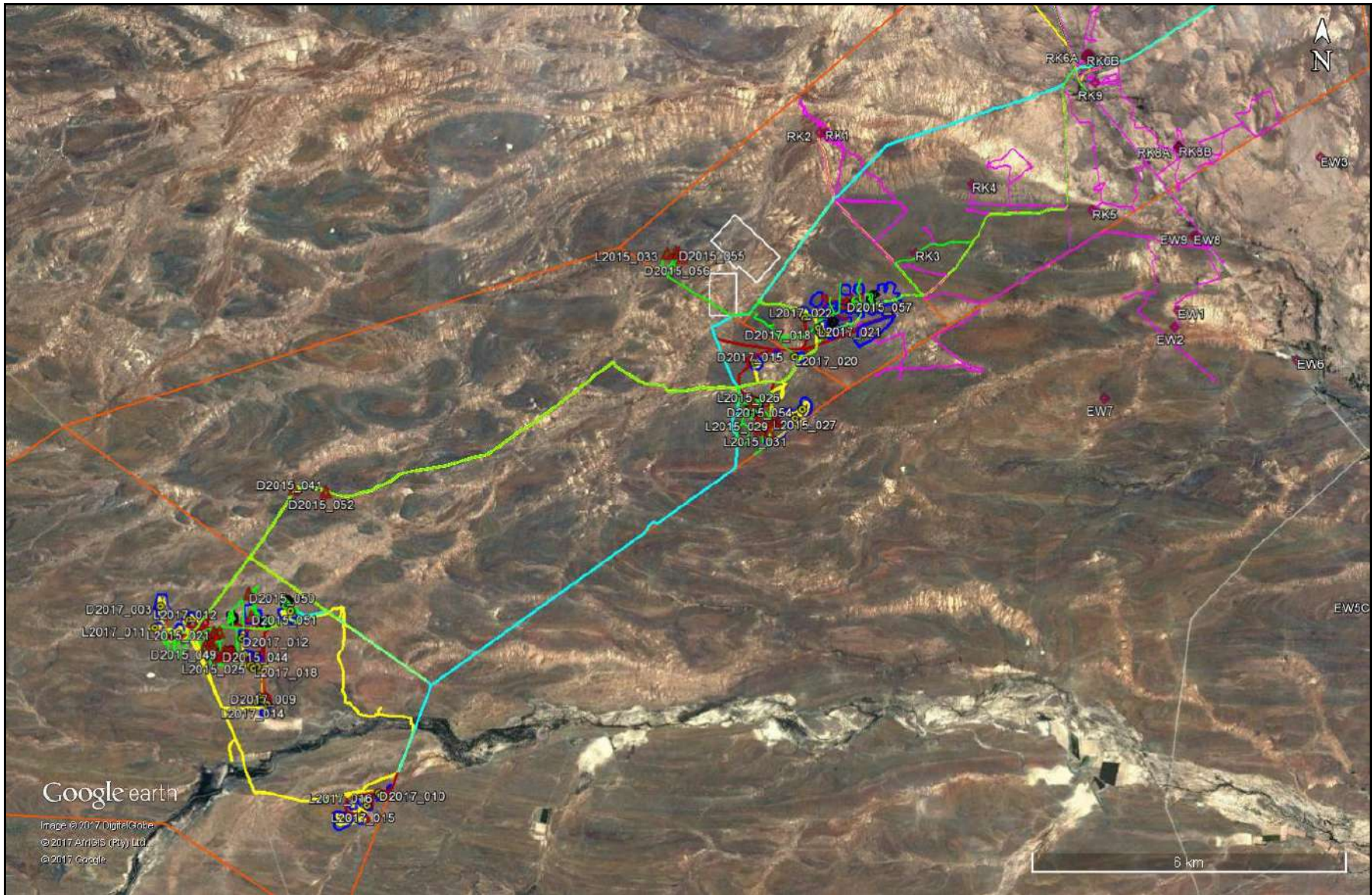


Figure 5: The Ryst Kuil areas (Main and Abante in the centre of the map and South and Extension to the south west). The turquoise lines indicate preferred haulage routes.

3. HERITAGE LEGISLATION

This report is conducted in terms of Section 38 (8) of the National Heritage Resources Act, No 25 of 1999.

The NHRA provides protection for the following categories of heritage resources:

- Landscapes, cultural or natural (Section 3 (3))
- Buildings or structures older than 60 years (Section 34);
- Archaeological Sites, palaeontological material and meteorites (Section 35);
- Burial grounds and graves (Section 36);
- Public monuments and memorials (Section 37);
- Living heritage (defined in the Act as including cultural tradition, oral history, performance, ritual, popular memory, skills and techniques, indigenous knowledge systems and the holistic approach to nature, society and social relationships) (Section 2 (d) (xxi)).

3.1 Structures (Section 34(1))

No person may alter or demolish any structure part of a structure which is older than 60 years without a permit issued by Heritage Western Cape (HWC), the responsible provincial heritage resources authority.

3.2 Archaeology & Palaeontology (Section 35(4))

No person may, without a permit issued by HWC, destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite.

Archaeological is defined as: “material remains resulting from human activity which is in a state of disuse and is in or on land and which is older than 100 years, including artefacts, human and hominid remains and artificial features and structures”.

Palaeontological is defined as: “any fossilised remains or fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace”.

3.3 Burial grounds and graves (Section 36(3))

No person may, without a permit issued by the South African Heritage Resources Authority (SAHRA), destroy, damage, alter, exhume or remove from its original position or otherwise disturb any grave or burial ground older than 60 years, which is situated outside a formal cemetery administered by a local authority.

3.4 Grading

The South African heritage resources management system is based on grading, which provides for assigning the appropriate level of management responsibility to a heritage resource.

Table 1: Grading of Heritage Resources

Grade	Level of significance	Description
I	National	Of high intrinsic, associational and contextual heritage value within a national context, i.e. formally declared or potential Grade 1

		heritage resources.
II	Provincial	Of high intrinsic, associational and contextual heritage value within a provincial context, i.e. formally declared or potential Grade 2 heritage resources.
IIIA	Local	Of high intrinsic, associational and contextual heritage value within a local context, i.e. formally declared or potential Grade 3a heritage resources.
IIIB	Local	Of moderate to high intrinsic, associational and contextual value within a local context, i.e. potential Grade 3b heritage resources.
IIIC	Local	Of medium to low intrinsic, associational or contextual heritage value within a national, provincial and local context, i.e. potential Grade 3c heritage resources.

The grading of heritage sites, as prescribed in the NHRA, is only concerned with categories I, II and III. The subdivision of Grade III sites was introduced in the Western Cape and is used in this report.

Quaggasfontein (Central Block) and Ryst Kuil (Eastern Block) falls in the Western Cape and the responsible provincial heritage resources authority is Heritage Western Cape.

A Notice of Intent to Develop (NID) was submitted to Heritage Western Cape, **on the 09 October 2015. The NID also included the Eastern, Central, Western and Southern Blocks in the Karoo.**

The NID response, dated 19th October 2015, required the following studies:

- Impacts to archaeological heritage resources
- Impacts to palaeontological heritage resources
- Visual impacts of the proposed development
- Impacts to the built environment including a detailed site development plan

However, after submission of the NID application, Ferret Mining & Environmental Services (Pty) Ltd indicated that the client was initially only considering mining certain sections of the Eastern and Central Blocks (Figure 2).

The HIA (with appendices) for Quaggasfontein and Ryst Kuil was submitted to Heritage Western Cape in November 2015, and the FINAL COMMENT was received 16 February 2016. It reads as follows:

“The requirements of S 38(3) have been met. The Committee endorses the recommendations of the consultants in the HIA as follows:

Palaeontology:

- A palaeontologist must show the geologists from the mining company how to recognize fossils and instruct them on the monitoring of excavations for any possible fossil discoveries;
- The Fossil Finds protocol must be implemented, and if any fossils are uncovered, they must be left in place and reported to a recognized South African Palaeontological Research centre, so that they can be excavated with and stored for future research purposes. A Work Plan for this mitigation for this mitigation work must be approved by HWC.

Archaeology:

- Site D009 on Quaggasfontein must be mitigated under a Work Plan approved by HWC before work commences and a report must be submitted to HWC for approval before destruction. A surface collection may be sufficient as there does not appear to be any depth to the site. Mitigation must involve setting up a grid across the site and collecting and

- recording the archaeological material. Some sieving of sub-surface material may be required; and
- If there are any significant changes to the layout of the facilities, the new designs should be assessed by a heritage practitioner and HWC must be informed.
 - If any archaeological material or evidence of burials is discovered during earth-moving activities, all work must be stopped immediately and HWC must be notified without delay.

This letter does not exonerate the applicant from obtaining any necessary approval from any other applicable statutory authority. HWC reserves the right to request additional information as required”.

Approximately 12 months after receiving the FINAL COMMENT, ACO Associates was asked to assess several changes to the layout of the mining areas on Quaggasfontein and Rystkuil.

Heritage Western Cape was notified of amendments to the layout and they responded with the following interim comment (attached to the HIA) dated 6 July 2017:

“HWC has previously endorsed the Heritage Impact Assessment prepared by ACO Associates dated November 2015. Since there has been changes to the proposed layout of the facilities, HWC requires an amended HIA to be submitted for assessment.

The revised HIA must satisfy the provisions of Section 38(3) of the NHRA. This HIA must have specific reference to the following:

- Impacts to archaeological heritage resources
- Impacts to palaeontological heritage resources
- Visual impacts of the proposed development
- Impacts to the built environment including a detailed site development plan
- Consultation with the relevant interested and affected parties

The findings of the previous HIA may be used as appendixes to the revised HIA and elaborated upon within the scope of the revised proposal”

4. METHODOLOGY

4.1 Background Literature study

Numerous impact assessments have been conducted in proximity to the proposed facility as reflected on the SAHRIS database. Most recently, after completion of the first draft (2015) of this AIA report, Orton et al. (2016) produced a review of the archaeological heritage of the Karoo as part of a Shale Gas Assessment.

This archaeological assessment also draws on a number of reports related to uranium prospecting in the area conducted over the last 10 years. In 2008, Dr John Kinahan was approached to undertake an archaeological survey of the Ryst Kuil Section as part of a Baseline Assessment; in 2009, David Halkett and Tim Hart of ACO Associates conducted an archaeological survey of the Ryst Kuil Section prior to the initiation of prospecting on the property. In 2010, Lita Webley and Tim Hart of ACO Associates undertook an archaeological assessment of portions of the Quaggasfontein Section prior to prospecting. While the Kinahan (2008) report is available on SAHRIS, none of the other reports have been submitted to heritage authorities for comment.

Reports available for this assessment include:

- An assessment of the Ryst Kuil Section of the Eastern Block by Kinahan (2008) which was included in the Environmental and Social Baseline report (Targus Mining Consultants 2008);
- An Archaeological Assessment of Uranium prospecting on Portions of the Farms Eerste Water 349 and Ryst Kuil 351 (Halkett 2009) on the Ryst Kuil Section;
- An Archaeological Assessment of Uranium Prospecting on Quaggasfontein 166 and Oude Volks Kraal 164 (Webley & Hart 2010) in the Quaggasfontein Section;
- A Heritage Impact Assessment conducted by Orton (2011) on Portion 1 of the farm Steenrots Fontein 168 for a proposed photo-voltaic facility, near Quaggasfontein;
- The Aberdeen – Droerivier 400 kV powerline (Hart & Schietecatte 2012) which will cross over the De Pannen (Kareepoort) and Quaggasfontein.

Background research included a review of the published material as well as unpublished reports on the SAHRIS database. The 1:50 000 maps of the area as well as Google Earth aerial images were consulted.

4.2 Field Survey

The polygon of the proposed development was provided to ACO Associates. The area was surveyed by Lita Webley and David Halkett on 20-22 October 2015; while changes to the layout were assessed during 27-29 June 2017.

Our tracks were recorded by means of Garmin GPS devices and all sites were digitally recorded.

We accessed the area by the local farm roads and drove along sections of the access roads where this was possible. We walked transects across the proposed mining pits, stockpile areas and haulage roads looking for archaeological remains.

4.3 Assumptions and Limitations

Visibility was good due to sparse vegetation in the study area. We were able to cover most of the study area satisfactorily.

A limitation was that not all of the revised layout could be assessed in the time available

However, we are of the opinion that this is not a significant limitation, as we have discussed further below and in the amended HIA.

5. RECEIVING ENVIRONMENT

The mountains and kopjes between Beaufort West and Aberdeen are comprised of horizontally bedded, fossiliferous shales and mudstones of the Beaufort Series in the Karoo system. They are intersected at numerous locations by dolerite dykes and sills that are more resistant to erosion than the surrounding sedimentary rocks. While small overhangs do occur under the lintels of these siltstone caps, they are very rare. San (Bushmen) rock paintings may occur in shelters, but they are very scarce.

The dykes and sills have baked the surrounding shales resulting in patches of high quality hornfels. Hornfels (also known as indurated shales) are an attractive rock for stone tool makers because it flakes predictably and produces sharp edges. The igneous rocks erode into rounded spherical boulders which the San used for rock engravings. Ridges and lines of rocky hills strewn with these boulders are a characteristic feature of the Karoo. In addition, the dykes have the effect of damming up small streams resulting in small springs which often generate pans of seasonal water – another feature of the landscape which attracted pre-colonial settlement.

5.1 Quaggasfontein



Plate 1: View of the landscape around Quaggasfontein with the Nuweveldberge in the background.



Plates 2 & 3: The study area is bisected by a shallow stream which becomes more incised towards the north-west, forming a small kloof.

5.2 Ryst Kuil

The Ryst Kuil Block (Figure 4) comprises the 3 portions known as Haanekuil, Ryst Kuil Main and Ryst Kuil Extension.



Plate 4: The view of the landscape at Ryst Kuil Extension showing good visibility. There is very little change to the contours, with the area uniformly flat.



Plates 5 & 6: The existing mining infrastructure on Ryst Kuil Main dates to 1978.



Plate 7: The many prospecting holes on the landscape; **Plate 8:** The sheets of rock on Haanekuil.

5.3 Archaeological Background

Because of the scarcity of caves and shelters in the Karoo, more than 90% of archaeological sites are open sites. They are, as Orton et al. (2016) point out, generally concentrated near permanent sources of water. The artefacts are generally not in primary location and organic remains are rarely preserved. This limits their information value and therefore their significance.

Early and Middle Stone Age

Isolated Early Stone Age artefacts, including occasional handaxes have been reported from the Beaufort West area but are generally quite ephemeral. Kinahan (2008) noted with respect the archaeology of Ryst Kuil, a total of only seven (7) ESA sites, with isolated finds of quartzite artefacts and he commented “none of the ESA material was considered to be in primary context and therefore of little research value”. The earlier Pleistocene assemblages are primarily made on coarse-grained quartzites.

Middle Stone Age artefacts are widespread, occurring in isolated as well as relatively dense concentrations over large areas. They do not occur with any associated organic remains. They have been reported by the Kinahan (Turgis Baseline Report 2008) who noted that 126 or 50% of the total sites he recorded were Middle Stone Age but that they “probably formed part of a continuous surface scatter almost without focal points”. He noted that the MSA artefacts were dominated by quartzite and hornfels. He also notes, interestingly: “There was some evidence of Levallois core production and *examples of Howieson’s poort segments and allied forms were found at a number of sites*” (Turgis Baseline Report 2008: 225).

This reference to the Howieson’s Poort in this particular context, is highly significant. The Howieson’s Poort is a name given to a particular expression (or subdivision) of the Middle Stone Age dating to between 80 000 and 60 000 years ago and characterised by backed tools including segments often on fine-grained raw material. Recognized mainly from cave sites along the coastal margins of South Africa, it has not been recorded from open sites in the interior of South Africa. However, despite a fairly intensive field assessment of the area, we did not recognize any Howieson’s Poort material during our survey.

Halkett (2009) and Webley & Hart (2010) support Kinahan’s observations on the widespread distribution of MSA material in the Ryst Kuil and Quaggasfontein blocks.

Late Stone Age

While ESA and MSA stone artefacts are ubiquitous, LSA artefacts are scarcer. They tend to be manufactured on hornfels, but of interest is a patchy occurrence of a chert horizon that forms a capping on some low hills. Halkett (2009) noted that LSA material was located close to dry river courses, typically marked by dense acacia growth. The pre-colonial inhabitants were probably restrained by the need for water and shelter, of which the latter is almost completely absent and acacia stands are the only possibility of respite from wind and sun.

Kinahan (2008) reported on a more focused distribution of LSA sites (97 sites) across the entire Ryst Kuil property. This is supported by Halkett (2009) who found LSA sites along dry river beds. The LSA included a number of suspected hut circles and short lengths of stone walling as well as possible burial cairns. The hut circles/stone kraals have been interpreted to represent pre-colonial pastoralist groups. Kinahan also observed that the occurrence of a minor chert horizon on the Ryst Kuil property provided a raw material of high quality for stone artefact manufacture.

Rock engravings, on dolerite boulders, may occur throughout the mining area although none were recorded by Kinahan (2008) or Halkett (2009).

6. FINDINGS

In general, artefact distributions were low and very few discrete “sites” were identified. Our survey tracks and recorded sites are reflected in Figures 3, 4 and 5.

6.1 Quaggasfontein Section of the Central Block

The proposed mining and related infrastructure consists of at least nine (previously five) open cast mine pits (indicated as irregular shapes) and five stockpile areas with an associated haulage road which links to the Central Processing Plant on Ryst Kuil (Figure 2). The total foot print is 1.7km by 1.1km in size and the maximum size of the mining pits will be 400m². Stockpile areas range between 200m² and 400m².

The archaeology of the area is characterised by isolated scatters of Middle Stone Age flakes and cores on weathered hornfels/chert (Table 2). There are also some unpatinated hornfels flakes which may indicate Later Stone Age occupation but they generally have no distinctive characteristics.

The only significant site identified during our 2015 survey on Quaggasfontein was the LSA site (D009) on the banks of a small stream. It was situated on the boundary of an area set aside for a stockpile. However, the position of the stock pile was subsequently changed in 2017, and the site is no longer threatened by mining.

6.2 Ryst Kuil (Haanekuil)

The Ryst Kuil Block (Figure 4) comprises the five portions termed as **Haanekuil**, **Ryst Kuil Main** and **Ryst Kuil Abante**, as well as **Ryst Kuil Extension** and **Ryst Kuil South**. These areas are discussed separately, from north to south.

The mining block Haanekuil is about 4 km x 6 km in size and consists of about 10 open pits of varying size, the largest being 400m x 200m while the smallest are 150m x 100m. There will be three stockpile areas with the largest, 900m x 500m. The mining area will be connected to the CCP at Ryst Kuil Main via a haulage road.

It is important to emphasise that many of the “sites” (red triangles) reflected in Figure 7 above, consist of a single flake or core (see Table 2). There are very few discrete archaeological sites with more than 3 artefacts. The archaeology consists of ephemeral scatters of hornfels flakes, some clearly LSA but others difficult to ascribe to any time period. There is a single MSA snapped blade on very weathered hornfels. Artefact densities are low and of very low significance.



Plate 9: An isolated large, chert core

6.3 Ryst Kuil Main and Ryst Kuil Abante

Ryst Kuil Main has been the focus of mining activities since the 1970s. There is an existing underground mine (Plates 5 & 6) and associated infrastructure within the area. The large rectangles (900m x 600m) to the north-west in Figure 8, represents the proposed slimes dam, the new plant position, the ore and waste stockpiles. We were unable to assess these areas because we did not have their positions prior to fieldwork. Each of the four mine pits (the circular shapes in Figure 8) are about 200m in diameter and three of the mines are associated with a stockpile (the rectangular shape) which measures 1km x 200m.

Coverage of the area by Kinahan (2008), Halkett & Hart (2009) and Webley & Halkett (2015), while not comprehensive, has been sufficiently extensive to assess the archaeological potential in the proposed mining areas (Figure 5). There is some evidence for recent mining activities nearby, with occasional glass bottles, tin cans etc found in the veld.

For example, the material illustrated in Plate 10 consists of a roughly circular collection of cobbles, some flaked artefacts and the handle of a pocket knife – suggesting that this may represent a recent campsite.



Plate 10: Site 029 is a roughly circular pile of stones, associated with a pocket knife handle and some nearby hornfels flakes.

6.4 Ryst Kuil Extension

Ryst Kuil Extension is located in the southern portion of the mining area (Figure 5) on portions of the farm Kant Kraal 360. The mining polygon is 2 km x 1 km in size and comprises 4 mine pits (each around 200m in diameter) and 3 stockpile areas vary in size but are around 800m x 200m each

There is a widespread ‘presence’ of stone artefacts, both MSA and LSA in the Ryst Kuil Extension, in the south of the Block (Figure 4). Site L021 consists of a small pan with a scatter of hornfels flakes, there does not appear to be any retouch on any of the artefacts. Site L023 comprises a very weathered (MSA?) collection of cores and flakes, also on a small pan. In addition to the hornfels, there are numerous chert nodules which have been weathered red on the outside, they too have been utilised for stone artefacts.



Plates 11 & 12: Site L021 (left) and L)23 (right) represent two types of stone artefact scatters on Ryst Kuil Extension.

Kinahan (2008) reported on a site QRS88/34 in his report that was close to the originally proposed haulage route between Ryst Kuil Extension and Ryst Kuil Main. The site was revisited in 2015 and is recorded as D054. It comprises two semi-circular stone foundations and probably represents a late 19th century or early 20th century stockpost. The nearby midden includes burnt bone, ostrich eggshell fragment, some refined earthen ware (including some transferware Willow Pattern) and spongeware designs, tin cans, glass and one patinated MSA blade with retouch. The site will not be impacted under the current layout.



Plates 13 & 14: Site QRS88/34 or D054 is the remains of a small stockpost first recorded by Kinahan (2008).

6.5 Haulage Roads

Three alternative options have been proposed for the haulage route which connects the various mining blocks to the R61 and R332. The preferred route, the turquoise route in Figures 3, 4 & 5, runs from the R61 in a south-westerly direction to Ryst Kuil Extension, with connections to Haanekuil and Quaggasfontein.



Figure 6: The preferred haulage road option to the R61 and R332.

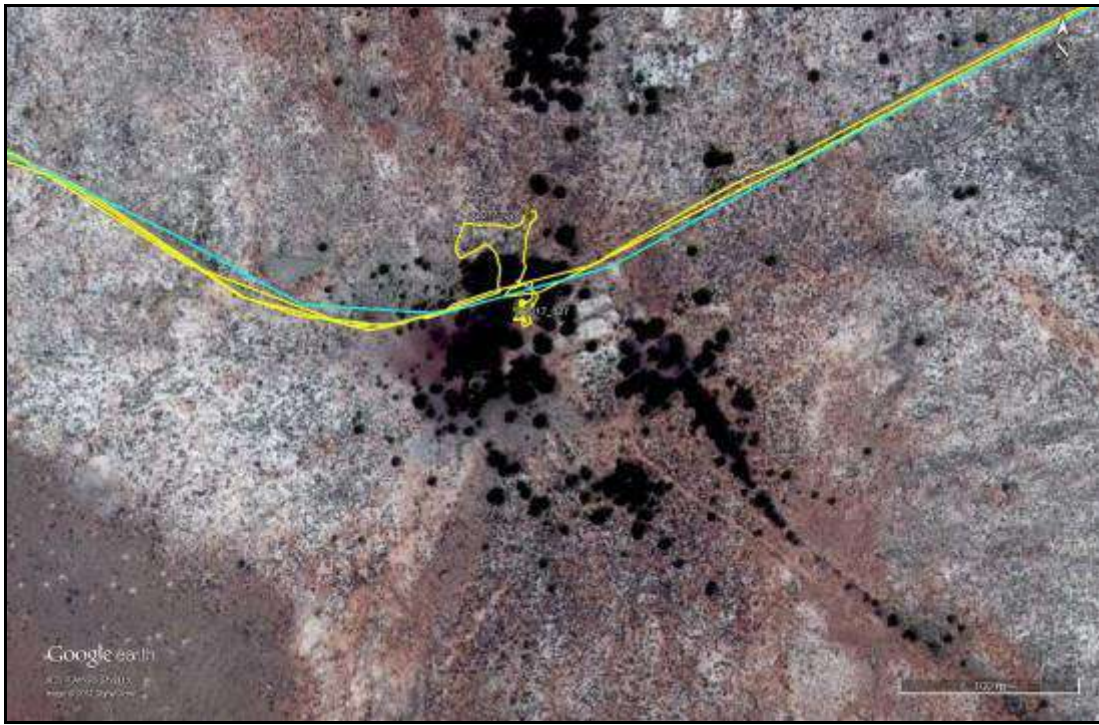


Figure 7: The haulage road to Haanekuul runs through a small stand of acacia trees on Farm 394 close to a small stockpost within which is found the ruins of a small stone vernacular structure (D027).

The haulage road from Haanekuul connects to the main haulage road between Ryst Kuil and the R61. The ruins of a small vernacular structure with stone foundation (Plate 15) are found at an existing stock post (acacia trees and windmill) on the branch haul road to the Haanekuul mining area. The stone building appears to be a dwelling but there are very few associated artefacts to give a sense of age.



Plate 15: The ruins of a small stone building in a copse of trees, near the haulage road (D027).

Minor amendment of the route is suggested to avoid impacts to the stockpost. This can be easily achieved by moving the section of road going through the trees slightly north of the proposed alignment there.

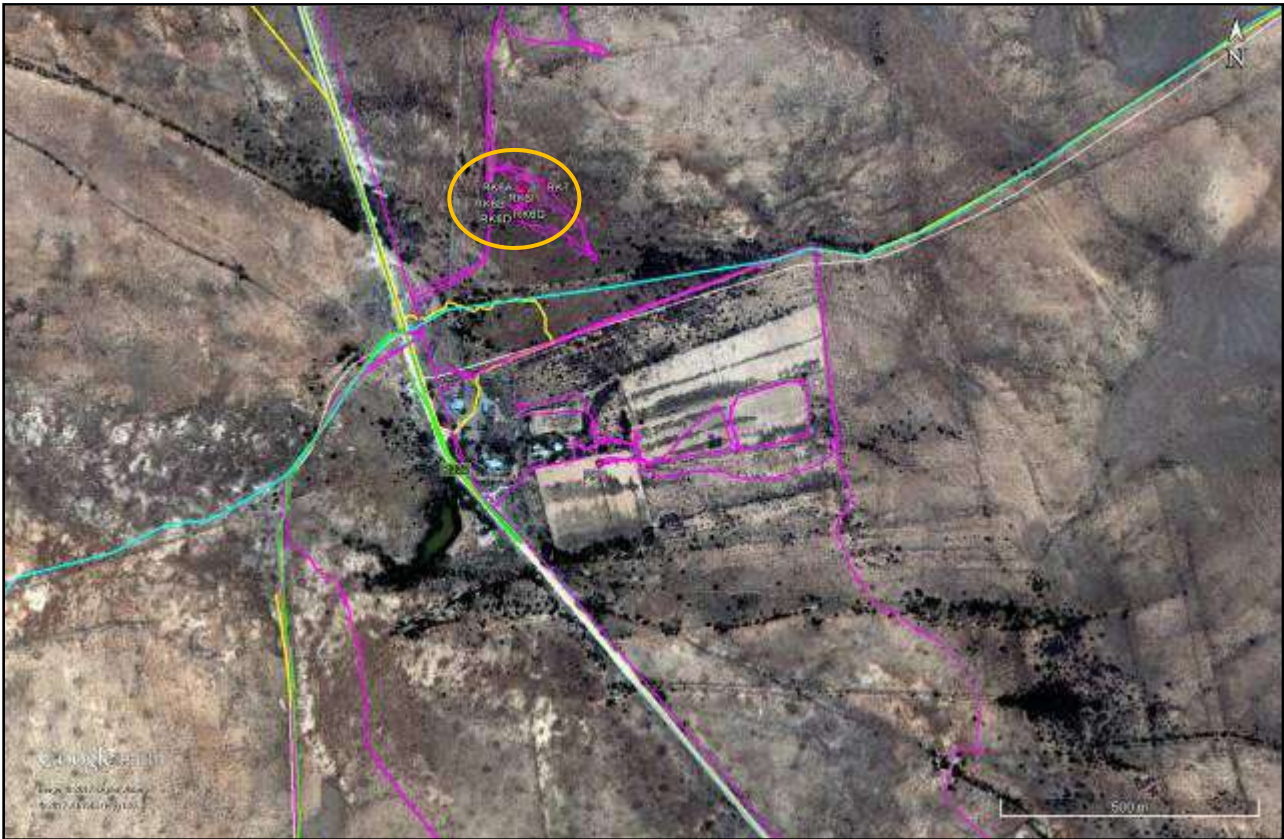


Figure 8: The preferred haulage road alternative (turquoise) situated between the Ryst Kuil farmhouse and the farm cemetery (outlined in orange) crosses the R332 here en route to the processing plant at RK Main.

The cemetery on Ryst Kuil was first reported by Halkett when he surveyed the property prior to uranium prospecting in 2009.



Plate 16: The relatively extensive farm cemetery near the Ryst Kuil farm werf. One grave is fenced (r) while another formal tomb made from stone slabs (flagged) appears older, possibly 19th Century. Several less formal stone covered earth mounds mark what are probably farm workers graves.

The 2009 Halkett report is attached to this report as an appendix. He describes the cemetery thus:

“A substantial cemetery some 450 m to the north east of the Ryst Kuil farmhouse. Mostly farm workers graves with simple stone covered earth mounds, some with head and foot stones. One of these had a collapsed stone headstone “Hendrik Conradie ...died 1998.....”. Two formal graves, one elaborate, built with stone slabs projecting above ground (no inscription) looks old, the other

fenced with headstone (inscription broken away and disintegrated). We estimate there to be ±40 graves. One or two have been dug open by aardvarks”.

There is no immediate threat to the cemetery, as the proposed haulage road runs some 100m from the outer edge.

7. IMPACT ASSESSMENT

Since archaeological sites, are non-renewable, it is important that they are identified and their significance assessed prior to development.

The main cause of impacts to archaeological sites is direct, physical disturbance of the material itself and its context. The significance of an archaeological site is highly dependent on its geological and spatial context. This means that even though, for example a deep excavation may expose buried archaeological sites and artefacts, the artefacts are relatively meaningless once removed from the area in which they were found. The impacts are likely to be most severe during the construction period although indirect impacts may occur during the operational phase of the project.

The excavation of open pit mines may result in the destruction of surface and sub-surface archaeological material, while the stockpiling of ore on the soil surface adjacent to the mine pits may cover any surface archaeological material. The removal of the stock pile may result in direct or indirect damage to the surface archaeological material although sub-surface archaeological material will remain unaffected. Damage can also result to archaeological material through the construction of the central processing plant and slimes dam at Ryst Kuil Main.

7.1 Pre-colonial Archaeology

However, our survey confirmed the findings of Kinahan (2008) and Halkett & Hart (2009) who have already undertaken extensive surveys in the Ryst Kuil area. Archaeological material is predominantly present in the form of isolated flakes and cores, which are difficult to ascribe to a particular time period and which do not occur in sufficient quantities to be termed a “site” (Tables 2 & 3). There are ephemeral traces of ESA material in the form of large, patinated cores but no distinctive bifacial artefacts were recorded. The ESA is of very low significance.

There are low density scatters of MSA material in the areas. Some of these scatters occur in association with a chert band which may have provided the raw material for stone tool production. The MSA artefacts are not distinctive. There are very few blades present and no evidence of the “Howiesons Poort” artefacts recorded by Kinahan (2008). The MSA material is considered to be of low significance.

There are a few scatters of LSA material in all three mining areas, generally on hornfels but also occasionally on chert and quartz.

7.2 Colonial Period Archaeology

Kinahan (2008) recorded a number of late 19th/early 20th century stockposts and stone kraal features during his survey of Ryst Kraal. One site in particular, QRS88/34 or D052, on the farm road between Ryst Kuil Main and Ryst Kuil extension, was re-visited to assess its significance. The site has been given a Graded IIIC. It does not appear to contain any Later Stone Age contact material (indicating early contact) and is of low significance. This site will not be impacted by mining (or the construction of the haulage road) as an alternative route will be used.

Table 4: Potential impact to Archaeology at Quaggasfontein

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without Mitigation	1 Local	1 Local	3 Irreversible	5 Low	Improbable	Very Low	Negative	High
Essential Mitigation Measures: <ul style="list-style-type: none"> If any significant concentrations of archaeological material area uncovered, then work in that area should stop, and Heritage Western Cape (Telephone: 021 483 5959) should be contacted. Best Practice Mitigation Measures: <ul style="list-style-type: none"> Archaeological remains are best left <i>in situ</i>, and conserved for the future. If this is not possible then mitigation in the form of excavation with a permit will be required. 								
With mitigation	1 Low	1 Low	3 Irreversible	5 Low	Improbable	Very Low	Neutral	High

Table 5: Potential Impacts to Archaeology at Ryst Kuil

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without Mitigation	1 Local	1 High	3 Irreversible	5 Low	Probable	Low	Negative	High
Essential Mitigation Measures: <ul style="list-style-type: none"> If any significant concentrations of archaeological material area uncovered, then work in that area should stop, and Heritage Western Cape (Telephone: 021 483 5959) should be contacted. Best Practice Mitigation Measures: <ul style="list-style-type: none"> Archaeological remains are best left <i>in situ</i>, and conserved for the future. If this is not possible then mitigation in the form of excavation with a permit will be required. 								
With mitigation	1 Low	1 Low	3 Irreversible	5 Low	Improbable	High	Neutral	High

7.3 Impacts from Powerline and Haulage Roads

Potential impacts caused by the construction of haulage roads were assessed where access was possible.

Table 6: Potential impacts to archaeology along the haul roads

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without Mitigation	1 Local	1 High	3 Irreversible	5 Low	Probable	Medium	Negative	High
Essential Mitigation Measures: <ul style="list-style-type: none"> Avoid impacts to the stone stockpost along the haul road on Farm 394 (Site D027); If any significant concentrations of archaeological material area uncovered, then work in that area should stop, and Heritage Western Cape (Telephone: 021 483 5959) should be contacted. Best Practice Mitigation Measures: <ul style="list-style-type: none"> Archaeological remains are best left <i>in situ</i>, and conserved for the future. If this is not possible then mitigation in the form of excavation with a permit will be required. 								

8. MITIGATION

It is recommended that a small section of the haul road connecting the mining area at Haanekuil to the main haulage route, where it is close to the site D027 should be moved slightly north by approximately 50 meters) at that point, to avoid negative impacts. The haulage road is unlikely to impact on the cemetery at Ryst Kuil farmhouse and no mitigation is required.

9. CONCLUSION

Archaeological field assessments were conducted in the mining blocks of Quaggasfontein and Ryst Kuil. This involved walking transects across the areas identified for mining as well as stockpile locations.

Generally, archaeological material comprised small numbers of ESA artefacts, scatters of MSA and occasional LSA. The majority were manufactured on indurated shales (hornfels) although some artefacts were manufactured from a chert band which crosses Ryst Kuil.

Artefact numbers are very low and are of low significance. No significant archaeological resources were identified.

The following recommendations should be enforced:

- It is recommended that the haul road through the trees at the site D027 on Farm 394 should be slightly moved, to avoid negative impacts;
- If any human remains are uncovered during construction, the ECO should have the area fenced off and contact HWC (Tel: 021 483 5959) immediately;
- if there are any significant changes to the layout of the facilities, the new designs should be assessed by a heritage practitioner.

Indications are that in terms of archaeological heritage the proposed activity is viable; impacts are expected to be very limited and controllable.

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MAP 242 OP. General Plan of Crown Land, situated in the Field Cornetcy of Gouph, Division of Beaufort, Divided into Suitable Lots of Farms. 27 August 1868.

Table 2: Archaeological sites recorded in 2015

*IHS Insufficient Heritage Significance (this term is replaced with NCW or Not Conservation Worthy): The archaeologist proposes that the heritage resource does not have enough heritage significance to be included in the National Estate. OES = Ostrich eggshell fragments.

Field Name	Lat S Dec Deg	Lon E Dec Deg	Description	Significance/ Grading
L001	32.43535096	22.63685502	Quaggasfontein: 1 possible lower grindstone, 1 large quartzite flake and 1 very weathered MSA blade.	IHS
L002	32.43598002	22.63714604	Near site 001, on the same rocky plain, a quartzite radial core, an irregular chert core, a chert flake and a MSA blade on chert. Stone artefact density is generally very low.	IHS
L003	32.43389100	22.62347298	To the north of the Mine Pit, two fragments of thick blue and white Chinese porcelain, about 20 m apart, one piece has clear evidence of retouch along one margin	IIIC
L004	32.43877002	22.63040003	A single flaking episode with 7 reasonably unpatinated hornfels flakes, all in close proximity in the veld	IHS
L005 L006	32.43791004 32.43779596	22.63007398 22.63004003	Dense scatter of unpatinated hornfels over an area of 5m x 5m, in the gravel wash/slope of a little stream (i.e. on soft soils). About 100 flakes and cores. No obvious signs of retouch and probably LSA	IIIC
L008	32.49167299	23.26887902	A line of round cobbles, possibly either related to the drill holes nearby, or natural. No associated artefacts	IHS
L009	32.49271603	23.26551603	In the middle of a large pan, a single rectangular shaped, retouched flake. Retouch only along one margin, and some patination	IHS
L010	32.49546899	23.26756901	A single lead slug	IHS
L011	32.59784404	23.07831704	Haanekuil: A single very large chert core	IHS
L012	32.59824403	23.07795100	Two hornfels flakes	IHS
L013	32.59194503	23.07849700	A single hornfels flake	IHS
L014	32.59114003	23.07207604	1 LSA hornfels flake	IHS
L015 L016	32.61138903 32.61152398	23.05019097 23.04910703	2 isolated hornfels flakes	IHS
L017	32.60694997	23.04441903	1 sidestruck hornfels flake	IHS
L018	32.60856701	23.04279000	1 MSA snapped flake/blade on very weathered hornfels	IHS
L019	32.59727198	23.05533201	A very dense scatter of OES in a small area, no associated artefacts.	IHS
L020	32.73575904	22.73331899	Rystkuil: Single small chert flake with scraper retouch along one margin	IHS
L021	32.73388803	22.73490099	A small pan with a scatter of hornfels artefacts, Very coarse hornfels, no retouch, one artefact has MSA appearance. About 20 artefacts in proximity to each other, over an area of 10 m x 10 m.	IHS
L022	32.73427402	22.73374798	Near a little pan, a chert core with crushing along striking platform. Single platform core.	IHS
L023	32.73387898	22.73386499	On a small pan, a number of very weathered (ESA or MSA?) flakes and cores. The cores are discoid and the flakes are almost circular. Probably weathered hornfels, as they have a red patination but they could be chert	IHS

L024	32.73710400	22.73733300	One flaked chert core and one hornfels chunk	IHS
L025	32.73806800	22.73469396	A distribution of red chert nodules with widespread, but ephemeral evidence of flaking. No distinguishing characteristics	IHS
L026	32.69370200	22.84245104	Single large grey hornfels flake with patinated cortex.	IHS
L027	32.69697203	22.84662598	On a very slight ridge line, a scatter of OES fragments and one hornfels flake	IHS
L028	32.69680004	22.84685397	On a ridge, a very large pile of round cobbles. Perhaps related to mining or the construction of the gravel track? No associated artefacts	IHS
L029	32.69701503	22.84743198	A small (70cm x 70 cm) stone packed circle, perhaps the base of a hearth, associated with a handle of a metal knife and some clear bottle glass. Probably related to the drill holes nearby	IHS
L030	32.69891102	22.84591603	Scatter of OES	IHS
L031	32.69829897	22.84395400	Single large hornfels core with red patinated cortex	IHS
L032	32.66831104	22.82642500	A single chert flake	IHS
L033	32.66851002	22.82474502	A dense spread of OES on a cleared space, with a large hornfels core and 1 hornfels flake	IHS
D001	32.43675803	22.63582899	Quaggasfontein: Isolated MSA patinated hornfels chunk	IHS
D002	32.43530402	22.63615396	Flat gravel area next to big watercourse. Including 2 x quartz chunks, 1 fresh small hornfels flake, 1 x small fresh grey chert side scraper, 1 x small grey chert bladelet, 1 x hornfels chunk/core. Few OES fragments. Very low density	IIIC
D003	32.43427103	22.62772503	3-4 patinated flakes/chunks probably MSA near water course	IHS
D004	32.43359696	22.62807003	Occasional patinated hornfels. MSA. On flat gravel pavement	IHS
D005	32.44038697	22.62632098	Tortoise	
D006	32.43809503	22.62752797	Isolated small grey chert bladelet, LSA	IHS
D007	32.43664102	22.63142003	2 x patinated hornfels flakes. MSA. Isolated	IHS
D008	32.43486397	22.62368202	Isolated chert flake. MSA	IHS
D009	32.43481896	22.62370901	LSA stone scatter on bank above river (gravel terrace). Lots of chert and hornfels, some quartz artefacts. Cores, chips, chunks. 2 x thumb nail scrapers, 1 x drill, 1 x MRP/Scraper? Possible bone fragments. It will be necessary to grid and collect surface material.	IIIB
D010	32.45969301	23.22493002	Tortoise	
D024	32.59804797	23.07729696	Ryst Kuil (Haanekuil): Isolated hornfels items, 1 x core, 1 x flake and 1 x chunk	IHS
D025	32.59764799	23.07684400		
D026	32.59737700	23.07608401		
D027	32.59395802	23.07652398	Isolated core. Large. Patinated	IHS
D028	32.59224401	23.07886697	2 x isolated hornfels chunks. Very patinated	IHS
D029	32.59213001	23.07927098	1 x patinated disk core	IHS
D030	32.59191502	23.07898197	Medium pebble, quartzite, grey material. Scars look fresh	IHS
D031	32.59172500	23.07866799	Isolated MSA flake, patinated hornfels	IHS
D032	32.58919903	23.07454803	Isolated silcrete MSA flake	IHS
D033	32.58866703	23.07412399	Large core (ESA?) patinated and 1 hornfels flake, heavily patinated	IHS
D034	32.58782004	23.07456899	Another big core, patinated chert. Quite a few chert artefacts in the area, there is a chert	IHS

			lens in the area which could be the source of the artefacts.	
D035	32.58956498	23.07787699	Large flake with some core damage – ESA?	IHS
D036	32.58734303	23.07652096	Isolated core, edge. Chert cobble	IHS
D037	32.58840996	23.07565402	Chert core and few flakes	IHS
D038	32.58848699	23.07564598	Quite a few chert flakes	IHS
D039	32.60630004	23.04144404	Remains of a small dry stone structure, lots of refuse scattered around. Modern glass, metal also blue glass. Tin cans, cartridge cases, green “Codd” bottle type glass, some earthenware and ceramics but these appear recent. No obvious graves nearby	IHS
D040	32.60718198	23.04354002	2 x patinated hornfels, MSA	IHS
D041	32.70952703	22.74966697	Old gabled house with verandah, at Katdoringkuil?	
D042	32.73642004	22.73215902	Ryst Kuil Extension: Isolated small stone scatter mostly on chert (in distinctive red outer patina). Lots of it on the veld surface: 5 chert flakes, 1 chert bladelet core, 1 heavily patinated core (MSA?) [2735-2736]. There are a few more flakes in the vicinity. The scatter is more widespread and more cores seen. Not dense so difficult to assess area. Possibly LSA?	IIIC
D043	32.73529300	22.73282697	Another area where chert has been worked. Few cores and flakes	IHS
D044	32.73755796	22.73559099	Stone scatter of moderate density. Using chert (grey with red patina), also a darker material also with red patina (hornfels?) and some chert. Chips, chunks, flakes and cores could be ESA/MSA or LSA?	IHS
D045	32.73736099	22.73668198	Odd finds of grey chert artefacts, probably MSA	IHS
D046	32.73774203	22.73714902		
D047	32.73757196	22.73786098		
D048	32.73727298	22.73786400		
D049	32.73712403	22.73620103		
D050	32.72733204	22.74078500	tented tortoise	
D051	32.73120004	22.74132304	Stone scatter. MSA. Patinated, grey quartzite material also some chert with red patina, not dense on small pan, flakes, chunks, cores	IHS
D052	32.70990900	22.75610402	Kinahan’s site QRS88/34. Two lobed stone hut? With mid to late 19 th century material. “Small stockpost, two circular rock outlines. Midden with burnt bone, OES, refined earthenware (transfer willow pattern), spongeware. 1 patinated MSA blade with retouch. Tin. Probably later 19 th or early 20 th century.	IIIC
D054	32.69625303	22.84470703	Ryst Kuil Main: A small area (10m ²) with a few heavily patinated large flakes (around 11) and 3 large flakes that show traces of flake scars on dorsal surface, possibly all ESA? [2748-2754]	IHS
D055	32.66835697	22.82709598	2 x large isolated flakes (ESA?). Nearby core on edge of pebble	IHS
D056	32.66935199	22.82764600	Area of flake production, quite a few cores and flakes with moderate patination. Large cores – end cobble type. Big crude flakes. On dusty flat gravel pan. Grey siltstone with reddish cortex. [2759-2765].	IHS
D057	32.67673703	22.86122801	Isolated chert (red patina), 1 x large chert flake, 5 MSA-like chert pieces, 1 flake core.	IHS

Table 3: Archaeological sites recorded on Quaggasfontein and Ryst Kuil in 2017. NCW stands for Not Conservation Worthy.

LABEL	LAT S (dec dg)	LON E (dec dg)	Description	Grading
D2017_003	32.72952500	22.72303398	Isolated MSA flake on pan.	NCW
D2017_004	32.74470697	22.74336504	Low density scatter of MSA flakes cores and chunks amongst pebbles. Some material shows fresh scars while others are patinated. Exclusively grey chert with red cortex .	NCW
D2017_008	32.74493898	22.74400399	As for D2017_004.	NCW
D2017_009	32.74598496	22.74485199	A few isolated patinated MSA flakes.	NCW
D2017_010	32.76089796	22.76763501	Isolated MSA(?) core.	NCW
D2017_011	32.73010000	22.74935902	Low density MSA scatter on chert. Some material patinated and some show fresh scars.	NCW
D2017_012	32.73483200	22.73956703	This was a marker point for a note.	n/a
D2017_013	32.73760004	22.74016801	Low density MSA scatter on chert.	NCW
D2017_014	32.73960499	22.74282298	Note: very occasional MSA material in this area.	n/a
D2017_015	32.68683001	22.84269696	Note: No material in this area.	n/a
D2017_016	32.69477899	22.85258300	Isolated MSA flake with patination	NCW
D2017_017	32.68202199	22.85645502	Isolated MSA single platform core on chert with red cortex.	NCW
D2017_018	32.68154598	22.85592402	Ephemeral scatter of flakes and 2x cores on grey chert.	NCW
D2017_019	32.59856103	23.07309503	Isolated grey chert core in stream bed.	NCW
D2017_020	32.59884199	23.07154899	Isolated grey chert core in stream bed.	NCW
D2017_021	32.60283002	23.05848797	Single core and a few flakes of the same material at the edge of a rocky "koppie". Not chert. (MSA/LSA?)	NCW
D2017_022	32.61297002	23.06201700	Pebble core and 2x flakes (MSA/LSA?)	NCW
D2017_023	32.61291202	23.06167301	Heavily patinated MSA flake and core on a pan.	NCW
D2017_027	32.60865502	22.98198600	Ruins of a small vernacular structure with stone foundation t an existing stock post (acacia trees and windmill). Few artefacts to give a sense of age? Possibly a small dwelling. The site lies alongside the proposed haul road. Minor amendment of the route suggested to avoid impacts.	IIIC
D2017_028	32.60817298	22.98204702	Note: Haul road should be relocated to this alignment to bypass the stockpost	n/a
L2017_003	32.44442001	22.64718597	Quaggasfontein - Snapped, weathered MSA flake and 1 flaked cobble on the pan surface	NCW
L2017_004	32.45208199	22.67559500	2 very weathered MSA flakes, in the pan, near the road	NCW
L2017_008	32.43859400	22.63969003	Remains of a small stockpost, situated between a small rocky ledge and a dry stream bed, and bisected by a farm track. Fair amount of historic debris, scattered over a wide area, including glass (19 th century dark green bottle glass; aqua glass; dark blue glass), lots of wire and tins, fragmented bone; 19 th /20 th century British ceramics (cream stone ware; plain white; blue transfer ware; annular ware). The large ash heap has been dug up by a porcupine, lots of charcoal. A cartridge case. The historic site appears overprinted on a earlier pre-colonial site. There are stone	IIIB

			tools, at least 2 ostrich eggshell beads (about 5mm in external diameter), 2 lower grindstones and a sea shell pendant.	
L2017_009	32.43814196	22.63940002	Near the stockpost, along the river bank, a cairn of stone which probably represents a grave. A grindstone lies on the grave	IIIA
L2017_010	32.43819502	22.63948702	Possible grave, cairn of a few stones which have been disturbed, on the river banks	IIIA
L2017_011	32.73318596	22.72188398	Rystkuil - On a small pan, some fresh looking flakes, ± 5 flakes and 1 large core (hornfels?). All close to one another, single knapping episode?	NCW
L2017_012	32.73177202	22.72880601	Very worn chert core, nearby a worn chert flake, 20m away another flake – very sparse distribution	NCW
L2017_013	32.74522698	22.74375698	A plain of weathered chert cobbles, with the occasional flake, mostly very weathered. But one freshly flaked core, possibly LSA?	NCW
L2017_014	32.74554298	22.74267102	A large chert core with triangular flake removed – MSA? A hotspot nearby with a number of stone tools in one area	IIIC
L2017_015	32.76306904	22.76529503	A large flat pan which has been partly made into a dam, with stone mud walling, as well as stone and brick walling. Probably 20 th century	NCW
L2017_016	32.76128001	22.76803298	1 core and 3 flakes, not patinated, they appear quite fresh. LSA?	NCW
L2017_017	32.73937298	22.74147701	1 thumbnail scraper on chert	NCW
L2017_018	32.73988000	22.74198999	5 flakes, near the Rystkuil shaft.	NCW
L2017_019	32.69633601	22.85111600	Large quartzite lower grindstone	NCW
L2017_020	32.68581497	22.85086001	Mining related activities	NCW
L2017_021	32.68082798	22.85557299	Occasional flakes, about 5 m apart. Near the track.	NCW
L2017_022	32.67917499	22.85280998	A plain of weathered (red) chert cobbles, with the occasional flake, mostly very weathered. There is a scatter of grey chert flakes, some with a red cortex. One MSA flake.	NCW
L2017_027	32.60307603	23.06105702	2 flakes with patina	NCW
L2017_028	32.60479096	23.05950603	A large, roughly packed cairn on the ridge –could be a boundary/prospecting marker. Possibility of a grave unlikely as ground very rocky.	
L2017_029	32.6047500	23.0596500	1 chert bladelet and 1 clear quartz chip nearby on this slight elevation. Near expanse of flat rocks	NCW
L2017_030	32.6046900	23.0564900	1 chert core with red patina, and fresher looking flakes, as well a number of flakes on a cleared site near a small stream. There is a large lower grindstone.	NCW
L2017_031	32.6135500	23.0623800	On edge of a pan, soil is very clayey. There is a core with a red patina, and 9 flakes.	NCW
L2017_032	32.6152200	23.0604900	One piece of early 20 th century ceramic, green on outside and white inside with hand painted pink flowers and green leaves.	NCW
L2017_033	32.6148500	23.0599500	A number of large chert cores	NCW
L2017_034	32.559100	23.0107100	The Neverset farmhouse and stone kraal - on the route of the haul road. The house probably dates to the late 19 th century and has been abandoned. Now used to store prospecting materials.	IIIC

APPENDIX 3

BUILT ENVIRONMENT ASSESSMENT (AMENDED): PROPOSED URANIUM MINING AND ASSOCIATED INFRASTRUCTURE ON PORTIONS OF THE FARMS QUAGGASFONTEIN AND RYST KUIL NEAR BEAUFORT WEST IN THE WESTERN CAPE

(Assessment conducted under Section 38 (8) of the
National Heritage Resources Act No 25 of 1999)

Case Number: 15100705WD1009E

Prepared for:

Ferret Mining & Environmental Services (Pty) Ltd



November 2015
Amended June 2017

Prepared by:

Lita Webley & David Halkett
ACO Associates cc
8 Jacobs Ladder
St James

Email: lita.webley@aco-associates.com
Tel: 0217064104
Fax: 0866037195

EXECUTIVE SUMMARY

ACO Associates cc was appointed by Ferret Mining & Environmental Services (Pty) Ltd on behalf of the client, Peninsula Energy Ltd., to undertake a Built Environment assessment for the mining of uranium in the Karoo.

The NID application, submitted on the 09 October 2015, included the Eastern, Central, Western and Southern Blocks in the Karoo.

The NID response, dated 19 October 2015, required the following studies:

- Impacts to archaeological heritage resources
- Impacts to palaeontological heritage resources
- Visual impacts of the proposed development
- *Impacts to the built environment including a detailed site development plan*

However, after submission of the NID application, Ferret Mining & Environmental Services (Pty) Ltd indicated that the client was only considering mining certain sections of the Central and Eastern Blocks. The other blocks will be developed at a later stage and will require a separate EIA process.

The HIA (with appendices) for Quaggasfontein and Ryst Kuil was submitted to Heritage Western Cape in November 2015, and the FINAL COMMENT was received 16 February 2016. It reads as follows:

“The requirements of S 38(3) have been met. The Committee endorses the recommendations of the consultants in the HIA as follows:

Palaeontology:

- A palaeontologist must show the geologists from the mining company how to recognize fossils and instruct them on the monitoring of excavations for any possible fossil discoveries;
- The Fossil Finds protocol must be implemented, and if any fossils are uncovered, they must be left in place and reported to a recognized South African Palaeontological Research centre, so that they can be excavated with and stored for future research purposes. A Work Plan for this mitigation for this mitigation work must be approved by HWC.

Archaeology:

- Site D009 on Quaggasfontein must be mitigated under a Work Plan approved by HWC before work commences and a report must be submitted to HWC for approval before destruction. A surface collection may be sufficient as there does not appear to be any depth to the site. Mitigation must involve setting up a grid across the site and collecting and recording the archaeological material. Some sieving of sub-surface material may be required¹; and
- If there are any significant changes to the layout of the facilities, the new designs should be assessed by a heritage practitioner and HWC must be informed.
- If any archaeological material or evidence of burials is discovered during earth-moving activities, all work must be stopped immediately and HWC must be notified without delay.

This letter does not exonerate the applicant from obtaining any necessary approval from any other applicable statutory authority. HWC reserves the right to request additional information as required”.

¹ Changes to the layout of the Quaggasfontein mining block, means that Site D009 is no longer threatened and this provision can fall away.

Approximately 12 months after receiving the Final Comment, ACO Associates was asked to assess several changes to the layout of the mining areas on Quaggasfontein and Ryst Kuil.

Heritage Western Cape was notified of amendments to the layout and they responded with the following interim comment (attached to the HIA) dated 6 July 2017:

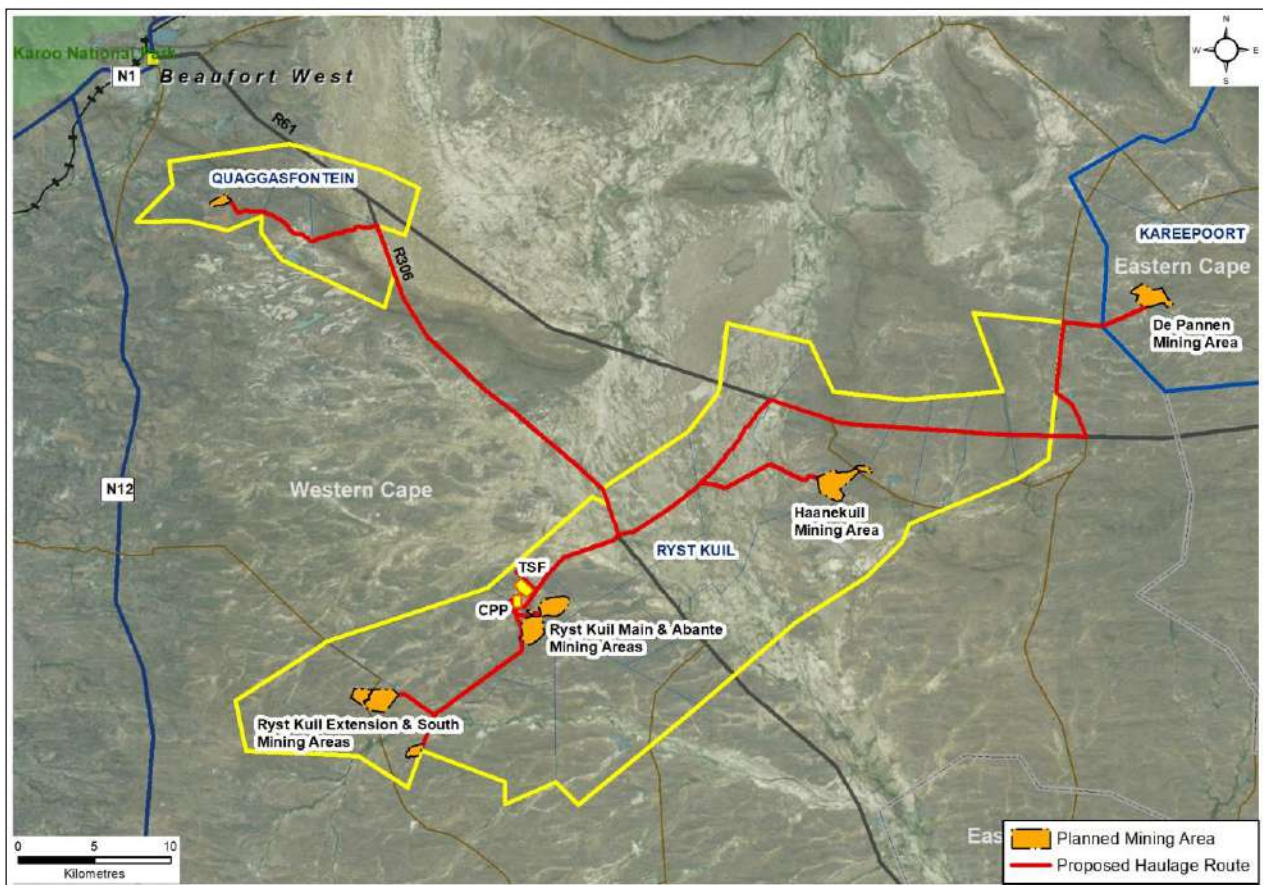
“HWC has previously endorsed the Heritage Impact Assessment prepared by ACO Associates dated November 2015. Since there has been changes to the proposed layout of the facilities, HWC requires an amended HIA to be submitted for assessment.

The revised HIA must satisfy the provisions of Section 38(3) of the NHRA. This HIA must have specific reference to the following:

- Impacts to archaeological heritage resources
- Impacts to palaeontological heritage resources
- Visual impacts of the proposed development
- Impacts to the built environment including a detailed site development plan
- Consultation with the relevant interested and affected parties

The findings of the previous HIA may be used as appendixes to the revised HIA and elaborated upon within the scope of the revised proposal”

This Built Environment submission is therefore only concerned with the areas indicated in the figure below:



The Mining Blocks include Quaggasfontein and Ryst Kuil in the Western Cape. Kareepoort, in the Eastern Cape, does not form part of this application.

Uranium prospecting and mining has been actively pursued in this area of the Karoo for the last forty years and there is an existing mine on Ryst Kuil Main dating to 1978. The uranium deposits occur in discrete pods or lenses following ancient, meandering river channel courses. The open case surface mining will be a standard opencast to a depth of no more than 85m. The maximum height of the waste dumps will be 20m and of the TSF it will be 25m.

Nature of the Impact

This assessment is concerned with the open pit mines, stockpiles, the haulage roads and site offices. A single, Central Processing Plant (CCP) and Tailing Storage Facility (TSF) with a height of 25m will be constructed at Ryst Kuil Main, close to the existing mine.

It is important to emphasise, that although the blocks are large, relatively small areas within each block will be mined.



An example of type of mine which will be excavated at Quaggasfontein and Ryst Kuil. Each mine pit is around 200m² in size.

Heritage Resources Identified

The heritage resources identified include:

- The regional road, the R61, connects Beaufort West and Aberdeen and is situated to the north of the proposed mining blocks of Quaggasfontein and Ryst Kuil. The road is not considered to carry high volumes of traffic nor is it a popular tourist route. It has not been given a significance grading by Winter & Oberholzer (2014);
- The farmhouse at Quaggasfontein is located 6km west of the proposed mine and haul roads all lie to the east of the mine;
- The farmhouse of Neverset (Field grading of IIIC) is on the R61 and one haul route passes to the west of the farmhouse;
- The farmhouse of Water Gift (Haanekuul) is located 2km north of the proposed mine and no haul route passes near the house;
- The farmhouse of Ryst Kuil is 5km north-east of the proposed mine. One haul route will pass between the house and a farm cemetery (the cemetery is addressed in Appendix 2: Archaeology);
- The farmhouse of Kat Doorn Kuil (Field grading of IIIC) lies 2km north-east of the proposed mine. The haul route will not pass near the house;

- Although technically the landscape which will be mined is characterised as agricultural, in real terms the Cultural Landscape has the character of a wilderness. Occasional stock posts, fences, wind pumps, concrete reservoirs and tracks are the only apparent elements of human modification on the landscape apart from the farmhouses. The land appears, even in prehistoric times, to have been marginally inhabited, with the only remnants of pre-colonial settlement the scatters of stone artefacts across the landscape. The landscape is almost completely flat with occasional pans and low ridges, and there are none of the typical elements of the Karoo (i.e. the iconic flat-topped koppies) found north of Beaufort West. The landscape around Ryst Kuil main has also been considerably disturbed, with old prospecting holes, mine shafts, ventilators, head gear and other infrastructure related to uranium mining in the 1970s littering the area. Therefore, the Cultural Landscape is given a field grading of IIIC.

Anticipated Impacts on Heritage Resources

- Beaufort West is at least 9km from the closest mining block, that of Quaggasfontein. The view shed map for Quaggasfontein indicates that waste dumps with a height of 20m will be visible from town;
- There are no listed conservation worthy buildings or places of celebrated heritage significance in the area;
- While some of the existing farm houses contain 19th century fabric, very few have anything more than low heritage significance. Neverset on the junction of the R61 and the main haulage road, and Kat Doorn Kuil, near the Ryst Kuil Extension mine, have been given field gradings of Grade IIIC, but both houses are unoccupied and in a derelict condition;
- No demolition of farm buildings is proposed but it is recognised that abandoned buildings may be vulnerable to vandalism when more people are on site;
- The waste dump heights will reach a maximum height of 20m while the TSF will reach a maximum height of 25m. The Cumulative Viewshed indicates that the waste dumps from Quaggasfontein will be visible from the N1;
- However, the waste dumps and TSF on Ryst Kuil Main, Ryst Kauil Abante, Ryst Kuil South and Extension as well as Haanekuil not be visible from the N1 and only marginally visible from the R61 to Aberdeen and the R306 to Rietbron;
- Due to the lack of screening in the context of wide open vistas, there is a potential for visual impact in the flat, arid Karoo landscape. However, farmsteads are sparsely located and many houses are unoccupied;
- Impacts to the Cultural Landscape are considered to include the erosion of the sense of wilderness with the addition of the mining infrastructure, particularly the tailings which may be visible for some distance. This will have a negative impact on the landscape but rehabilitation will occur at the end of the lifespan of the mine.

In general terms, the proposed activity will have a low to medium impact on the built heritage, including farm houses, roads and landscapes.

Recommendations

- The EMP must ensure that there are no indirect impacts to the Neverset farm house which is situated next to a haul road. This will include making the farm houses off limits to mining crews to prevent vandalism;
- No demolition or modification of any farm buildings older than 60 years may be undertaken without an assessment of the significance of the buildings by the heritage authority;
- If farm buildings of Neverset or Kat Doorn Kuil are used for mining accommodation, then the approval of the relevant heritage compliance authority is necessary if any building alterations are undertaken.

If there are any significant changes to the layout of the facility, the new design should be assessed by a heritage practitioner.

GLOSSARY

Fossil: Mineralised bones of animals, shellfish, plants and marine animals. A trace fossil is the track or footprint of a fossil animal that is preserved in stone or consolidated sediment.

Heritage: That which is inherited and forms part of the National Estate (Historical places, objects, fossils as defined by the National Heritage Resources Act 25 of 1999).

Heritage Western Cape: The compliance authority which protects national heritage in the Northern Cape.

National Estate: The collective heritage assets of the Nation

Palaeontology: Any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace.

Structure (historic): Any building, works, device or other facility made by people and which is fixed to land, and includes any fixtures, fittings and equipment associated therewith. Protected structures are those which are over 60 years old.

Acronyms

CPP	Central Processing Plant
DEA	Department of Environmental Affairs
ESA	Early Stone Age
GPS	Global Positioning System
HIA	Heritage Impact Assessment
LSA	Late Stone Age
MSA	Middle Stone Age
NHRA	National Heritage Resources Act
SAHRA	South African Heritage Resources Agency
TSF	Tailing storage facility

1 INTRODUCTION

ACO Associates cc was appointed by Ferret Mining & Environmental Services (Pty) Ltd on behalf of the client, Peninsula Energy Ltd (Tasman Pacific Minerals Limited (Tasman Pacific) and Lukisa JV Company (Pty) Ltd (Lukisa JVCo)), to undertake an Archaeological Impact Assessment for the mining of uranium in the Northern, Western and Eastern Cape Provinces. The applications are for consolidated blocks of properties contained in the original prospecting right areas, but clustered according to geographic location to simplify the application areas.

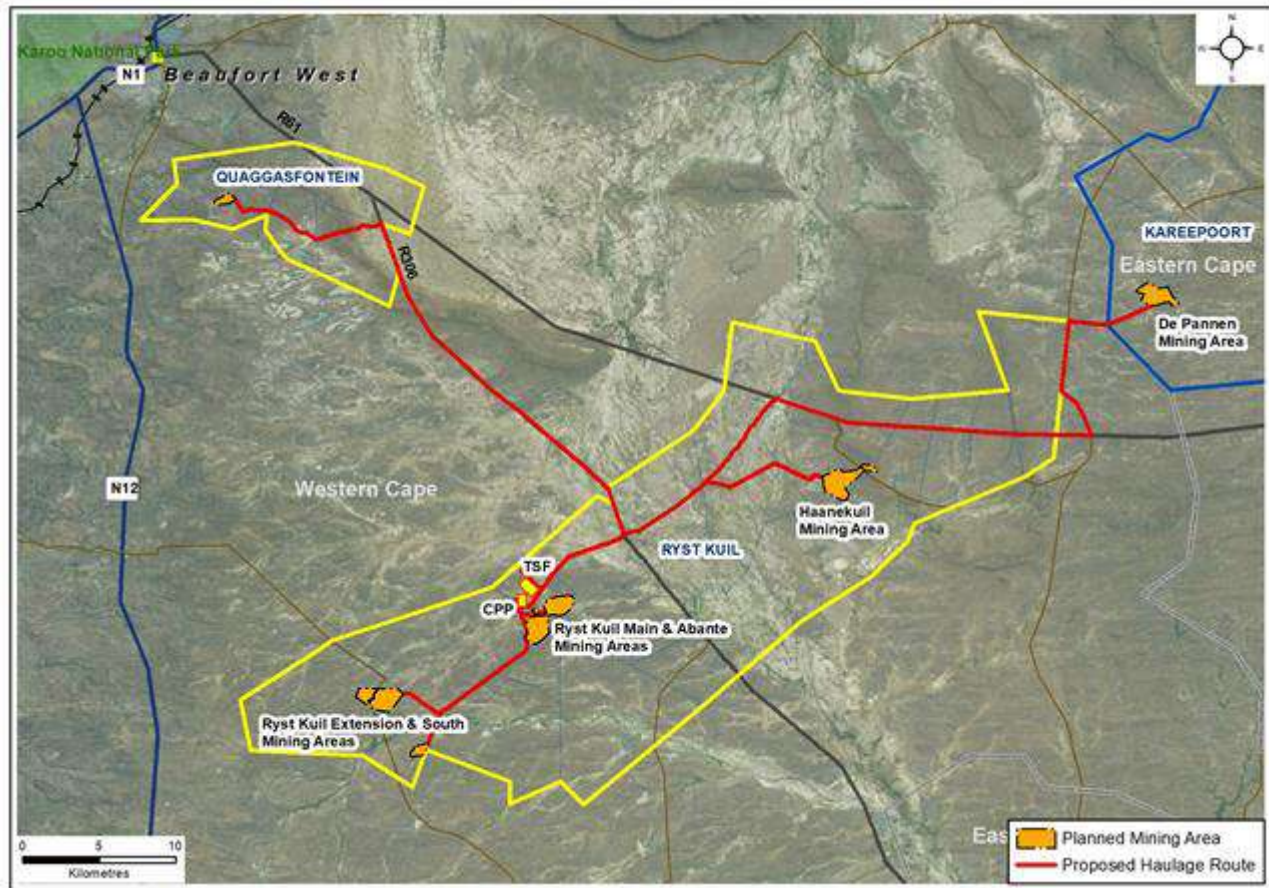


Figure 1: The location of the mining blocks discussed in this report.

The Karoo Mining Infrastructure map demonstrates the phased nature of the project with the construction of the CPP and TSF in the Ryst Kuil block and then production areas brought into active mining from the CPP in concentric circles (see HIA report).

The first 50km circle represents the first 17 years of production. The project is focussed on the Ryst Kuil channel, a mineralised zone extending over 90 km in a NE/SW direction and between 10 km and 40 km wide. It is the largest of the sandstone bodied and contains major clusters of uranium mineralization.

The initial mining area is concerned with the following farms:

Mining Block	Farm Portions
Quaggasfontein	Oude Volks Kraal 164 Quaggas Fontein 166
Ryst Kuil	Haane Kuil 335 Vlak Plaats 350 Eerste Water 349 Farm 351

2 DEVELOPMENT PROPOSALS

Mining Rights applications have been submitted in terms of Section 22 of the Mineral and Petroleum Development Act, 2002 (MPRDA) by Tasman Pacific Minerals Limited (Tasman Pacific) and Lukisa JV Company (Pty) Ltd (Lukisa JVCo) for uranium (U) and molybdenum (Mo) mining in the Karoo.

Traces of uranium occur throughout the Karoo Supergroup. Historically, uranium mineralisation in the Karoo Basin was first detected in the last 1960s. Subsequently, several international companies began showing interest in the Karoo sequences. Drilling has taken place on the farm Ryst Kuil since the 1970s. As a result of increases in the uranium price over the past few years, a new era of uranium prospecting is currently taking place in the southern Karoo.

The product will be mined using the surface (open pit) mining method. The open cast surface mining will be a standard opencast to a depth of no more than 85 m. The mining method will be traditional drill, blast, load and haul using trucks to deliver the material to the processing plant. The topsoil will be removed and stored. The underground mining method will use the board and pillar method. There will be a waste stockpile, construction area, ore stockpile, slimes dam, access roads and Eskom powerlines. The TSF will reach a maximum height of 25m. A single CPP and TSF will be constructed at Ryst Kuil Main, close to the existing mine. The main product will be road freighted to Beaufort West and then railed to Cape Town.

It is important to emphasise, that although the blocks are large, relatively small areas within each block will be mined.



Figure 2: The location of the farmsteads, discussed in the text, in relation to the mining blocks and the haulage roads.

2.1 Quaggasfontein



Figure 3: The map of the proposed mining activities on Quaggasfontein. The green pin shows the location of the Quaggasfontein farm house, some 6km to the west of the proposed mine. It will not be impacted.

2.2 Ryst Kuil

The Ryst Kuil mining block is comprised of a number of smaller components, these include Haanekuil in the north-east, Ryst Kuil Main and Ryst Kuil Abante in the centre, Ryst Kuil South and Ryst Kuil Extension in the south. The mining block is approximately 55 km in length and 14km wide.

The most significant changes to the final layout were made at the Ryst Kuil Main Block, which is also the site of the mining undertaken in 1978. There is considerable mining infrastructure still on the site as well as the original mining shaft and old waste piles (Plates 5 & 6).

2.2.1 Haanekuil

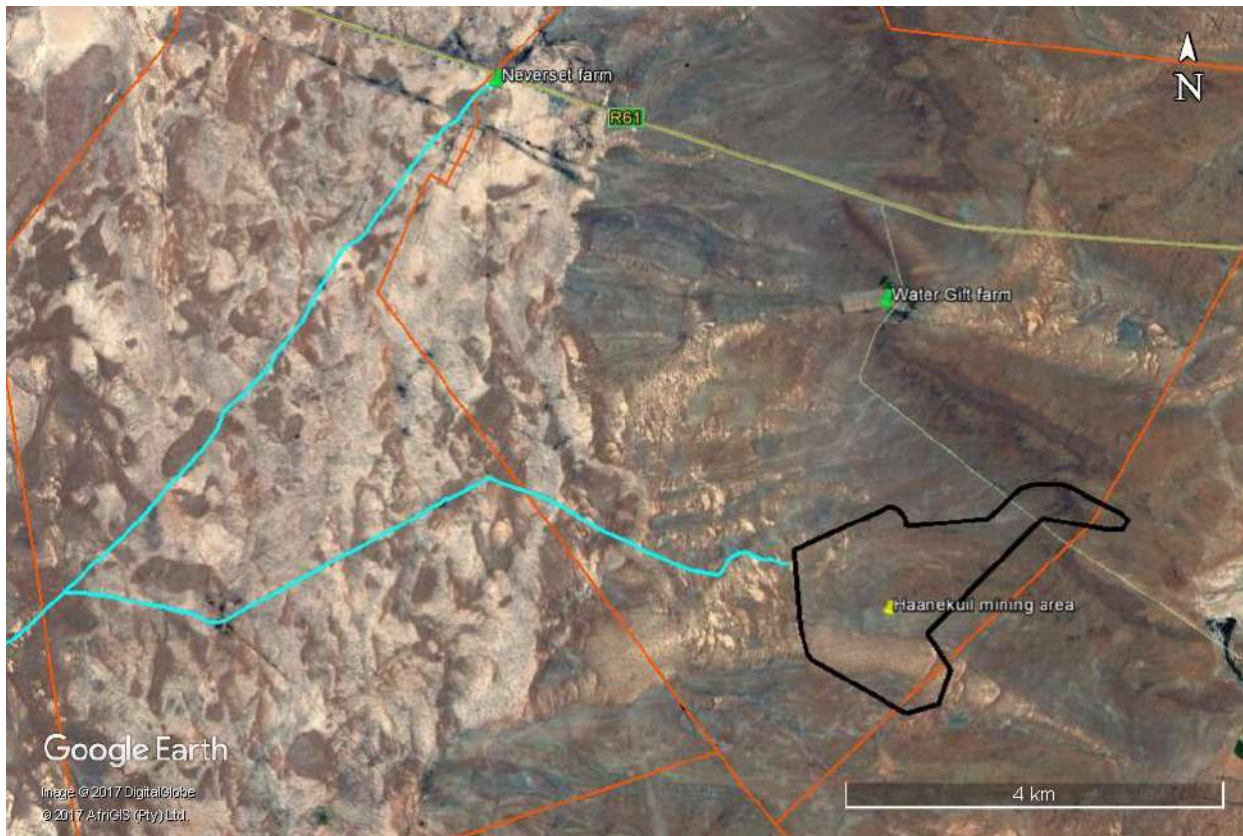


Figure 4: A map of the Haanekuil mining area which is on the northern edge of the Eastern (Ryst Kuil) Block. The green pins indicate the locations of Water Gift, some 2 km to the north of the mining area, and Neverset, some 6 km nw. The haul road from the mining area (turquoise) runs in a westerly direction to meet up with the main haulage road. There will therefore be no impacts to Water Gift although the main haul road closely bypasses the Neverset werf (see below for discussion).

2.2.2 Ryst Kuil Main and Ryst Kuil Abante

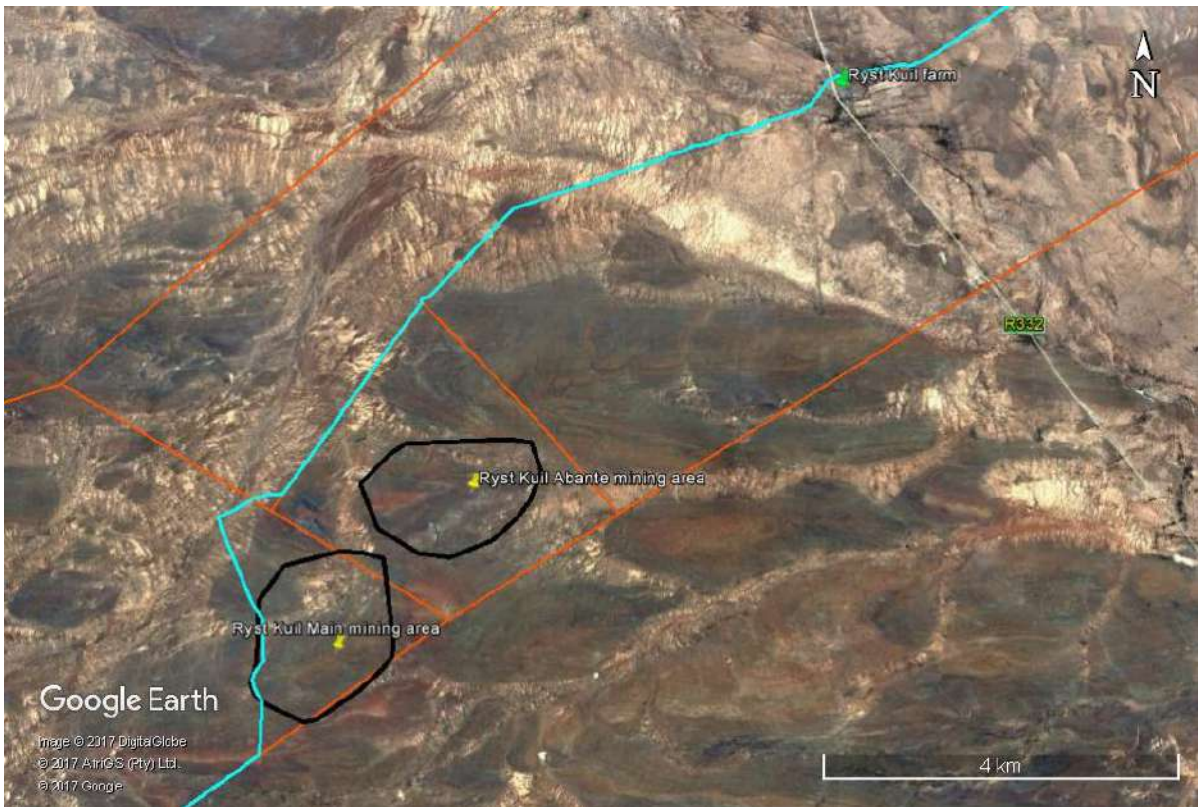


Figure 5: The mining areas lie inside black polygons The Ryst Kuil farmhouse is approximately 7 km to the north east. One of the haul roads bypasses the Ryst Kuil farm house (see below for discussion)

2.2.3 Ryst Kuil Extension and Ryst Kuil South

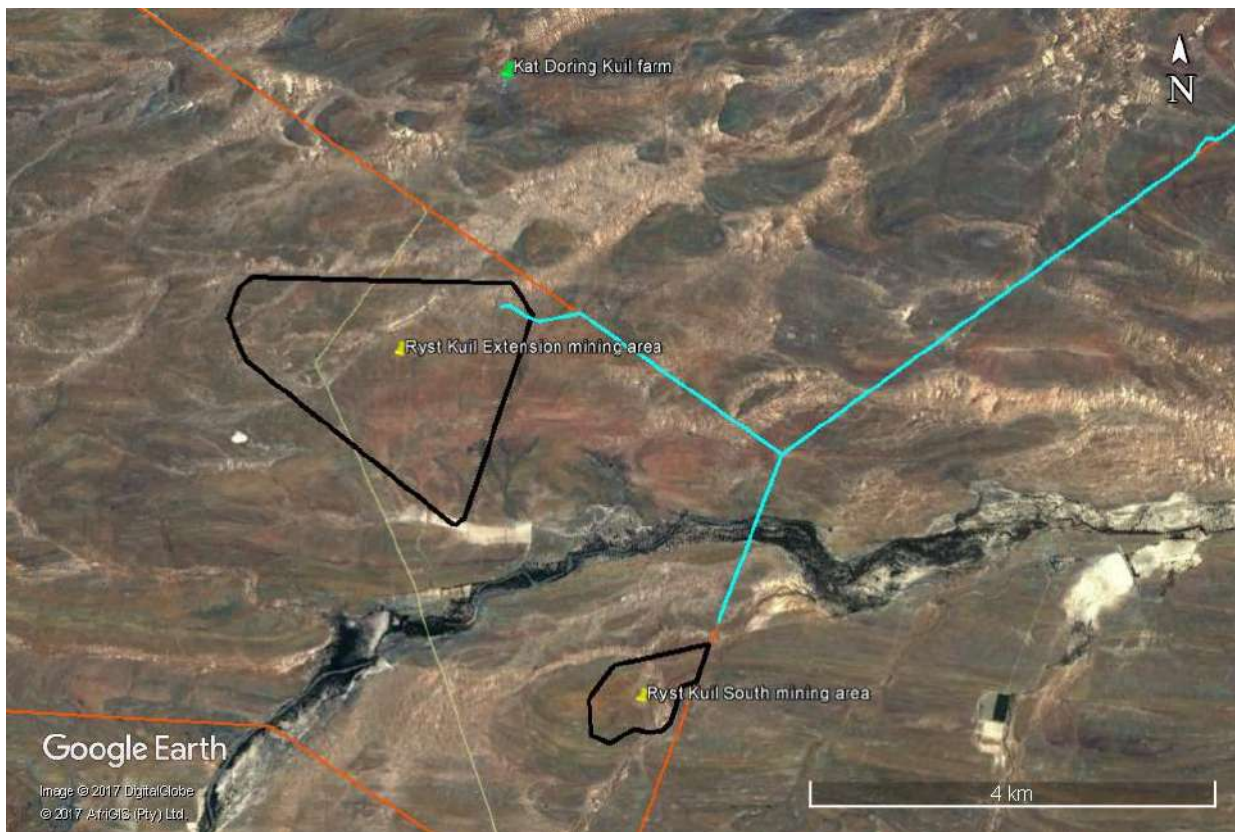


Figure 6: Ryst Kuil Extension and Ryst Kuil South. The Kat Doorn Kuil homestead (green pin) lies approximately 3 km north of the RK Extension mining area and will not be impacted directly by the activities.

3 HERITAGE LEGISLATION

This report is conducted in terms of Section 38 (8) of the National Heritage Resources Act, No 25 of 1999.

The NHRA provides protection for the following categories of heritage resources:

- Landscapes, cultural or natural (Section 3 (3))
- Buildings or structures older than 60 years (Section 34);
- Archaeological Sites, palaeontological material and meteorites (Section 35);
- Burial grounds and graves (Section 36);
- Public monuments and memorials (Section 37);
- Living heritage (defined in the Act as including cultural tradition, oral history, performance, ritual, popular memory, skills and techniques, indigenous knowledge systems and the holistic approach to nature, society and social relationships) (Section 2 (d) (xxi)).

3.1 Structures (Section 34(1))

No person may alter or demolish any structure part of a structure which is older than 60 years without a permit issued by Heritage Western Cape (HWC), the responsible provincial heritage resources authority.

3.2 Grading

The South African heritage resources management system is based on grading, which provides for assigning the appropriate level of management responsibility to a heritage resource.

Table 1: Grading of Heritage Resources

Grade	Level of significance	Description
I	National	Of high intrinsic, associational and contextual heritage value within a national context, i.e. formally declared or potential Grade 1 heritage resources.
II	Provincial	Of high intrinsic, associational and contextual heritage value within a provincial context, i.e. formally declared or potential Grade 2 heritage resources.
IIIA	Local	Of high intrinsic, associational and contextual heritage value within a local context, i.e. formally declared or potential Grade 3a heritage resources.
IIIB	Local	Of moderate to high intrinsic, associational and contextual value within a local context, i.e. potential Grade 3b heritage resources.
IIIC	Local	Of medium to low intrinsic, associational or contextual heritage value within a national, provincial and local context, i.e. potential Grade 3c heritage resources.

The grading of heritage sites, as prescribed in the NHRA, is only concerned with categories I, II and III. The subdivision of Grade III sites was introduced in the Western Cape and is used in this report.

Quaggasfontein and Ryst Kuil falls in the Western Cape and the responsible provincial heritage resources authority is Heritage Western Cape.

A Notice of Intent to Develop (NID) was submitted to Heritage Western Cape, **on the 09 October 2015. The NID also included the Eastern, Central, Western and Southern Blocks in the Karoo.**

The NID response, dated 19th October 2015, required the following studies:

- Impacts to archaeological heritage resources
- Impacts to palaeontological heritage resources
- Visual impacts of the proposed development
- *Impacts to the built environment including a detailed site development plan*

However, after submission of the NID application, Ferret Mining & Environmental Services (Pty) Ltd indicated that the client was initially only considering mining certain sections of the Central and Eastern Blocks (Figure 2).

The HIA (with appendices) for Quaggasfontein and Ryst Kuil was submitted to Heritage Western Cape in November 2015, and the FINAL COMMENT was received 16 February 2016. It reads as follows:

“The requirements of S 38(3) have been met. The Committee endorses the recommendations of the consultants in the HIA as follows:

Palaeontology:

- A palaeontologist must show the geologists from the mining company how to recognize fossils and instruct them on the monitoring of excavations for any possible fossil discoveries;
- The Fossil Finds protocol must be implemented, and if any fossils are uncovered, they must be left in place and reported to a recognized South African Palaeontological Research centre, so that they can be excavated with and stored for future research purposes. A Work Plan for this mitigation for this mitigation work must be approved by HWC.

Archaeology:

- Site D009 on Quaggasfontein must be mitigated under a Work Plan approved by HWC before work commences and a report must be submitted to HWC for approval before destruction. A surface collection may be sufficient as there does not appear to be any depth to the site. Mitigation must involve setting up a grid across the site and collecting and recording the archaeological material. Some sieving of sub-surface material may be required; and
- If there are any significant changes to the layout of the facilities, the new designs should be assessed by a heritage practitioner and HWC must be informed;
- If any archaeological material or evidence of burials is discovered during earth-moving activities, all work must be stopped immediately and HWC must be notified without delay.

This letter does not exonerate the applicant from obtaining any necessary approval from any other applicable statutory authority. HWC reserves the right to request additional information as required”.

Approximately 12 months after receiving the FINAL COMMENT, ACO Associates was asked to assess a number of changes to the layout of the mining areas on Quaggasfontein and Rystkuil.

Heritage Western Cape was notified of amendments to the layout and they responded with the following interim comment (attached to the HIA) dated 6 July 2017:

“HWC has previously endorsed the Heritage Impact Assessment prepared by ACO Associates dated November 2015. Since there has been changes to the proposed layout of the facilities, HWC requires an amended HIA to be submitted for assessment.

The revised HIA must satisfy the provisions of Section 38(3) of the NHRA. This HIA must have specific reference to the following:

- Impacts to archaeological heritage resources
- Impacts to palaeontological heritage resources
- Visual impacts of the proposed development
- Impacts to the built environment including a detailed site development plan
- Consultation with the relevant interested and affected parties

The findings of the previous HIA may be used as appendixes to the revised HIA and elaborated upon within the scope of the revised proposal”

4 METHODOLOGY

4.1 Background Literature study

Numerous impact assessments have been conducted in proximity to the proposed facility as reflected on the SAHRIS database. Most recently, after completion of the first draft (2015) of this report, Orton et al. (2016) produced a review of the archaeological heritage of the Karoo as part of a Shale Gas Assessment. Information from the SEA has informed this report.

Reports available for this assessment include:

- An assessment of the Ryst Kuil Section of the Eastern Block by Kinahan (2008) which was included in the Environmental and Social Baseline report (Targus Mining Consultants 2008);
- An Archaeological Assessment of Uranium prospecting on Portions of the Farms Eerste Water 349 and Ryst Kuil 351 (Halkett 2009) on the Ryst Kuil Section;
- An Archaeological Assessment of Uranium Prospecting on Quaggasfontein 166 and Oude Volks Kraal 164 (Webley & Hart 2010) in the Quaggasfontein Section;
- A Heritage Impact Assessment conducted by Orton (2011) on Portion 1 of the farm Steenrots Fontein 168 for a proposed photo-voltaic facility, near Quaggasfontein;
- The Aberdeen – Droerivier 400 kV powerline (Hart & Schietecatte 2012) which will cross over the De Pannen (Kareepoort) and Quaggasfontein.

Background research included a review of the published material as well as unpublished reports on the SAHRIS database. The 1:50 000 maps of the area as well as Google Earth aerial images were consulted.

4.2 Field Survey

The polygon of the proposed development was provided to ACO Associates. The area was surveyed by Lita Webley and David Halkett on 20-22 October 2015, and after an amended layout was received, further fieldwork was undertaken from 27-29 June 2017.

Our tracks were recorded by means of Garmin GPS devices and all sites were digitally recorded. We accessed the area by the local farm roads and drove along sections of the access roads where this was possible.

4.3 Assumptions and Limitations

Visibility was good because of the sparse vegetation of the study area. We were able to cover most of the study area satisfactorily.

Changes to the layout cannot really be considered a limitation as they did not affect our assessment of the built environment. There was almost no built environment within the mining

area. Only the haulage roads may have some limited impact, but these were physically assessed during the survey in 2017.

5 RECEIVING ENVIRONMENT

The landscape between Beaufort West and Aberdeen is comprised of horizontally bedded, fossiliferous shales and mudstones of the Beaufort Series in the Karoo system. They are intersected at numerous locations by dolerite dykes which have the effect of damming up small streams resulting in small springs which often generate pans of seasonal water – another feature of the landscape. There are also small, seasonal river beds which are lined with acacia trees. However, in general the landscape to the south of the R61 is remarkably flat, with little change in elevation though occasional ridges are noted (Plates 1 and 2). The natural vegetation is predominantly knee-high with stands of acacia along river beds or at stockposts, and visibility is excellent.

Although technically all the land is characterised as agricultural, in real terms it has the appearance of a wilderness. Occasional stock posts, wire fences, wind pumps, concrete reservoirs and tracks are the only apparent elements of human modification on the landscape apart from the farmhouses. The study area is thinly inhabited and remote. Farmhouses are often located in a clump of exotic trees and are visible from a considerable distance. The evidence for past uranium mining activities in the 1970s is evident throughout the study area, in the form of prospecting holes, shafts, ventilators, head gear, roads, tailings, etc. (Plates 4 & 5).

6 QUAGGASFONTEIN



Plate 1: View of the landscape around Quaggasfontein with the Nuweveldberge in the background. The town of Beaufort West is located behind the ridge, and there is no direct line of sight between the town and the mining area.

6.1 Ryst Kuil

The Ryst Kuil Block (**Error! Reference source not found.**4-6) comprises the portions termed Haanekuil, Ryst Kuil Main, Ryst Kuil Abante, Rystkuil South and Ryst Kuil Extension.



Plate 2: The view of the landscape at Ryst Kuil Extension showing the flat topography with little relief.



Plate3 and 4: The existing mining infrastructure on Ryst Kuil Main dating to 1978. Shaft and ventilator.

6.2 Historical Background

The indigenous people of Karoo waged a bitter war against colonial expansion as they gradually lost control of their traditional lands. The *Trekboere* settled on the escarpment where most of the springs were found, from here they were able to exploit the vegetation of the onder-Karoo on a seasonal basis. These early European pastoralists were highly mobile, trekking between winter and summer grazing lands. Land ownership was informal and only became regulated after the implementation of the quitrent system in the 1830s. Beaufort West and Graaff Reinet were established as major regional administrative centres to exert hegemony over the activities of the *Trekboere*. Beaufort West was established on the farm Hooyvlakte in 1818 and was given the name Beaufort West in 1869. Aberdeen, further to the east in the Eastern Cape, grew out of a typical *Kerksdorp* (church town).

According to the Surveyor General and a General Plan of the Crown Land in the Division of Beaufort (1868), many of the farms in the study area were only surveyed after 1870. Haane Kuil 335 (in the Ryst Kuil Section) was surveyed in 1908 and is described as having a house and dam. Eerste Water 349 (in the Ryst Kuil Section) was first surveyed in 1869 and is bisected by a small

stream and is described as having a house and dam. It would appear that water would have been a prime determinant in the early allocation of farms and settlement in the Beaufort West area.

Kinahan (2008) reported a total of 13 historic sites in the Ryst Kuil section of the Eastern Block. Historic stone structures were identified by their rectangular floor plan and dry stone construction, with occasional evidence of mud-brick construction, and the presence of European items such as ceramics and cartridge cases. Halkett (2009) reports on the presence of farm complexes, abandoned and ruined farm structures, ruined stock posts, old stone kraals and stone walling, "trapvloere" and old wagon tracks.

6.3 Cultural Landscape and Scenic Routes

The Orton et al. (2016) review on the impact of shale gas exploration in the Karoo, defines the term "Cultural Landscape" and gives some examples within the context of the Karoo. The cultural landscape of this particular section of the Karoo, between Beaufort West and Aberdeen, is characterised by successive (and very ephemeral) layers of human occupation, from the earliest Stone Age scatters to more recent stock farms. The generally flat landscape, is only alleviated by the occasional farmhouse, with associated clump of exotic trees, and small undulations in the landscape. There are occasional pans, particularly on Quaggasfontein, which served as a focus for pre-colonial settlement, as well as very shallow, dry stream beds.

This assessment suggests a field grading of IIC for the Cultural Landscape.

Stephen Stead, who undertook the initial Visual Impact Assessment for the Ryst Kuil Mining Block in 2008, concluded with respect to the much broader landscape: "The area has unique landscape character with endless plains on an arid plateau. The broad expanse of the plains is broken by flat-topped mesas and kopjes. The built environment is one of isolated farmsteads and small country towns". The mesas to which he refers, are situated to the north of Beaufort West, and are not visible from the mining area.

Winter & Oberholzer (2014) have graded a number of natural landscape features in the Central Karoo. The Nuweveldberge, to the west of Beaufort West, are described as a scenic landscape of Grade II significance. However, no grading is provided for the landscape to the east between Beaufort West and Aberdeen.

The R61 is the 20th century replacement of an earlier 19th century wagon road, or Voortrekker route that meandered from farm to farm linking the Beaufort West and Graaff Reinet districts.. It has not been graded by Winter & Oberholzer (2014) and carries low traffic volumes.

7 FINDINGS

Five farmhouse complexes have been identified in relative proximity to the proposed mining areas.

7.1 Quaggasfontein Section of Central Block

The farmhouse of Quaggasfontein is situated some 6km west of the proposed mining block (Figure 3). The access road which links the mining block of Quaggasfontein with the Processing Plant on Ryst Kuil, will run in a south-easterly direction and will not pass the farmhouse. It is not anticipated that there will be any direct or indirect impacts.

7.2 Haanekuil

The Ryst Kuil Block (Figures 4-7) comprises the five portions termed as **Haanekuil**, **Ryst Kuil Main**, **Ryst Kuil Abante** and **Ryst Kuil Extension** and **Ryst Kuil South** and is where the main impacts will occur. These areas are discussed separately, from north to south.



Plate 5: View of Water Gift on Haanekuil.



Plate 62: The garage and shed at Water Gift.

The farmhouse on Haanekuil is named “Water Gift”. It is constructed of red brick with steel windows and under corrugated roof. The house is covered with ivy. The adjacent shed indicates that the farm complex has little heritage significance.

The house is located 1km from the mine, but the haul roads are 3km to the south and 5km to the west and thus no direct impact is anticipated.

7.3 Ryst Kuil Main

The Ryskuil farmhouse is located 5km north-east of the Ryst Kuil Main mining area. A haul road will run between the house and a farm cemetery and no impacts are anticipated. The cemetery is discussed further in Appendix 2 (Archaeology) as well as in the Halkett (2009) report.

The red brick farmhouse of Ryst Kuil includes steel framed windows and glass sliding doors. While the house appears to have been built recently, it is possible that it represents a modified building because of the age of some of the graves in the family cemetery.



Plate 7: The front view of the Rystkuil farmhouse.



Plate 8: The view of the shed on Ryst Kuil.

7.4 Ryst Kuil Extension

The farmhouse of Kat Doorn Kuil is located 2 km north-east of the proposed Ryst Kuil Extension mining area.

The oldest structure on the werf is a flat roof building with a “gable” on the front parapet and rooms at either end of the stoep. The building is given a tentative field grading of Grade IIIC. No direct impacts are anticipated.



Plate 9: The farmhouse of Kat Doorn Kuil retains considerable heritage value as a typical Karoo style flat roofed structure.

7.5 Haulage Roads and Powerlines

The amended haul routes shown in earlier maps.

One haul road runs to the west of the Neverset werf also shown on Figure 4. The buildings (Plates 10 and 11) are in moderate condition with no windows in the rear and damaged roof sheets. The werf is currently used to store prospecting cores and other mining related equipment.



Plate 10: The Neverset farmhouse. The position of the asymmetrical front door and chimney, as well as the larger window on the right, suggests some additions to the building over time. At least part of the structure appears to date to the late 19th century.



Plate 11: Between the house and the R61, is a well-maintained stone shed attached to a stone kraal.

This report proposes a preliminary grading of IIIC for the farmhouse and associated shed. It is a good example of Karoo architecture.

8 IMPACT ASSESSMENT

The construction of open pits, mining stockpiles, a processing plant and slimes dam at Ryst Kuil Main and haul routes were assessed to determine whether they will have an impact on the heritage significance of the town of Beaufort West, on the R61 between Beaufort West and Aberdeen, on nearby farmsteads and on the Cultural Landscape of this section of the Karoo.

8.1 The Built Environment

There are no listed conservation worthy buildings or known places of celebrated heritage significance in the mining area.

There are two farm houses in the study area which contain 19th century fabric; namely Kat Doorn Kuil and Neverset. Both have been given a field gradings of Grade IIIC. Previously, a haul road passed through Kat Doorn Kuil werf but this is no longer the case and thus no direct impacts are anticipated. The haul road, does however, run past Neverset (Figure 4) where a new section of road is proposed to bypass the werf itself (Figure 7). The Ryst Kuil farmhouse may contain some older fabric, but it has been altered so much that it is considered not conservation worthy (NCW).

No demolition of farm buildings or farmsteads is proposed. There have been no proposals to utilize abandoned farmhouses, such as those at Kat Doorn Kuil or Neverset., or Ryst Kuil.



Figure 7: The location of the Neverset werf on the R61. The haul road, (turquoise), does a bypass to the west of the house and barn, and does not go through the werf itself. The bypass has been assessed.

Table 2: Potential impact to Built Environment

	Extent	Magnitude	Duration	Consequence	Probability	Significance	Status	Confidence
Without Mitigation	1 Local	2 Local	4 Long Term	5 Low	3 Probably	21 Low	Negative	High
Essential Mitigation Measures:								
<ul style="list-style-type: none"> No demolition or alteration of any farm buildings older than 60 years may be undertaken without an assessment of the significance of the buildings by the heritage authority; 								
Best Practice Mitigation Measures:								
<ul style="list-style-type: none"> Haul routes should avoid passing close to farm buildings/werfs. 								
With mitigation	1 Low	1 Low	3 Irreversible	5 Low	2 Improbable	10 Very Low	Neutral	High

8.2 Cultural Landscape and Scenic Routes

In general terms, the study area represents a remote wilderness landscape, which even in prehistoric times appears to have been marginally inhabited. The landscape is flat, with little variation in topography and little scenic variation between Quaggasfontein and Ryst Kuil. Impacts to the Cultural Landscape are considered to include the erosion of the sense of remoteness with the addition of the mining infrastructure. This will have a negative impact on the landscape but rehabilitation is possible at the end of the lifespan of the mine.

Beaufort West is 9 km from the closest mining block of Quaggasfontein and the waste dumps with a height of 20m will be visible from town and from the N1. However, the cumulative viewshed (Figure 8) suggests that there will be only limited visibility from the N12 and the R61.

The R61 between Beaufort West and Aberdeen is long and straight and carries relatively low volumes of traffic. Nor is it a popular tourist route. The scenery is flat and open and this kind of “wide open space” scenery is considered to have some scenic value. In their assessment of potential visual impacts on the R61 resulting from construction of a proposed 400kV powerline, Hart & Schietecatte (2012) observe that: “the impact is difficult to assess as the aesthetic qualities of the landscape in this area is difficult to pin a value to”. This report concurs with respect to the difficulty of assigning a field grading to the cultural landscape.

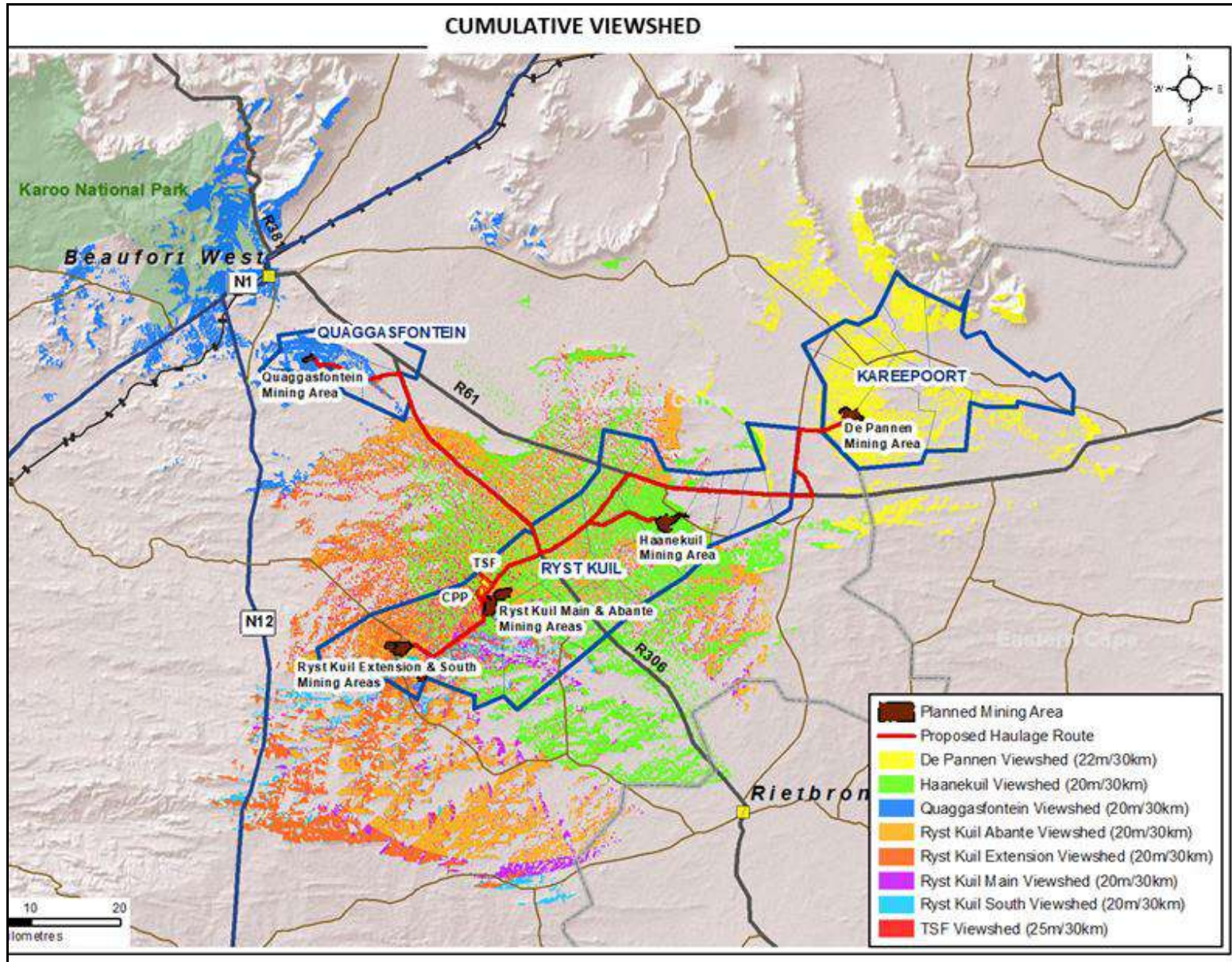


Figure 8: Cumulative viewshed of the impacts of the mining (waste dumps and TSF) on the landscape including N1, N12 and R61.

Table 3: Potential impact to Cultural Landscape and Scenic Routes

	Extent	Magnitude	Duration	Consequence	Probability	Significance	Status	Confidence
Without Mitigation	3 Local	5 Moderate	4 Long term	5 Low	3 Probable	36 Medium	Negative	High
Essential Mitigation Measures: <ul style="list-style-type: none"> Mining infrastructure (other than haul roads) should not be placed close to the R61 in order to prevent additional visual impact; Best Practice Mitigation Measures: <ul style="list-style-type: none"> Mine infrastructure to be dismantled and removed after closure of the mine; Rehabilitation of the landscape, including the filling of the mine pits, on closure of the mine. 								
With mitigation	1 Low	1 Low	3 Irreversible	5 Low	Improbable	Very Low	Neutral	High

8.3 Impacts from Powerline and Haulage Roads

Potential impacts caused by a 132kV power line and the haul roads are likely to be limited and local.

9 CONCLUSION

In general terms, the study area represents a remote farming landscape, which even in prehistoric times appears to have been marginally inhabited. The landscape is flat, with little variation in topography and little scenic variation between the various mining areas. Impacts to the Cultural Landscape are considered to include the erosion of the sense of remoteness with the addition of the additional mining infrastructure, there is considerable evidence of prospecting throughout the area following years of such activity. There is an existing old mine at Ryst Kuil with shafts, ventilators, head gear and other infrastructure. While some negative impact on the landscape is unavoidable in such projects, rehabilitation of the landscape will be ongoing and possible by the end of the lifespan of the mine.

The Cultural Landscape has been given a field grading of IIIC.

Due to the lack of screening in the context of wide open vistas, there is a potential for visual impact from tailings dumps in the flat, Karoo landscape but farmsteads are sparse and the R61 has not been given a scenic grading.

There are two farm houses in the study area which contain 19th century fabric; namely Kat Doorn Kuil and Neverset. Both have been given a field grading of Grade IIIC because of their derelict condition. Kat Doorn Kuil is not threatened directly, as the proposed route of the haulage road has changed and it no longer runs past the farmhouse. The haulage road, does however, run in close proximity to Neverset. It is recommended that:

- Mine workers do not have access to the abandoned farmhouses of Neverset and Kat Doorn Kuil, which both have IIIC significance;
- No demolition or alteration of any farm buildings older than 60 years may be undertaken without an assessment of the significance of the buildings by the heritage authority;
- The use of abandoned farm buildings for mining accommodation is encouraged. The approval of the relevant heritage compliance authority is necessary if the buildings are older than 60 years;
- The position of the TSF, midway between the N1 and the R61 is intended to avoid maximum impacts to these roads and the Cultural Landscape. The visibility of mining activities on the R61 will be low and there is not anticipated to be any significant impact on the N12.

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THE PROPOSED RYST KUIL URANIUM MINE, BEAUFORT WEST MUNICIPALITY, WESTERN CAPE PROVINCE, SOUTH AFRICA

Landscape & Visual Impact Assessment

Draft_V1 (Pending EIA comments)

DATE: 10 July 2025

Document prepared for Aquatox Consulting (Pty) Ltd
On behalf of Lukisa Invest 100 (Pty) Ltd



Visual Resource Management Africa cc
P O Box 7233, George, 6531
Cell: +27 (83) 560 9911
E-Mail: steve@vrma.co.za
Web: www.vrma.co.za



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LIST OF 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>DEM</i>	Digital Elevation Model
<i>DoC</i>	Degree of Contrast
<i>EIA</i>	Environmental Impact Assessment
<i>EMPr</i>	Environmental Management Plan
<i>GIS</i>	Geographic Information System
<i>GPS</i>	Global Positioning System
<i>IDP</i>	Integrated Development Plan
<i>IEMA</i>	Institute of Environmental Management and Assessment (United Kingdom)
<i>KOP</i>	Key Observation Point
<i>LVIA</i>	Landscape and Visual Impact Assessment
<i>MAMSL</i>	Metres above mean sea level
<i>NELPAG</i>	New England Light Pollution Advisory Group
<i>PNR</i>	Private Nature Reserve

<i>SDF</i>	Spatial Development Framework
<i>SEA</i>	Strategic Environmental Assessment
<i>VAC</i>	Visual Absorption Capacity
<i>VIA</i>	Visual Impact Assessment
<i>VRM</i>	Visual Resource Management
<i>VRMA</i>	Visual Resource Management Africa
<i>ZVI</i>	Zone of Visual Influence

GLOSSARY OF TECHNICAL TERMS

Technical Terms Definition (Oberholzer, 2005)

Degree of Contrast	The measure in terms of the form, line, colour and texture of the existing landscape in relation to the proposed landscape modification in relation to the defined visual resource management objectives.
Visual intrusion	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”.
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.
Viewshed	The outer boundary defining a view catchment area, usually along crests and ridgelines. Similar to a watershed. This reflects the area, or the extent thereof, where the landscape modification would probably be seen.
Visual Absorption Capacity	The potential of the landscape to conceal the proposed project.

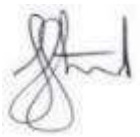
Technical Term Definition (USDI., 2004)

Key Observation Point	Receptors refer to the people located in the most critical locations, or key observation points, 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.
Visual Resource Management	A map-based landscape and visual impact assessment method development by the Bureau of Land Management (USA).
Zone of Visual Influence	The ZVI is defined as ‘the area within which a proposed development may have an influence or effect on visual amenity.’

1 DFFE SPECIALIST REPORTING REQUIREMENTS

1.1 Specialist declaration of independence

Table 1. Specialist declaration of independence

<p>All intellectual property rights and copyright associated with VRM Africa’s services are reserved, and project deliverables, including electronic copies of reports, maps, data, shape files and photographs, may not be modified or incorporated into subsequent reports in any form, or by any means, without the written consent of the author. Reference must be made to this report, should the results, recommendations or conclusions in this report be used in subsequent documentation. Any comments on the draft copy of the Visual Impact Assessment (VIA) must be put in writing. Any recommendations, statements or conclusions drawn from, or based upon, this report, must make reference to it.</p> <p>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 this VIA. I, Stephen Stead, hereby declare that VRM Africa, an independent consulting firm, has no interest or personal gains in this project whatsoever, except receiving fair payment for rendering an independent professional service.</p>  <p>Stephen Stead <i>APHP accredited VIA Specialist</i></p>

1.2 Specialist report requirements in terms of Appendix 6 of the EIA Regulations (2014), as amended in 2017

Table 2: Specialist report requirements table

A specialist report prepared in terms of the Environmental Impact Regulations of 2014 (as amended in 2017) must contain:	Relevant section in report
Details of the specialist who prepared the report	Stephen Stead, owner / director of Visual Resource Management Africa. steve@vrma.co.za Cell: 0835609911
The expertise of that person to compile a specialist report including a curriculum vitae	Registration with Association of Professional Heritage Practitioners
A declaration that the person is independent in a form as may be specified by the competent authority	Table 1

A specialist report prepared in terms of the Environmental Impact Regulations of 2014 (as amended in 2017) must contain:	Relevant section in report
An indication of the scope of, and the purpose for which, the report was prepared	Terms of Reference
A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Baseline Assessment
The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	2 nd and 3 rd May 2025. Seasonal variation not relevant to the site survey.
A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Methodology
Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternative;	Baseline Visual Inventory
An identification of any areas to be avoided, including buffers	Visual Resource Management Classes
A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Visual Resource Management Classes Overlay Map
A description of any assumptions made and any uncertainties or gaps in knowledge;	Assumptions and Limitations
A description of the findings and potential implications of such findings on the impact of the proposed activity or activities	Visual Impact Assessment
Any mitigation measures for inclusion in the EMPr	Environmental Management Plan
Any conditions for inclusion in the environmental authorisation	NA
Any monitoring requirements for inclusion in the EMPr or environmental authorisation	NA
A reasoned opinion as to whether the proposed activity or portions thereof should be authorised	Opportunities and Constraints
Regarding the acceptability of the proposed activity or activities; and	Conclusion
If the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	The proposed development should be authorised with mitigation.
A description of any consultation process that was undertaken during the course of carrying out the study	Pending EIA PPP
A summary and copies if any comments that were received during any consultation process	Pending EIA PPP
Any other information requested by the competent authority.	Pending EIA PPP

1.3 DFFE Screening Tool Site Sensitivity Verification

In terms of Part A of the Assessment Protocols published in GN 320 on 20 March 2020, site sensitivity verification is required relevant to the DFFE Screening Tool. No landscape issues were flagged in the Screening Tool. As the area is located in a tourist area where landscapes are being used as a visual resource, visual input into the proposed development was a requirement.

2 EXECUTIVE SUMMARY

Visual Resource Management Africa CC (VRMA) was appointed by Aquatox Consulting (Pty) Ltd to undertake a **Landscape and Visual Impact Assessment** for proposed Ryst Kuil Uranium Mine on behalf of Lukisa Invest 100 (Pty) Ltd. The Proponent proposes to construct a Uranium Mine on a site located in Beaufort West Local Municipality. This assessment builds on the previous landscape and visual *scoping* report undertaken by VRMA in 2008. As a component of the updated study, a site visit was undertaken on 2nd and 3rd of May 2025. As no new detailed planning for the proposed mine was provided, information from the 2017 EIA was used to inform the nature of the mining landscape change. Should more recent mining plans be made available, the LVIA report would need to be updated accordingly.

CONCLUSION

The findings of the Landscape and Visual Impact Assessment **support the authorisation of the proposed mine with appropriate mitigation measures in place**. Owing to the site's remoteness and the undulating regional topography, the visual extent of most mining infrastructure and landform changes is expected to result in lower levels of visual intrusion, with the blast plume/ dust from moving vehicles representing the most visually prominent and regionally influential element. While the broader Karoo landscape holds regional significance, the immediate site area is relatively flat and lacks distinctive landforms, reducing its sensitivity to visual change. Furthermore, the mine is located at a considerable distance from major roads, approximately 2 km (avg.) from the R61 and 13 km from the N14, and is surrounded by a sparse distribution of rural receptors, particularly within the Foreground to Midground viewing zones. As such, the anticipated visual changes are not considered a Fatal Flaw, provided that mitigation measures are implemented to address key visual elements such as blast plumes, Waste Rock Dumps (WRD) shaping, and dust and light management.

Due to the high visual contrast introduced by the Waste Rock Dumps, Tailings Storage Facility, and Process Plant, the proposed mining activities will result in residual impacts to the local landscape character. As such, any decision to authorise the mine should acknowledge that the existing deep Karoo landscape context within a 12 km radius of the site will be irreversibly altered and effectively lost.

In conclusion, the proposed mining activities will result in a definite and largely irreversible negative visual impact, particularly at the local scale, where significant alteration of natural landforms and the introduction of industrial elements will degrade the landscape character. While the regional impact is moderated by the site's remoteness and limited number of receptors, the Zone of Visual Influence remains extensive due to the dispersed layout of mining clusters and the episodic presence of blast plumes. Visual significance is rated Medium to High without mitigation, especially during construction. However, with effective WRD shaping, dust control, and rehabilitation efforts, the residual impact can be reduced to Medium. Despite the limited mitigability and low reversibility of the pit voids, careful visual management and closure planning will be essential to minimise long-term degradation, particularly given the site's location within a sensitive Karoo landscape.

POLICY FIT: Medium to High Positive

In terms of regional and local planning fit for planned landscape and visual related themes, the **expected visual/ landscape policy fit of the landscape change is rated Medium to High Positive**. Both the District and Local Municipality planning documents are well informed about

the opportunities and threats of mining in the region. Opportunities for employment and economic growth are supported, but only with a clear recognition of risks such that can be more effectively addressed. Specifically, the risks from negative impacts to environmental health and human wellbeing. Also highlighted as a risk is the importance of effective rehabilitation of the post-closure mine-scapes to ensure that landscape degradation does not take place in a post mining scenario, such that tourism related landscapes are visually degraded.

As the regional planning also falls within the Beaufort West REDZ11 area, renewable energy projects are being attracted to the area. There are a number of large-scaled wind farms proposed to the southwest of the proposed mine site. While a Solar PV development would result in limited cumulative effects, intervisibility of the wind turbines has the potential to result in significant change to the current 'wilderness' sense of place. **Careful landscape planning and design are critical to avoid undermining the aesthetic and cultural values that define this distinctive region.**

METHODOLOGY

Visual Resource Management

The methodology for determining landscape significance is based on the United States Bureau of Land Management's Visual Resource Management (VRM) method (USDI., 2004). This GIS-based method allows for increased objectivity and consistency by using standard assessment criteria to classify the landscape type into four VRM Classes, with Class I being the most valued and Class IV, the least. The Classes are derived from *Scenic Quality*, *Visual Sensitivity Levels*, and *Distance Zones*. Specifically, the methodology involved: site survey; review of legal framework; determination of Zone of Visual Influence (ZVI); identification of Visual Issues and Visual Resources; assessment of Potential Visual Impacts; and formulation of Mitigation Measures.

VISUAL ABSORPTION CAPACITY

Low

Land use is a crucial factor in determining landscape character, especially regarding the Visual Absorption Capacity (VAC) of the landscapes. Oberholzer defines VAC as the potential of the landscape to conceal the proposed project (Oberholzer, 2005). i.e.

- High VAC – e.g., effective screening by vegetation and structures.
- Moderate VAC - e.g., partial screening by vegetation and structures.
- Low VAC - e.g., little screening by vegetation or structures.

According to the **2012 Vegetation Map of South Africa, Lesotho, and Swaziland** (South African National Biodiversity Institute, 2012), the project area is situated within the Nama-Karoo Biome. The dominant vegetation type across the study area is **Gamka Karoo**, with two sections of **Southern Karoo Rivière** associated with low-lying drainage lines. Apart from the small waste rock dump associated with the historic uranium mine, the landscape is characterised by deep arid-zone sheep farming with minimal structural development. Of particular relevance to the proposed project is the combination of flat terrain and sparse vegetation cover, which significantly limits the receiving landscape's capacity to visually absorb mining-related changes. Consequently, the **Visual Absorption Capacity (VAC)** is rated as **Low**.

ZONE OF VISUAL INFLUENCE:

Moderate

The visible extent, or viewshed, is "the outer boundary defining a view catchment area, usually along crests and ridgelines" (Oberholzer, 2005). In order to define the extent of the possible

influence of the proposed project, a viewshed analysis was undertaken from the proposed site at a specified height above ground level. The Zone of Visual Influence (ZVI) is classified as regional in scale and rated as **moderate in visual extent**, based on the following considerations:

- The relative height of the mine infrastructure and Waste Rock Dumps (WRDs), when contrasted with the generally flat Karoo terrain, results in clear visual incidence within the foreground and mid-ground zones. While the viewshed becomes fragmented beyond approximately 6 km—particularly to the north, east, and south due to intervening higher terrain—it extends up to 12 km in flatter terrain, primarily to the north and south.
- The ZVI is largely contained within the broader regional watershed, with the visual extent unlikely to exceed a 12 km radius from the proposed mine site.

VISUAL EXPOSURE: Medium to High.

Due to the close proximity of receptors located on isolated farmsteads and along the R61 road, visual exposure is rated as High. However, some moderation of this exposure is expected as a result of the average 1 km setback from most receptors. Taking this into account, the **overall visual exposure is rated as Medium to High.**

RECEPTORS AND KOPS: Multiple Receptors/ Six KOPs

Key Observation Points (KOPs) are 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. The following list of Key Observation Points were used to assess the intensity of the proposed mining landscape change.

KOP	Landuse	Distance
N14 National Road	National Road Tourist View Corridor	13km
Ryst Kuil Extension Access Road	Farm Access Road	200m
Farm 360 Labour Tenants	Residential	815m
Farmstead RE/352	Residential	5.1km
DR2370	Road	100m
R61	Road / Tourist View Corridor	2.6km

SCENIC QUALITY: Medium

The landscape within the project's zone of visual influence is defined by gentle undulations with few prominent landforms. Vegetation is relatively uniform, dominated by Gamka Karoo and Southern Karoo Riviere types, offering limited visual diversity. Water features are minimal and do not act as focal points, and the colour palette—mainly muted grey-browns—has low visual prominence. No protected or eco-tourism landscapes were identified in the area, although the broader Nama-Karoo region holds cultural and scenic value due to its largely unmodified nature and scattered Karoo farmsteads.

RECEPTOR SENSITIVITY: Medium to High

The primary landscape users in the area are remote farming communities; however, tourist receptors travelling along the main roads to the north and south of the proposed mining site

are likely to demonstrate higher sensitivity to visual degradation resulting from mining activities. While the northern extent of the mine is subject to high visual exposure, the majority of the proposed landscape change areas are set back and spaced from key receptors. Some sections fall within 'Seldom Seen' landscape zones, where only the most prominent mining landforms would be visible. Although the site itself contains no formally protected areas or landscapes designated as Special Areas, the broader setting holds cultural significance as part of the iconic Karoo landscape. As such, a diversity of perceptions is anticipated: some community members—particularly those seeking employment—may view the mine as a positive development, while others, particularly long-established rural communities, are likely to perceive the landscape change negatively due to the disruption of the established Karoo sense of place. Together, these factors support the assignment of a **medium to high sensitivity** rating to landscape change within the study area.

VISUAL RESOURCE MANAGEMENT ASSESSMENT

The BLM has defined four Classes that represent the relative value of the visual resources of an area and are defined making use of the VRM Matrix:

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

VRM Class I

Class I is assigned when legislation restricts development in certain areas, or when very high visual intrusion or loss of significant landscape resources is likely to take place. The level of change to the characteristic landscape should be very low and must not attract attention. A Class I visual objective was assigned to the following features within the proposed development area due to their protected status within the South African legislation:

- **Generic Landscape Issues**
 - Rivers / streams, wetlands and associated flood lines buffers identified as found significant by the Aquatic Biodiversity Specialist.
 - Vegetation areas (or plant species) identified as having a high significance by the Botanical Specialists.
 - Heritage area identified as having a high significance as defined by the Heritage Specialist.
- **Landscape Specific Issues**
 - **Not applicable.**

No significant landscapes that are being used as visual resources were identified in the project zone of visual influence.

VRM Class II

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. The proposed development 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.

- **Southern Karoo Riviere.**
- **R61 View corridor 2km Buffer.**
- **Ridgeline Buffer 100m.**

While not significant in their own right, collectively these landscape features do add to the scenic quality and visual resources related to eco-tourism planning emphasised in the local and regional planning documents. Given that this is the first mining to take place in the region, a positive mining framing should be incorporated into the design such that landscape degradation can be reduced to a minimum as seen from scenic routes and isolated Karoo farmsteads that are a key component of the cultural landscape. The recommendation is that a 2km buffer along the R61 is retained as a non development area, and that the northern, low ridgeline is used as a natural topographic screening landform. With the exception of the Waste Rock Dump (WRD), most of the mining activities are located to the south of this ridgeline, allowing some retention of the sense of place of the R61 receptors, as well as the two local farmsteads located with Very High Visual Exposure. It is recommended that the WRD is re-located to the south of the ridgeline, as this would allow some nature landform massing to the north of the WRD, reducing the massing effect of the WRD.

VRM Class III

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. The following landscape was defined as having Class III Visual Objectives where development would be most suitable:

- **Gamka Karoo.**

Owing to their moderate scenic value and likely lower receptor sensitivity these remote areas, broadly classified as 'Seldom Seen', are considered suitable for development, subject to the implementation of appropriate mitigation measures. These should include the removal of all mining structures post-closure, the shaping of the Waste Rock Dump (WRD), effective dust control from vehicular movement throughout the life of mine, and the minimisation of night-time light spillage to reduce visual intrusion.

VRM Class IV

The Class IV objective is to provide for management activities that require major modifications of the existing character of the landscape. The level of change to the landscape can be high, and the proposed development may dominate the view and be the major focus of the viewer's (s') attention without significantly degrading the local landscape character. Due to the degraded sense of place, the following areas were rated Class IV:

- **Not applicable**

With the exception of a small portion of the old Ryst Kuil Uranium Mine—which has undergone partial rehabilitation—no degraded or industrial-type landscapes were identified within the project's zone of visual influence. In recognition of the need to maintain the broader regional landscape character, no Class IV areas (i.e., areas deemed suitable for development without mitigation) have been defined for either the operational or post-mining phases of the project. As some components of the mine landscape change will include industrial developments that are Class IV in nature (i.e. high levels of visual contrast will occur), some residual impact to local area landscape will occur.

KEY MITIGATIONS PROPOSED

The following key mitigations would be required to assist in reducing the visual intensity of the proposed mine landscape change.

- Design waste rock dumps such that they can appear as a more organic form.
- Dust mitigation for moving vehicles.
- Restriction in height of waste rock dumps to less than 40m in height.
- Light spillage mitigation.
- Colour mitigation for structures.
- Effective communication regarding blast timings.
- Shaping of waste rock dump and tailing crests on closure.
- Removal of disused processing plants/ structures post closure.
- Rehabilitation and restoration of the impacted areas

3 INTRODUCTION

Visual Resource Management Africa CC (VRMA) was appointed by Aquatox Consulting (Pty) Ltd to undertake a **Visual Impact Assessment** for proposed Ryst Kuil Uranium Mine on behalf of Lukisa Invest 100 (Pty) Ltd. The Proponent proposes to construct a Uranium Mine on a site located in Beaufort West Local Municipality. This assessment builds on the previous landscape and *visual scoping report* undertaken by VRMA in 2008.

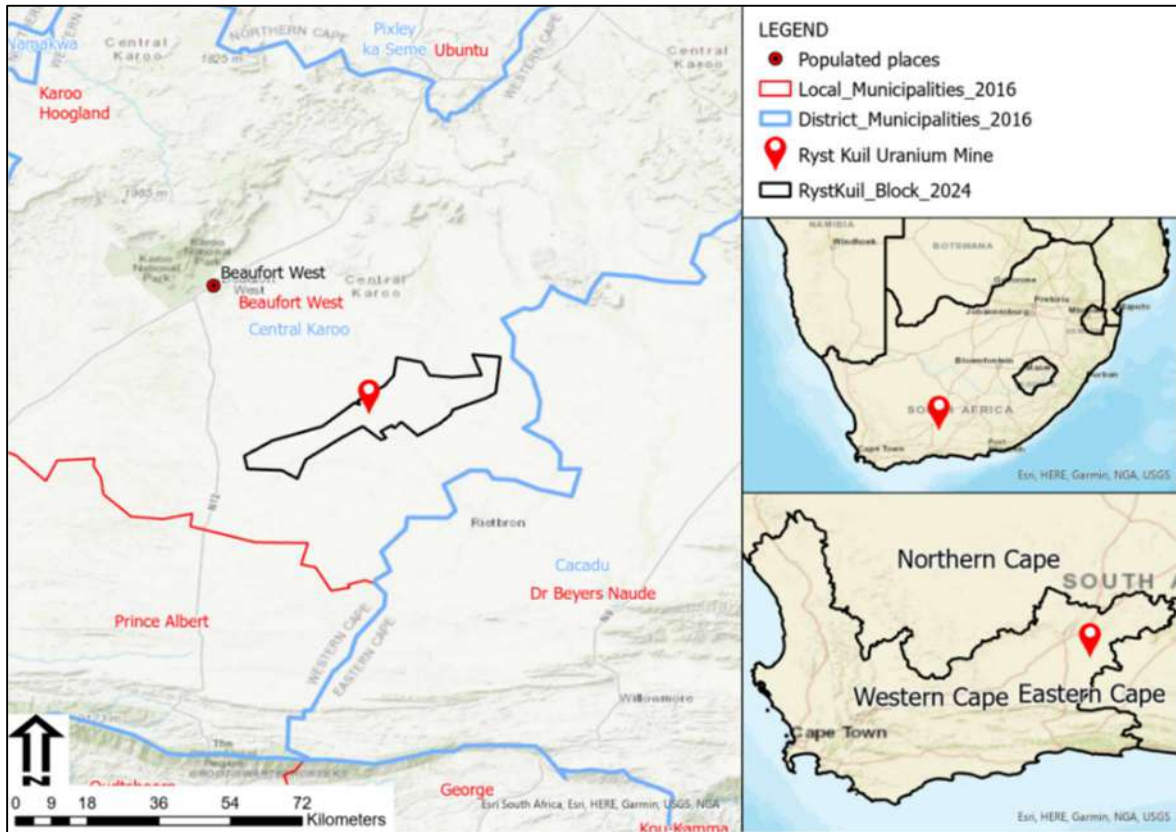


Figure 1: National and regional locality map.

3.1 Terms of Reference

The scope of this study is to cover the entire proposed project area. The broad terms of reference for the study are as follows:

- Collate and analyse all available secondary data relevant to the affected proposed project area. This includes a site visit of the full site extent, as well as of areas where potential impacts may occur beyond the site boundaries.
- Specific attention is to be given to the following:
 - Quantifying and assessing existing scenic resources/visual characteristics on, and around, the proposed site.
 - Evaluation and classification of 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, operation and decommissioning phases of the proposed project.
- Assessing the potential cumulative impacts associated with the visual impact.
- Generate photomontages of the proposed landscape modification.
- Identifying possible mitigation measures to reduce negative visual impacts for inclusion into the proposed project design, including input into the Environmental Management Programme report (EMPr).

3.2 Study Team

Contributors to this study are summarised in the table below.

Table 3: Authors and contributors to this report.

Aspect	Person	Organisation / Company	Qualifications
Landscape and Visual Assessment (author of this report)	Stephen Stead MSc Geography, 2023 (UKZN, Pietermaritzburg)	Visual Resource Management Africa CC	<ul style="list-style-type: none"> • 20 years of experience in visual assessments including 230 large scale landscape changes in five sub-Saharan African countries. • Registered with the Association of Professional Heritage Practitioners since 2014.

3.3 Visual Assessment Approach

The full methodology used in the assessment can be found in Annexure B, with this section outlining the key elements of the assessment process. 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 (USDI., 2004). This mapping and GIS-based method of assessing landscape modifications allows for increased objectivity and consistency by using standard assessment criteria.

- *“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 the basic design elements of form, line, colour, and texture, which have often been used to describe and evaluate landscapes, to also describe proposed projects. Projects that repeat these design elements are usually in harmony with their surroundings; those that don’t create contrast. By adjusting project designs so the elements are repeated, visual impacts can be minimized” (USDI., 2004).*

Baseline Phase Summary

The VRM process involves the systematic classification of the broad-brush landscape types within the receiving environment into one of four VRM Classes. Each VRM Class is associated with management objectives that serve to guide the degree of modification of the proposed site. The Classes are derived by means of a simple matrix with the three variables being the scenic quality, the expected receptor sensitivity to landscape change, and the distance of the proposed landscape modification from key receptor points. The Classes are not prescriptive and are utilised as a guideline to determine visual carrying capacity, where they represent the relative value of the visual resources of an area. Classes I and II are the most valued, Class III represents a moderate value; and Class IV is of least value. The VRM Classes are not prescriptive and are used as a guideline to determine the carrying capacity of a visually preferred landscape as a basis for assessing the suitability of the landscape change associated with the proposed project.

Table 4: VRM Class Matrix table

		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

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

The visual objectives of each of the classes are listed below:

- The Class I objective is to preserve the existing character of the landscape and the level of change to the characteristic landscape should be very low and must not attract attention. Class I is assigned when a decision is made to maintain a natural landscape.
- 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. The proposed development may be seen but should not attract the attention of the casual observer, and should repeat the basic elements of form, line, colour and texture found in the predominant natural features of the characteristic landscape.
- The 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. The proposed development 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; and
- The Class IV objective is to provide for management activities that require major modifications of the existing character of the landscape. The level of change to the landscape can be high, and the proposed development may dominate the view and be

the major focus of the viewer's (s') attention without significantly degrading the local landscape character.

Impact Phase Summary

To determine impacts, a degree of contrast exercise is undertaken. This is an assessment of the expected change to the receiving environment in terms of the form, line, colour and texture, as seen from the surrounding Key Observation Points. This determines if the proposed project meets the visual objectives defined for each of the Classes. If the expected visual contrast is strong, mitigation recommendations are to be made to assist in meeting the visual objectives. To assist in the understanding of the proposed landscape modifications, visual representation, such as photomontages or photos depicting the impacted areas, can be generated. There is an ethical obligation in the visualisation process, as visualisation can be misleading if not undertaken ethically.

3.4 VIA Process Outline

The following approach was used in understanding the landscape processes and informing the magnitude of the impacts of the proposed landscape modification. The table below lists a number of standardised procedures recommended as a component of best international practice.

Table 5: Methodology Summary table

Action	Description
Site Survey	The identification of existing scenic resources and sensitive receptors in and around the study area to understand the context of the proposed development within its surroundings to ensure that the intactness of the landscape and the prevailing sense of place are taken into consideration.
Project Description	Provide a description of the expected project, and the components that will make up the landscape modification.
Reviewing the Legal Framework	The legal, policy and planning framework may have implications for visual aspects of the proposed development. The heritage legislation tends to be pertinent in relation to natural and cultural landscapes, while Strategic Environmental Assessments (SEAs) for renewable energy provide a guideline at the regional scale.
Identifying Visual Issues and Visual Resources	Visual issues are identified during the public participation process, which is being carried out by others. The visual, social or heritage specialists may also identify visual issues. The anticipated significance of the proposed landscape change is defined, with the extend of the scope of work outlined.
Determining the Zone of Visual Influence	This includes mapping of viewsheds and view corridors in relation to the proposed project elements, in order to assess the zone of visual influence of the proposed project. Based on the topography of the landscape as represented by a Digital Elevation Model, an approximate area is defined which provides an expected area where the landscape modification has the potential to influence landscapes (or landscape processes) or receptor viewpoints.

Action	Description
Assessing Potential Visual Impacts	An assessment is made of the significance of potential visual impacts resulting from the proposed project for the construction, operational and decommissioning phases of the project. The rating of visual significance is based on the methodology provided by the Environmental Assessment Practitioner (EAP).
Formulating Mitigation Measures	Possible mitigation measures are identified to avoid or minimise negative visual impacts of the proposed project. The intention is that these would be included in the project design, the Environmental Management Programme report (EMPr) and the authorisation conditions.

3.5 Impact Assessment Methodology

As generic environmental impact criteria used by EAPs often don't adequately reflect the nature of landscape and visual impacts, the criteria used to define the impacts were those defined by the Western Cape *DEA&DP Guideline for involving Visual and Aesthetic Specialists in EIA Processes* (Oberholzer, 2005).

The **extent** of a visual impact refers to the geographic area it influences, ranging from *site-related* (limited to the development footprint), to *local* (affecting immediate surroundings), *regional* (covering broader municipal or regional areas), *national* (impacting significant parts of the country), or *international* (extending across borders). The **duration** of the impact considers its lifespan, which may be *short term* (e.g., limited to the construction phase), *medium term* (such as the time required for screening vegetation to mature), *long term* (aligned with the operational life of the project), or *permanent*, where natural processes are unlikely to mitigate the impact. The **intensity** reflects the degree to which views, scenic quality, or cultural landscape resources are affected—ranging from *low* (minimal effect), *medium* (moderate alteration), to *high* (significant visual degradation). The **probability** assesses the likelihood of the impact occurring and may be rated as *improbable*, *probable*, *highly probable*, or *definite*, depending on the certainty of occurrence. Finally, **significance** synthesises all these criteria to assess how the visual impact should influence decision-making. An impact may be considered *low* (unlikely to affect decisions), *medium* (influential unless mitigated), or *high* (likely to influence decisions regardless of mitigation efforts).

3.6 Assumptions and Uncertainties

- Digital Elevation Models (DEM) and viewsheds were generated using ASTER elevation data (NASA, 2009). Although every effort to maintain accuracy was undertaken, as a result of the 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. Thus, specific features identified from the DEM and derive contours (such as peaks and conical hills) would need to be verified once a detailed survey of the project area has taken place.
- The use of open-source satellite imagery was utilised for base maps in the report.
- Some of the mapping in this document was created using Bing Maps, Open-Source Map, ArcGIS Online and Google Earth Satellite imagery.

- 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.
- 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.
- As access to farms and private property is often limited due to security reasons, limiting access to private property in order that photographs from specific locations are taken. 3D modelling is used to reflect the expected landscape change area where applicable.
- Mapping makes use of the SANBI BGIS webmap (SANBI, 2018)
- The slopes analysis is approximate and is subject to detailed survey and detailed slopes analysis.

4 PROJECT DESCRIPTION

The following project information was provided by the client that will be incorporated into the assessment and proposed infrastructure relating to the project. The following table outlines the scope of the project, with reference to the extent, heights, and expects landscape change depiction as provide by the proponent/ architects involved in the project design and development.

Table 6: Project Information table

PROPONENT SPECIFICATIONS	
Applicant Details	Description
Applicant Name:	Lukisa Invest 100 (Pty) Ltd
Project Name:	Ryst Kuil Uranium Mine

As no new heights information was provided, the assessment made use of the previous mine planning from the 2017 assessment for 3D modelling and viewshed analysis.

The following height specific information has relevance:

- The waste rock dumps will not exceed a height of 20m.
- TSF wall height 25m.
- Plant ~ 6 m.

Table 7: Project technology table per Property Description

TECHNOLOGY DETAILS			
NAME OF ACTIVITY (All activities including activities not listed)	Aerial extent of the Activity Ha or m ²	LISTED ACTIVITY	APPLICABLE LISTING NOTICE
Ryst Kuil 351 RD ptn RE:			
Land use: Agriculture to Mining	7251,9003 Ha	X	GN R983 Activity 28
Chemicals at the CPP <ul style="list-style-type: none"> - Sulphuric Acid (24 634t) - Pyrolusite (1080t) - Flocculant (66t) - Alamine (10m³) - Isodecanol (10m³) - Kerosene (54m³) - Sodium Carbonite (106t) - Ammonium Hydroxide (148t) - Burnt Lime (1038t) - Diesel (~75m³) - Oil (~25m³) - Hydraulic fluid (tbd) 	Combined >500m ³ (tbd)	X	GN R984 Activity 4
CPP; TSF	217ha	X	GN R984 Activity 15 NWA S21g
Mining and mining related infrastructure: Open pit and underground operations CPP, TSF, Milling, Crushing	217 Ha	X	GN R983 Activity 12 GN R983 Activity 19 GN R984 Activity 15 GN R984 Activity 17 NWA S21j, S21a, S21g
Beneficiation plant	24Ha	X	GN R984 Activity 6 GN R984 Activity 21 GNR893 Category 4.1
Tailings Stockpile	193ha	X	GN R984 Activity 15 GN R984 Activity 6 GN R 632 & GN R633 GN R921 Category B(11) NWA S21g
ROM Stockpiles;	51ha	X	GN R984 Activity 15 GN R984 Activity 6 GN R921 Category B(11) NWA S21g
Water storage-reservoir; silt traps; Pollution control dam.	Volumes t.b.d	X	GN R983 Activity 12 GN R921 Category B(11) NWA: S21 a, b, g
Haul road (Mining operation not for public use)		X	GN R984 Activity 15 GN R984 activity 17

Ryst Kuil (351 RD Ptn 2)			
Land use: Agriculture to Mining	698,2151Ha	X	GN R983 Activity 28
Pit RKA1; RKA 2; RKA 3; RKA 4; RKA 5,	2.8ha; 46.72ha; 3.9ha; 2.8 ha; 3.1ha	x	GN R984 Activity 15 GN R 983 activity 21 GN R 984 activity 15 GN R 984 activity 17 GN R 984 activity 21
Back fill of most pits	~53ha	X	GN R984 Activity 6 NWA S21g
3 x stockpiles	19.5; 6.4; 3.5ha	X	GN R984 Activity 6 GN R921 Category B(11)
Haul road (Mining operation not for public use)		X	GN R984 activity 17 GN R983 activity 19 GN R 985 activity 4
Kat Doorn Kuil ptn RE			
Pit RKM1; RKM 2; RKM 3	17.5ha; 7.4ha; 6.5ha;	x	GN R 983 activity 21 GN R 984 activity 15 GN R 984 activity 17 GN R 984 activity 21
Back fill of most pits	~24ha	X	GN R984 Activity 6 NWA S21g
1 x stockpiles	36.8ha	X	GN R984 Activity 15 GN R984 Activity 6 GN R921 Category B(11)
Haul road (Mining operation not for public use)		X	GN R984 activity 17 GN R983 activity 19 GN R 985 activitv 4
Kant Kraal ptn RE			
Land use: Agriculture to Mining	6905,8035 Ha	X	GN R983 Activity 28
Pit RKE1; RKE 2; RKE3; RKE4; RKE5; RKE6; RKE7; RKE8; RKE9	2.2; 2.7; 3.6; 3.2; 8.2; 3.4; 10.2; 5.5; 2.4	x	GN R 983 activity 21 GN R 984 activity 15 GN R 984 activity 17 GN R 984 activity 21
Back fill of most pits	~35ha	X	GN R984 Activity 6 NWA S21g
5 x stockpiles	9.3ha; 5.6ha; 4.2ha; 13ha; 13ha.	X	GN R984 Activity 15 GN R984 Activity 6 GN R921 Category B(11) NWA S21g
Haul road (Mining operation not for public use)		X	GN R984 activity 17 GN R983 activity 19 GN R 985 activity 4

Haanekuil ptn 7:			
Land use: Agriculture to Mining	5572,09 Ha	X	GN R983 Activity 28
Pit HNK3; HNK6; HNK7; HNK8; HNK9; HNK10; HNK11; HNK12; HNK13; HNK14; HNK15; HNK16; HNK17,	14.8ha; 2.1ha; 2.2ha; 3.9ha; 8ha; 2.1ha; 3.4ha; 2.3ha; 4.4ha; 2.3ha; 5.7ha; 2.2ha; 2.1ha;	X	GN R 983 activitv 21 GN R 984 activity 15 GN R 984 activity 17 GN R 984 activity 21
Stockpiles	52.3ha	X	GN R984 Activity 6 Gf R921 Category B(11) NWA S21g
Back fill of most pits	~57ha	X	GN R984 Activity 6 NWA S21g
Haul road (Mining operation not for public use)		X	GN R984 activity 17 GN R983 activity 19 GN R 985 activity 4
Haanekuil ptn 7 & RE			
Land use: Agriculture to Mining	4007,9273Ha	X	GN R983 Activity 28
Pit HNK4; HNK5	1.8; 1.9;	X	GN R 983 activity 21 G R983 Activity 27 GN R 984 activity 17 GN R 984 activity 21
Back fill of pits	~3ha	X	GN R984 Activity 6 NWA S21g
Stockpile	3	X	GN R984 Activity 6 GN R921 Category B(11)
Haul road (Mining operation not for public use)		X	GN R984 activity 17 GN R983 activity 19 GN R 985 activity 4
Transportation road			
Development (4.5m x 51.5km) and widening (by 1.5m) and upgrade (9.9km) of tracks to roads	24.66 ha	X	GN R983 activity 12 GN R983 activity 19 GN R 985 activity 4
Bridges/culverts crossing drainage lines	>100m ²	X	GN R983 activity 12 NWA: S21 c & i.

4.1 Nature of the Landscape Change

The following images and photographs depict the expected nature of a large-scaled uranium mining operation. This is to inform I&APs/ Authorities of the expected nature of a large mine landscape change. The images pertain to the established Rossing Uranium Mine and proposed Bannerman Etango Uranium Mine in Namibia. As these mines are much larger, the proposed Ryst Kuil mine landscapes are likely to be less visually intrusive. As the images do represent a worst case scenario, they have been included.

Processing Plant

The processing plant is required to extract the uranium from the ore body. This is a process where extracted rock is crushed and milled separating the uranium bearing rock from waste rock. The surrounding area would also contain additional infrastructure related to the processing plant such as crushers, stockpiles, a conveyer system, handling systems for heap leach residue facility, uranium extraction and final product recovery, as well as workshops and offices. Modern changes in uranium mining show that the best mining method will be conventional open cast pit mining with the uranium extracted using acid leach processing. The ore-bearing rock and waste-rock material will be separated during excavation as far as possible.



Figure 2. Example of Rössing Uranium Limited Mine Plant that is well contained within the local valley topography and other than the white holding tanks, have a visually contained landscape context.

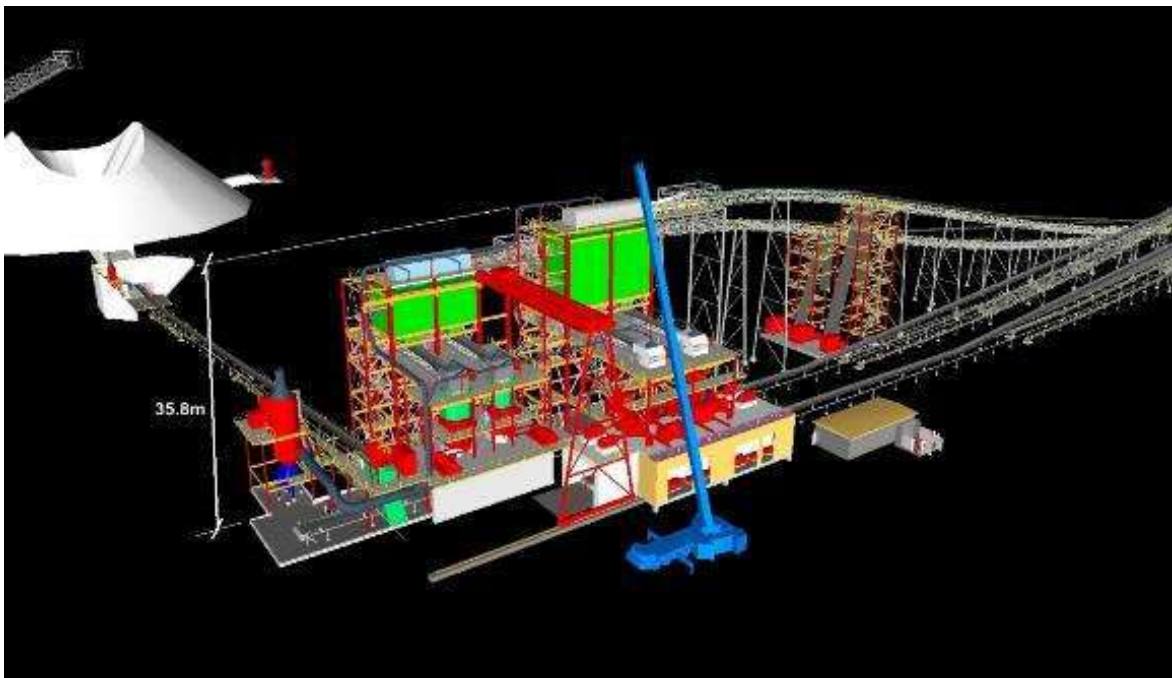


Figure 3: 3D Model view of a proposed Processing Plant (VRMA, 2012).

A processing plant and associated infrastructure could average at 20 metres with some of the higher structures being up to 45 metres. As indicated in the photograph below, the

lights at night would have a far reaching effect on the surrounding landscape. This is especially true if the plant is located in a prominent position and surrounded by a landscape that is open and horizontal and has existing dark sky such as in the Karoo.



Figure 4: Example of Processing Plant as seen at night

Source: Lumwana Plant, Zambia overview night. <http://www.miningweekly.com/equinox-uranium-project>

Open Pit

The mining method proposed is a conventional open pit truck and shovel operation, with underground mining also taking place. Benches are usually drilled on 12m cuts and blasted using conventional ammonium nitrate and fuel oil (ANFO), and in wet conditions emulsified blends of ammonium nitrate. Excavation of the blasted rock in nominal five metre cuts are completed using large hydraulic excavators (backhoe mode). Loaded rocks will be hauled from the pit using large payload haul trucks. Mining is likely to be scheduled to operate seven days a week, 365 days a year.



Figure 5: Rössing Uranium Limited Open Cut Pit (VRMA, 2012)



Figure 6: Oblique aerial photographic at Rössing Mine, Namibia as a (larger scaled) example of an Open Pit (<https://www.namibianuranium.org>, n.d.)

As the open pit is a void in the landscape, as opposed to an extrusion, the physical visual envelope would be limited and localised to the specific area where the landscape modification has been undertaken. The exception relates to the associated impact of the dust as a result of the mining activities which includes blasting, digging and hauling.

Potential Dust Impact from Blasting and Drilling

Dust is produced in many steps of the mining operations: the explosions to loosen the rock formation, the pulverizing and transporting operations associated with processing of the ore. Dust associated with open cast mines could potentially, depending on atmospheric conditions at the time, impact viewing clarity around key landscape viewpoints. The height of a blast plume can reach up to approximately 250 metres for a large blast. Blasting frequency is expected to take place of a weekly basis, with all seven days being available for the activity.



Figure 7. Example of blasting at Husab Mine, Namibia.
(<https://www.namibianuranium.org>, n.d.)

Coarse Ore Stockpile

The coarse ore stockpiles provide an economical means of storing large quantities of coarse ore in mining operations. The stockpile could potentially reach a height of 30m above normal ground level and 68.5m including the infrastructure. The diameter would be approximately 60m. There may be a requirement for a number of stockpiles or tip heads for different ore grades.

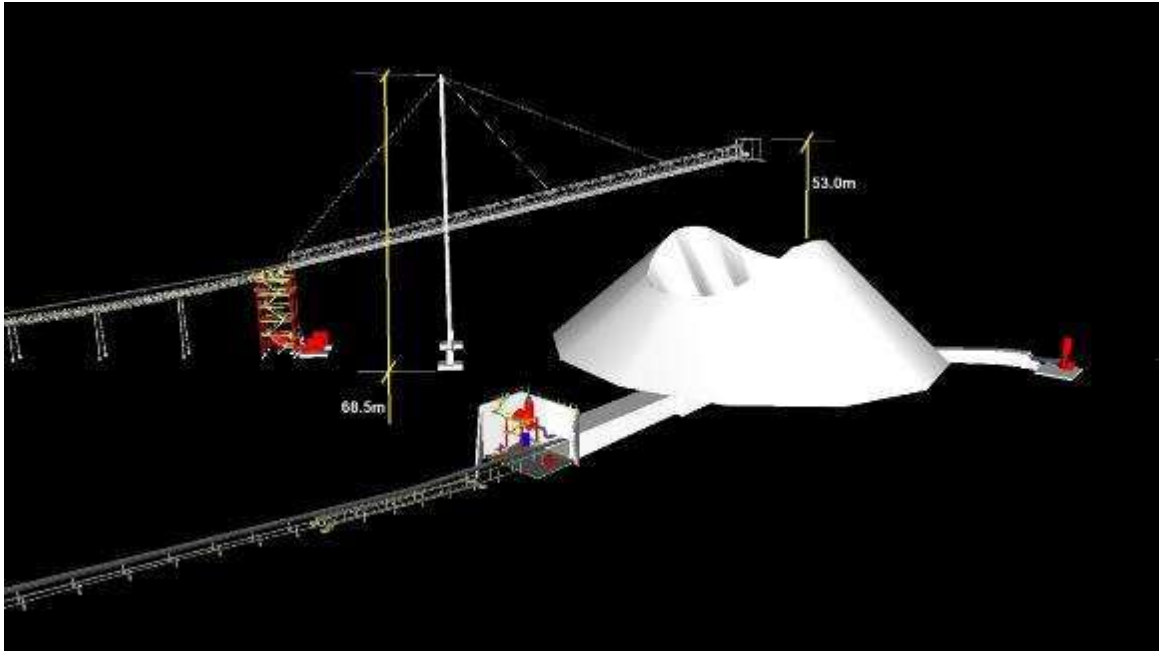


Figure 8: 3D example of Coarse Ore Stockpile and conveyor system (VRMA, 2012).



Figure 9. Example large scaled mine infrastructure of the Rio Tinto Rossing Uranium Mine stockpile (VRMA, 2012).

Waste Rock Dumps

Non uranium-bearing rock material is dumped at a site close to the open pit. The size and scale of the waste rock dumps (WRD) create large landscape modifications which can produce very strong forms, lines and colours. If they are located in prominent locations they can be visually intrusive.



Figure 10. Example of Waste Rock Dump tipping (Source: minerals.state.nv.us/MacArthurMineNews)



Figure 11. Example of Waste Rock Dumps post rehabilitation on the Langer Heinrich Uranium Mine (VRMA, 2012).

Waste rock is likely to be dumped externally to the mine. The waste dumps will be progressed by tipping from a higher level against a windrow and progressively pushing the waste rock out with a dozer. Surfaces of dumps could be contoured to minimise visibility and battered. All such rehabilitation work should be carried out progressively. Rock-lined drains shall be constructed, where required, to ensure excess runoff is controlled and directed down to sediment traps.



Figure 12. Example of Waste Rock Dumps benching at the Rio Tinto Rossing Uranium Mine (VRMA, 2012).

The linear and colour elements of the rock dumps can create high levels of contrast. However, the texturing is often similar to the rough texturing of arid landscape which can assist in reducing visual contrast if the WRD are shaped to appear natural. Their size and scale generate a very large viewshed. If not adequately managed and designed, these landscape modifications have the potential to transform the local sense of place.

Additional Infrastructure

Infrastructure elements included in the development of mines and processing plants include new access road to site, offices and workshops, power supply, water, fire water, fire detection and suppression, fuel storage and distribution, security, communications and sewage treatment and an explosive depot. The mine could also include housing of workers if the mine is remote.

Associated infrastructure would be smaller in context and scale but have visual implications which could influence the extent of the total visual envelope. An approximate general list of structures with a potential impact was compiled:

- Power lines.
- Water supply pipelines and storage reservoirs.
- Accommodation on site during construction offices, change room, mess, etc. during operation.
- Storage facilities.
- Sewerage works.
- Internal roads.
- External haul roads and dust from moving vehicles.

4.2 General Historical Background

Extracted from the Karoo Mineral Resource Estimation Report (2014) for Peninsular Energy Limited. (Peninsular Energy Limited, 2014) Page 24

The presence of uranium in the Main Karoo Basin was first noted in 1967, during radiometric logging of boreholes drilled by the Southern Oil Exploration Corporation (“SOEKOR”), in their search for inland oil and gas deposits.

Union Carbide Exploration Corporation (“UCEX”) was the first exploration company to take an interest in the Karoo, based on the similarity of these sediments and those hosting uranium on the Colorado Plateau in the USA. During a car-borne radiometric survey in 1970, uranium mineralisation was discovered on the farm Grootfontein in the Beaufort West

district. Follow-up operations led to the delineation of the Rietkuil deposit and submission of resource estimates to NUCOR in 1972.

Various exploration companies joined the subsequent 'uranium rush'. Vast areas were taken under option by various companies including Esso Minerals Africa Inc. ("Esso"), Johannesburg Consolidated Investments ("JCI") and Anglo American Corporation ("AAC") amongst others and prospecting continued over a period of 17 years between 1969 and 1985. The discovery sequence of the major uranium deposits in the Southern Karoo are summarised in the table below.

Table 8: Table of major uranium deposits in the Southern Karoo

Year	Deposit Name
1972	Rietkuil
1974	Vindragersfontein
1975	Damsfontein, Kaffersfontein
1976	Ryst Kuil
1977	Tierhok, Suurkop, Eselsfontein, Sandgat, Quaggasfontein
1978	Banksgaten, Bok Se Plaas, Swartkop, Blaauwhoogte, Klipbankskraal
1979	Kareepoort, De Pannen, Rondom, Plathoek, Dassieskloof, DR-3, GT-7, Agtersteland, Driefontein, De Goedehoop, Kraaifontein, Pauls Sypher
1980	Nieuwveldsfontein, Combrinckskraal
1981	Haanekuil, Davidskolk

(Peninsular Energy Limited, 2014)

The safety of nuclear power fell into disrepute after the Three Mile Island incident in the USA in 1979 and resulted in the curtailment of nuclear power projects. Utility selling of stockpiles created an oversupply in the uranium market and exploration for uranium lost momentum worldwide. Exploration efforts in the Karoo did not escape the depressed market conditions and were altogether stopped in early 1985.

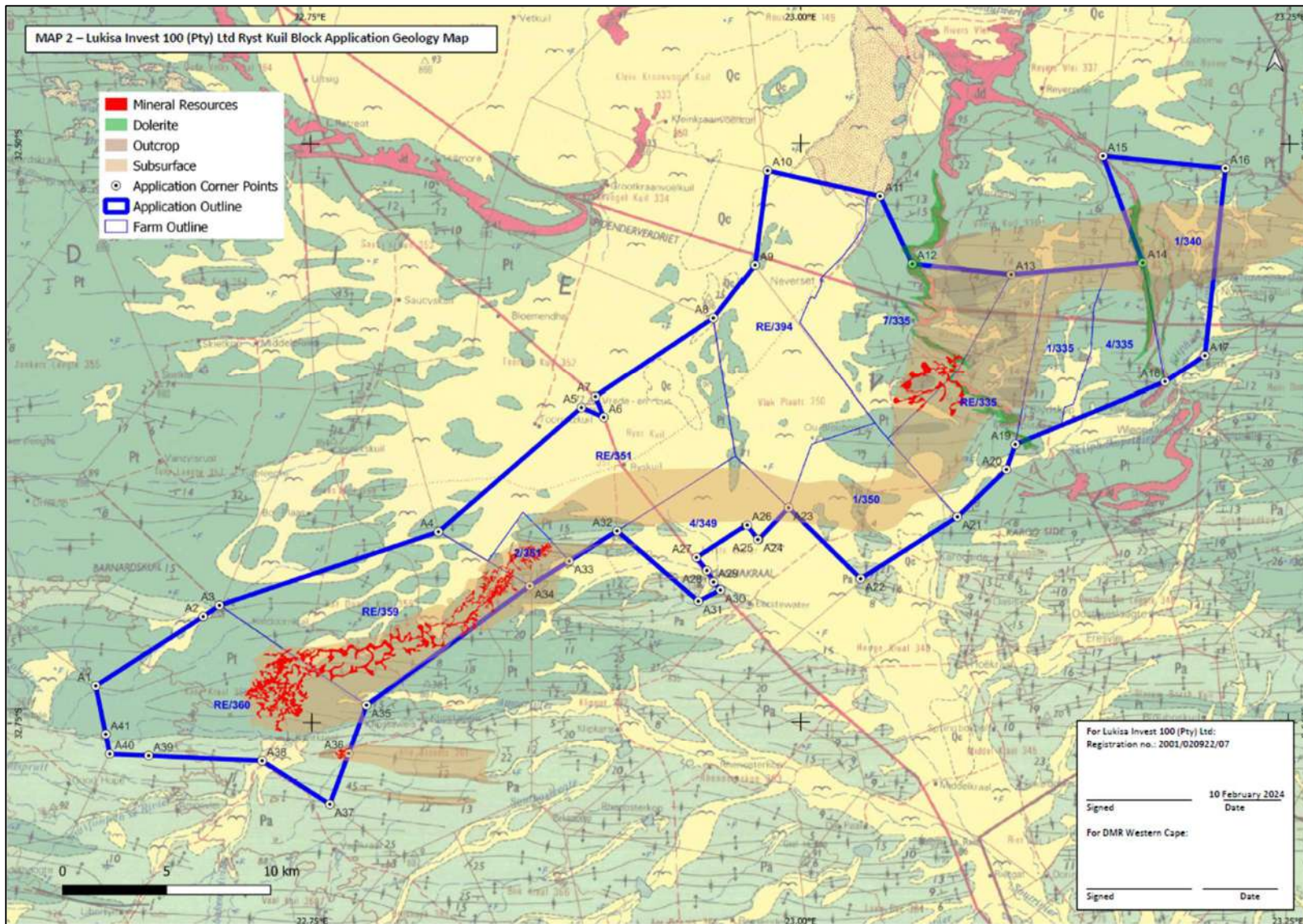


Figure 13: Mineral resources map.

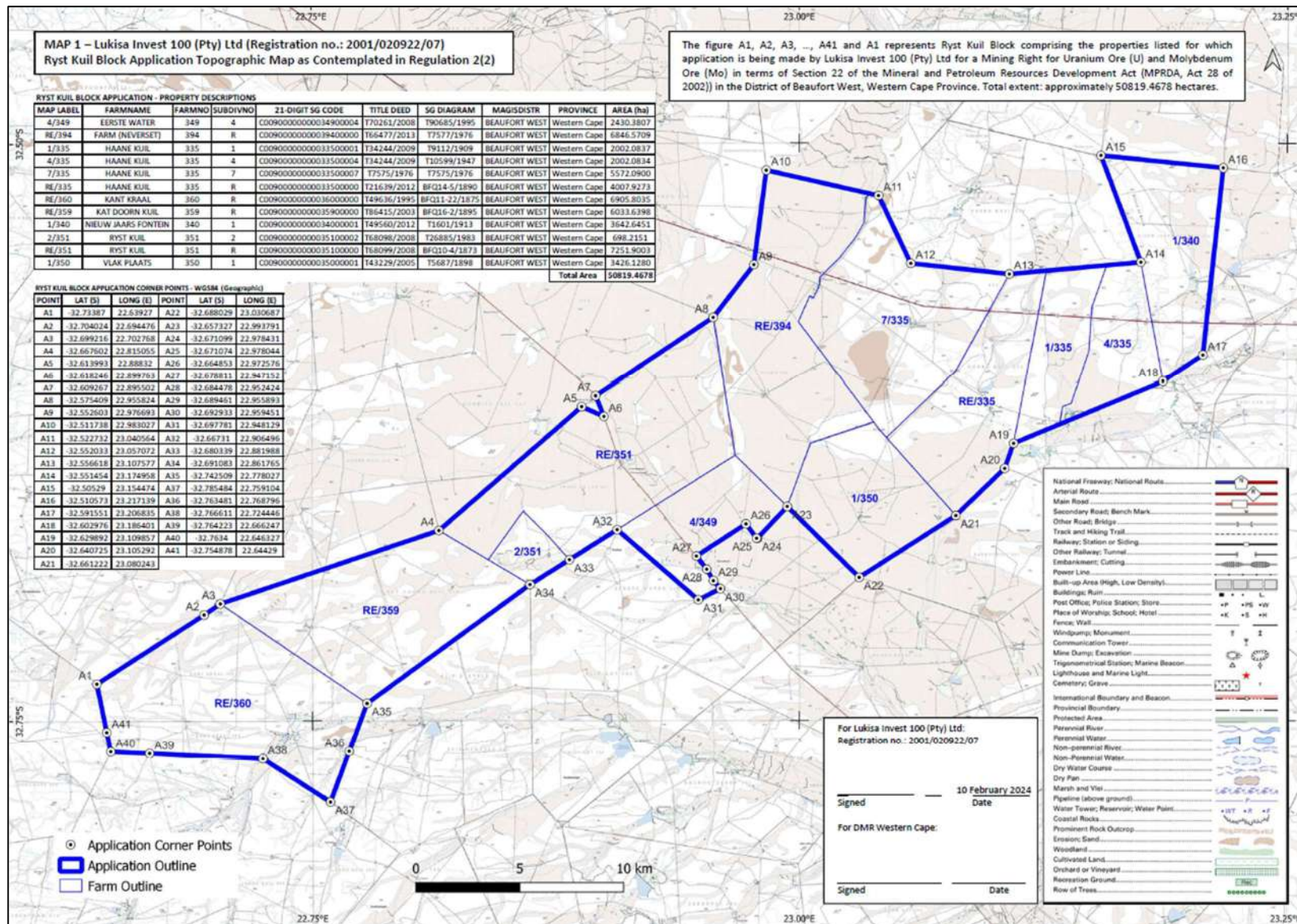


Figure 14: Proposed Project Property Description Map.

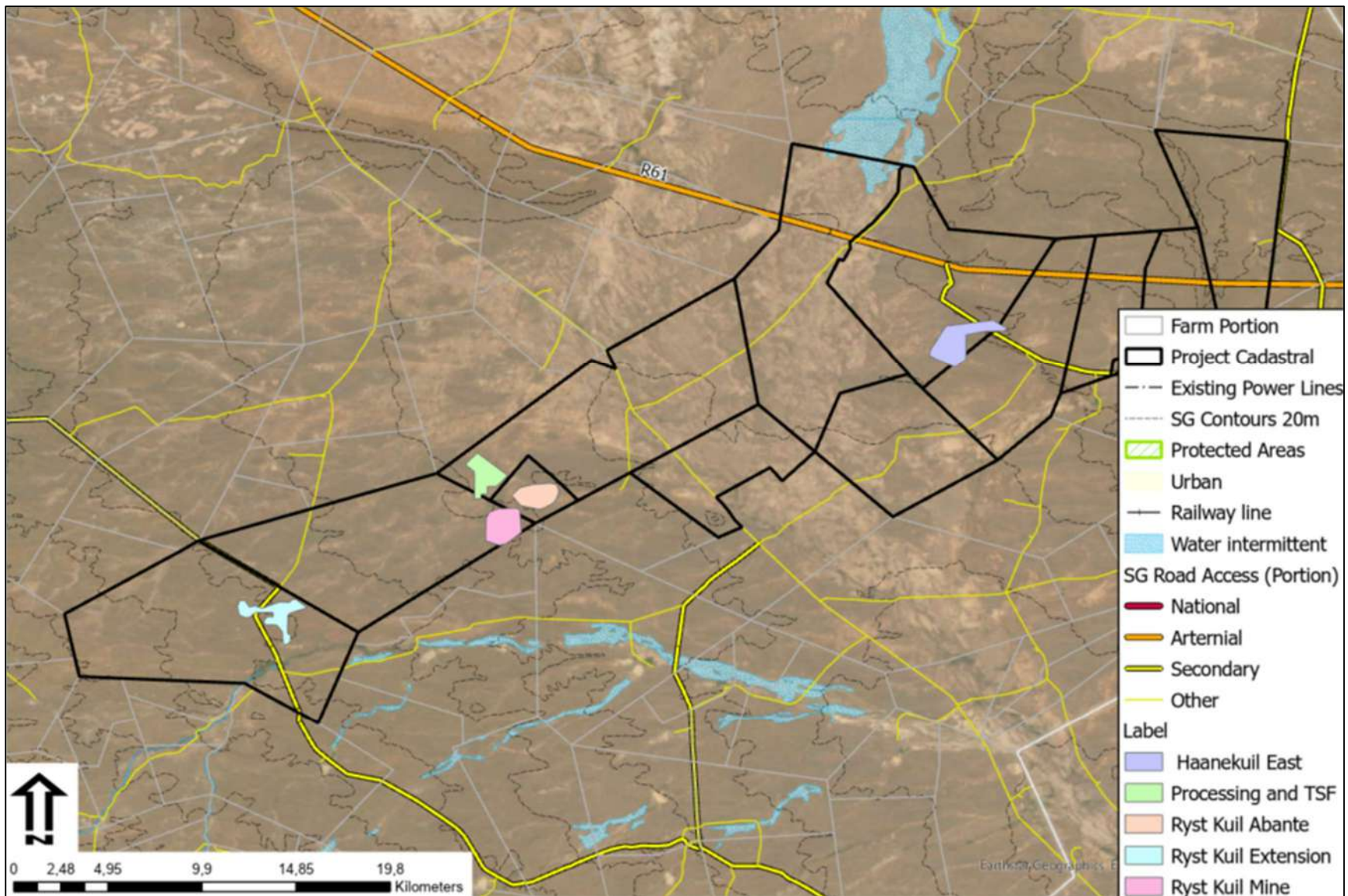


Figure 15: General Project Areas Locality map.

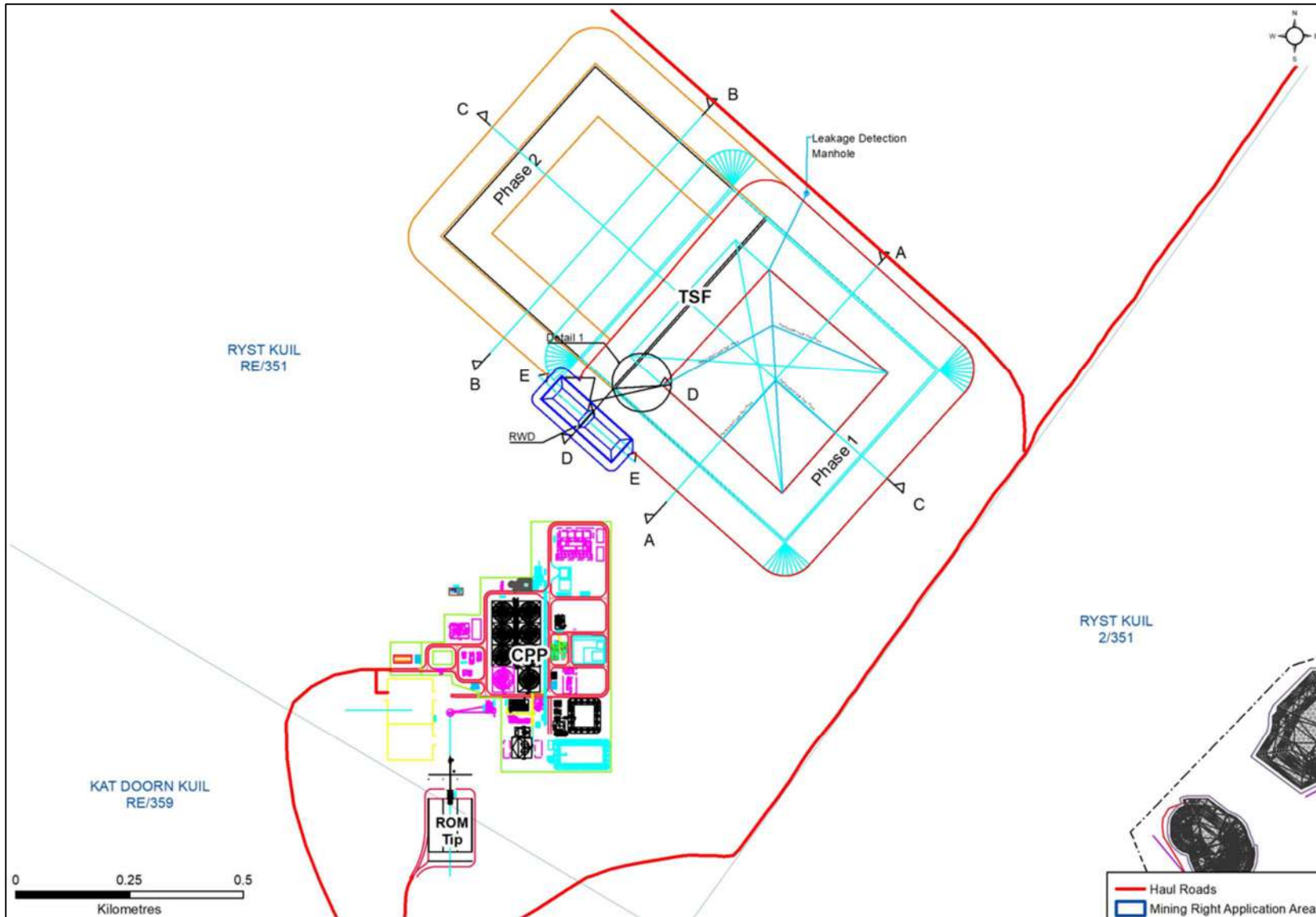


Figure 16: Proposed Initial layout plan map of the mine works and tailings storage facility at Ryst Kuil and Abante central areas.

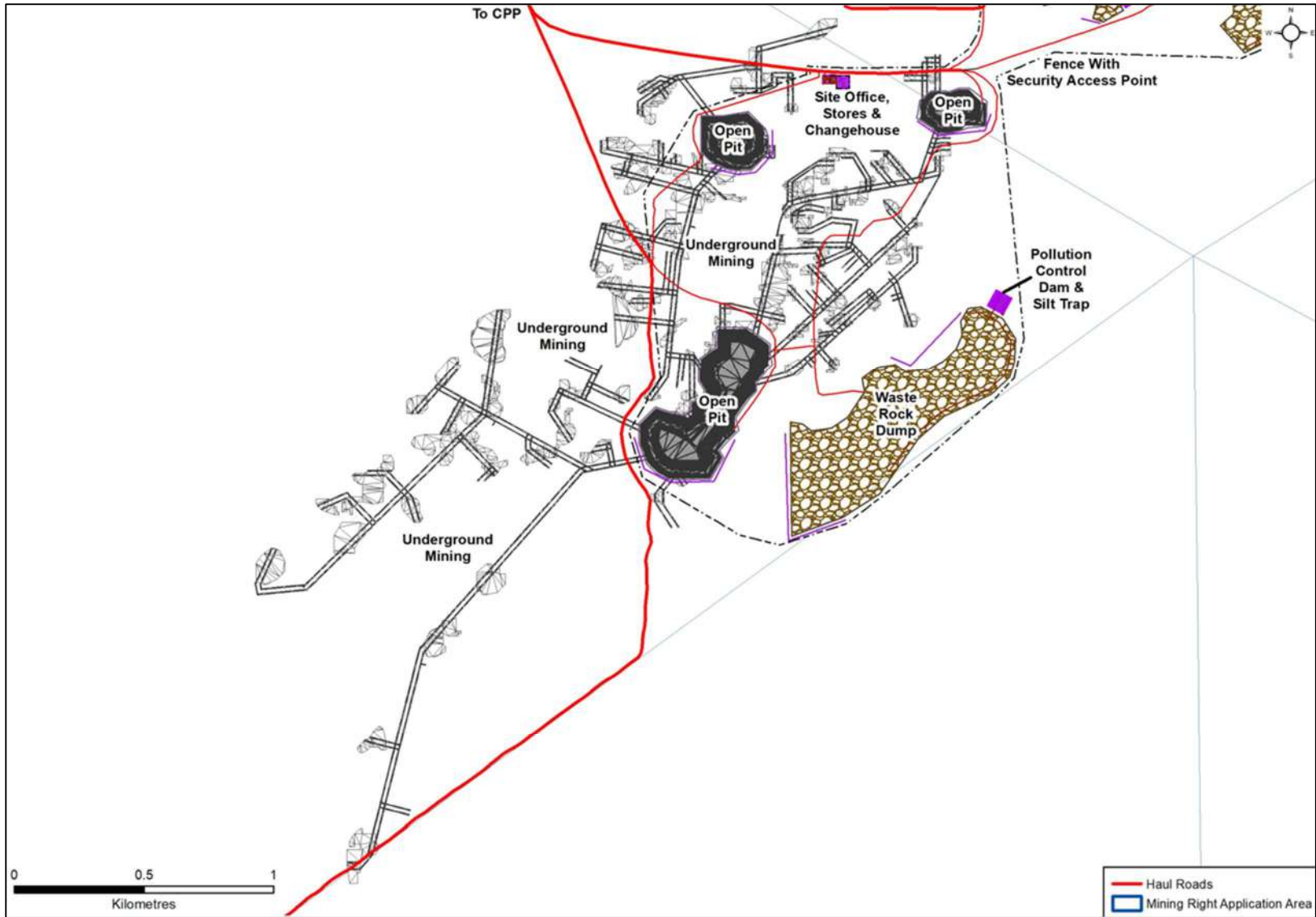


Figure 17: Proposed Ryst Kuil Mine layout plan map.

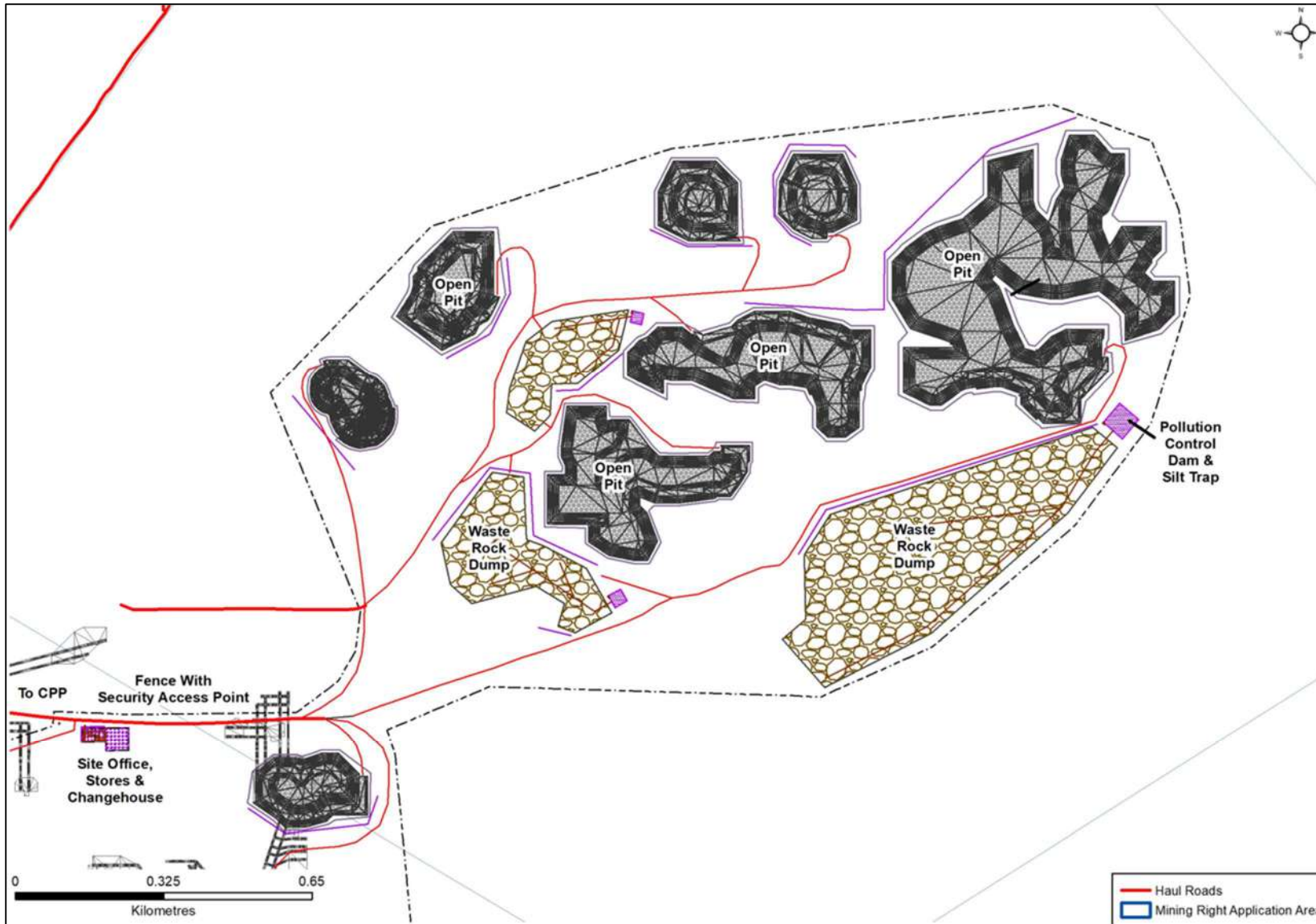


Figure 18: Proposed Ryst Kuil and Abante layout plan map

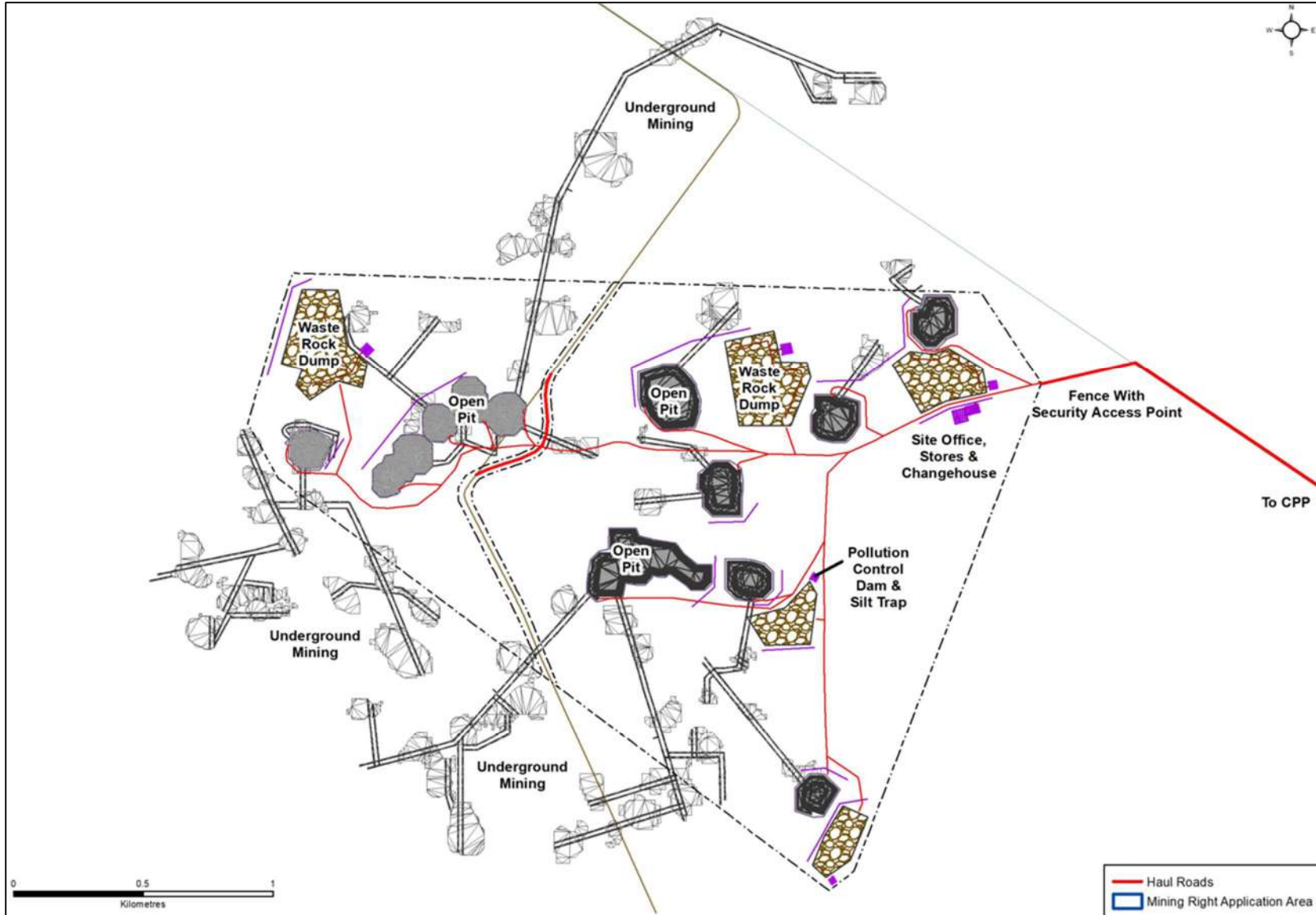


Figure 19: Proposed Ryst Kuil Extension layout plan map

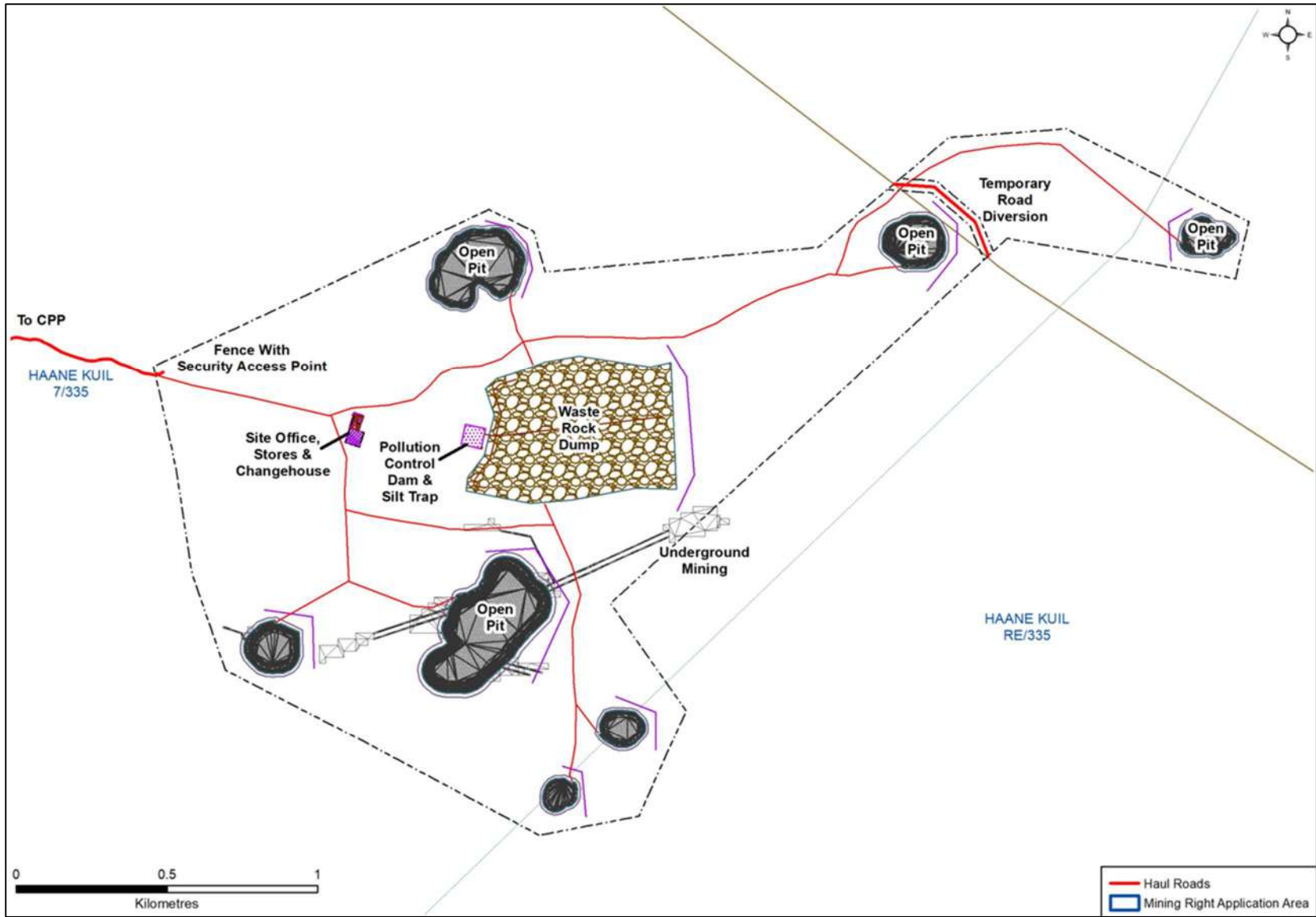


Figure 20: Proposed Haanekuil East layout plan map.

5 LEGAL FRAMEWORK

In order to comply with the Visual Resource Management requirements, it is necessary to relate the proposed landscape modification in terms of international best practice in understanding landscapes and landscape processes. The proposed project also needs to be evaluated in terms of 'policy fit'. This requires a review of International, National and Regional best practice, policy and planning for the area to ensure that the scale, density and nature of activities or developments are harmonious and in keeping with the planned sense of place and character of the area.

5.1 International Good Practice

For international good practice in assessment of landscapes, the following documentation is relevant, specifically:

- Guidelines for Landscape and Visual Impact Assessment (GLVIA), Second Edition.
- International Finance Corporation (IFC).

5.1.1 Guidelines for Landscape and Visual Impact Assessment, Second Edition

The Landscape Institute and the Institute of Environmental Management and Assessment (United Kingdom) have compiled a book outlining best practice in landscape and visual impact assessment. This has become a key guideline for LVIA in the United Kingdom. "The principal aim of the guideline is to encourage high standards for the scope and context of landscape and visual impact assessments, based on the collegiate opinion and practice of the members of the Landscape Institute and the Institute of Environmental Management and Assessment. The guidelines also seek to establish certain principles and will help to achieve consistency, credibility and effectiveness in landscape and visual impact assessment, when carried out as part of an EIA" (The Landscape Institute, 2003);

In the introduction, the guideline states that 'Landscape encompasses the whole of our external environment, whether within village, towns, cities or in the countryside. The nature and pattern of buildings, streets, open spaces and trees – and their interrelationships within the built environment – are an equally important part of our landscape heritage" (The Landscape Institute, 2003: Pg. 9). The guideline identifies the following reasons why landscape is important in both urban and rural contexts, in that it is:

- An essential part of our natural resource base.
- A reservoir of archaeological and historical evidence.
- An environment for plants and animals (including humans).
- A resource that evokes sensual, cultural and spiritual responses and contributes to our urban and rural quality of life; and
- Valuable recreation resources. (The Landscape Institute, 2003).

5.1.2 International Finance Corporation (IFC)

The IFC Performance Standards (IFC, 2012) do not explicitly cover visual impacts or assessment thereof. Under IFC PS 6, ecosystem services are organized into four categories, with the third category related to cultural services which are defined as "the non-material benefits people obtain from ecosystems" and "may include natural areas that are sacred sites and areas of importance for recreation and aesthetic enjoyment" (IFC, 2012).

However, the IFC Environmental Health and Safety Guidelines for Electric Power Transmission and Distribution (IFC, 2007) specifically identifies the risks posed by power transmission and distribution projects to create visual impacts to residential communities. It recommends mitigation measures to be implemented to minimise visual impact. These should include the siting of powerlines and the design of substations with due consideration to landscape views and important environmental and community features. Prioritising the location of high-voltage transmission and distribution lines in less populated areas, where possible, is promoted.

IFC PS 8 recognises the importance of cultural heritage for current and future generations and aims to ensure that projects protect cultural heritage. The report defines Cultural Heritage as “(i) tangible forms of cultural heritage, such as tangible moveable or immovable objects, property, sites, structures, or groups of structures, having archaeological (prehistoric), paleontological, historical, cultural, artistic, and religious values; (ii) unique natural features or tangible objects that embody cultural values, such as sacred groves, rocks, lakes, and waterfalls” (IFC, 2012). The IFC PS 8 defines Critical Heritage as “one or both of the following types of cultural heritage: (i) the internationally recognized heritage of communities who use or have used within living memory the cultural heritage for long-standing cultural purposes; or (ii) legally protected cultural heritage areas, including those proposed by host governments for such designation” (IFC, 2012).

Legally protected cultural heritage areas are identified as important in the IFC PS 8 report. This is for “the protection and conservation of cultural heritage, and additional measures are needed for any projects that would be permitted under the applicable national law in these areas”. The report states that “in circumstances where a proposed project is located within a legally protected area or a legally defined buffer zone, the client, in addition to the requirements for critical cultural heritage, will meet the following requirements:

- Comply with defined national or local cultural heritage regulations or the protected area management plans.
- Consult the protected area sponsors and managers, local communities and other key stakeholders on the proposed project; and
- Implement additional programs, as appropriate, to promote and enhance the conservation aims of the protected area” (IFC, 2012).

5.1.3 International Good Practice Findings

In terms of international best practice for Landscape and Visual Impact Assessment, **no issues pertaining to the above listed landscape resources were identified within the project zone of visual influence.**

5.2 National and Regional Legislation and Policies

In order to comply with the Visual Resource Management requirements, it is necessary to clarify which National and Regional planning policies govern the proposed development 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 as mapped in Figure 21 below.

- DEA&DP Visual and Aesthetic Guidelines.
- REDZ Planning.

- Regional and Local Municipality Planning and Guidelines.

Table 9: List of key planning informants to the project

Theme	Requirements
Province	Western Cape
District Municipality	Central Karoo
Local Municipality	Beaufort West
REDZ	REDZ 11
Strategic Powerline Corridor	Central Powerline Corridor

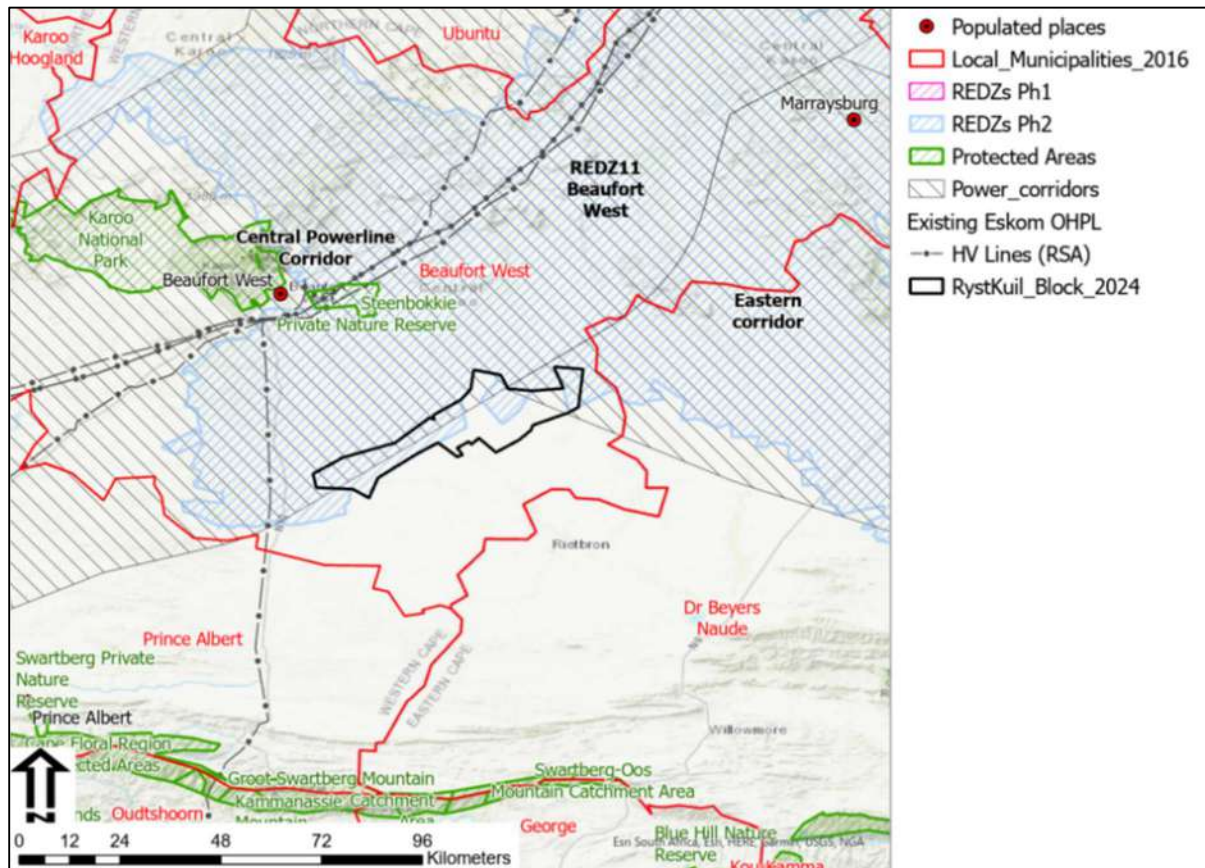


Figure 21: Planning locality map depicting the local, district and national planning zones.

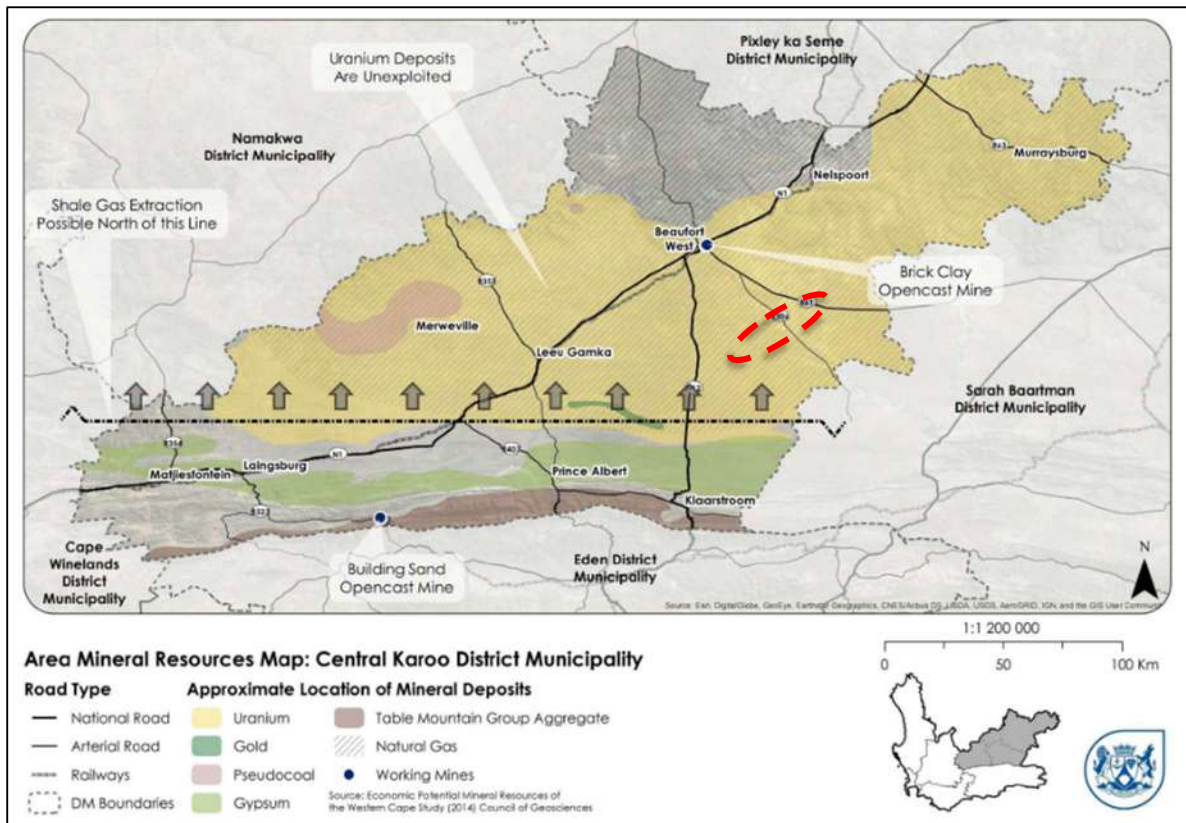


Figure 22: Extract map from the Central Karoo DM with a focus on the Mineral Resources (Figure 3.14)

5.2.1 DEA&DP Visual and Aesthetic Guidelines

Reference to the Western Cape Department of Environmental Affairs and Development Planning (DEA&DP) Guideline for involving visual and aesthetic specialists in Environmental Impact Assessment (EIA) processes is provided in terms of southern African best practice in Visual Impact Assessment. The report compiled by Oberholzer states that the Best Practicable Environmental Option (BPEO) should address the following:

- 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 BPEO must also ensure that development must be located to prevent structures from being a visual intrusion (i.e., to retain open views and vistas).
- Long term protection of important scenic resources and heritage sites.
- Minimisation of visual intrusion in scenic areas.
- Retention of wilderness or special areas intact as far as possible.
- Responsiveness to the area's uniqueness, or sense of place." (Oberholzer, 2005)

The area forms part of the Central Karoo, one of the world's most distinctive arid zones, renowned for its extensive fossil record and vast, low-density sheep farms. The unique regional identity is defined by uninterrupted horizons, flat-topped mesas, and conical hills with significant geological features. This stark landscape supports a strong sense of place associated with wilderness, solitude, and natural beauty—qualities that are central to the region's growing tourism appeal. The main areas that are used for eco-tourism are mountainous areas to the north (Nuweveld Mountains) and south (Swartberg Mountains), both located over 45km away from the mine site. While the area does have value as a unique, karoo landscape, the proposed mining area is remote, and due to limited

topographic landforms would not be viewed as a significant/ or scarce landscape resource in the broad tourist-economy landscape. However, as there are significant tourist activities in the area such as the Karoo National Park, minimisation of visual intrusion in scenic area/ tourist corridors should be taken into consideration.

5.2.2 Conservation Planning

As can be seen in Figure 21 above, the Karoo National Park and Steenbokkie Private National Park (PNR) is located in the region. Other protected areas are located to the south include the Swartberg PNR, Groot-Swartberg, Makkinassie and Swartberg-Oos Mountain Catchment areas as well as the Cape Floral Region Protected area and the Blue Hills Nature Reserve.

Due to the remoteness of the locality, the only proclaimed conservation area that could fall within the mine zone of visual influence are the more elevated portions of the Karoo National Park. However, as the proposed mine site is located 45km to the south of this area, it is unlikely that the mine related landscape change will be visible to the casual observer. There is, however, potential for light at night spillage from the mine. Given the current dark sky sense of place of the areas around the proposed mine site, lights for night-time operations would clearly be visible from this distance. The site visit to the National Park found that no accommodation areas within the park fall within the project viewshed as the main camp is located within a protected valley. Threats to conservation planning landscapes are thus rated as Low.

5.2.3 REDZ and Strategic Power Line Planning

A Strategic Environmental Assessment commissioned by the Department of Environmental Affairs, undertaken by the CSIR, identified Renewable Energy Development Zones (REDZs) (Department of Environment Affairs). These are gazetted geographical areas in which several wind and solar PV development projects will have the lowest negative impact on the environment while yielding the highest possible social and economic benefit to the country. The project is located in the REDZ11 and within the Central Powerline Corridor. While this is not a renewable energy project, the regional landscape is likely to become more associated with wind farming, solar PV as well as powerline infrastructure.

5.2.4 Renewable Energy Projects

The greater Karoo landscape is also possibly a natural gas area with a Strategic Environmental Plan undertaken for Shale Gas 'fracking' in 2015. Further the possible gas mining infrastructure, with the area also falling within the REDZ11, cumulative effects from intervisibility is also likely to take place. The author has been involved in numerous Solar PV assessments in the greater region, many of which have been authorised but not constructed. There are also two large-scaled wind farms proposed to the west of the proposed mine site. While the Solar PV would result in limited cumulative effects, intervisibility of the wind turbines has the potential to result in significant change to the current 'wilderness' sense of place. Careful landscape planning and design are critical to avoid undermining the aesthetic and cultural values that define this distinctive region.

5.2.5 Local and Regional Planning

The following tables list key regional and local planning that has relevance to the project pertaining to landscape-based tourism, and renewable energy projects.

Table 10: District Planning reference table relevant to the project

Central Karoo District Municipality SDF (Central Karoo District Municipality, 2020)		
Theme	Requirements	Page
Mining	<ul style="list-style-type: none"> Shale Gas extraction and uranium mining could negatively impact environmental health and human wellbeing if its impacts are not mitigated. Cumulatively, renewable energy developments 	31
	A threat to the area is an influx of people hoping to secure shale gas and mining jobs if public expectations of these industries are poorly managed. For example, when the first figures for shale gas were being reported, the number of associated jobs were arguably inflated.	45
	However, the District is on the cusp of major change in the mineral resources sector. Firstly, the Central Karoo has extensive uranium deposits which begin north of Prince Albert and Laingsburg and reach their highest density north of the N1 in the vicinity of Merweville. These deposits have attracted the attention of energy and mining conglomerates but remain untouched. Currently, the area-south east of Beaufort West is undergoing a process for receiving prospecting rights.	29
	The Critical Biodiversity Network, transport infrastructure network and water resources of the region are potentially threatened by the prospect of mineral resources extraction (both shale gas and uranium mining) on an expansive scale. Extensive agricultural practices are also threatened by potential mineral resources extraction	58
Central Karoo Local Economic Development Strategy	Approved in 2008. Review underway, which should take into account (1) the desire to protect and enhance landscape and sense of place assets for tourism, (2) the latent tourism opportunities present in the region, (3) the potential that this region has to create unique and special tourism, leisure and holiday experiences, (4) enhancing the agri-tourism opportunities and experiences and (5) the need for the towns of the Karoo to aim to become clean, well-maintained and desirable Karoo towns and spaces that create tourism, retail and related economic opportunities.	97
Land Use	The Central Karoo region has significant sense of place, heritage and tourism assets both in its landscape quality in the rural areas as well as its underutilised urban heritage potential that can easily be undermined or eroded by poor development decisions and land use practices	58

	In line with WC DEA&DP guidelines for rural land use development, new investment in rural areas should not: <ul style="list-style-type: none"> • Have significant impact on biodiversity; • Alienate unique or high value agricultural land; • Compromise existing farming activities; • Compromise the current and future use of mineral resources; • Be inconsistent with cultural and scenic landscapes within which it is situated; • Involve extensions to the municipality's reticulation networks; • Impose real costs or risks to the municipality delivering on their mandate; and • Infringe on the authenticity of the rural landscape and heritage assets. 	73
Tourism	Seven overall Strategies CKDM IDP: 6. Promote regional economic development, tourism and growth opportunities	10

Table 11: Local Planning reference table relevant to the project

Beaufort West Municipality SDF (Beaufort West Local Municipality, 2013)		
Theme	Requirements	Page
Mining	Central Karoo District Municipality Spatial Development Framework (2008) Uranium mining is proposed south of Beaufort West. Mining activity should not lead to a loss of agricultural land. This activity will need to be properly managed and rehabilitated when operations have ceased.	39
	Intensive engagement should continue with the shale gas exploration open cast uranium mining proponents to successfully resolve the following issues to protect the long term interests of the municipality and its residents: <ul style="list-style-type: none"> • Maximizing job opportunities for locals and identify what skills training will be required so that they, and not outsiders, receive job benefits; • Ensuring that the nature and location of any infrastructure maximizes long term benefits – e.g. staff housing should be located in existing settlements; • Rehabilitation plans, including proper top soil stock piling, are prepared and implemented on a phased basis as extraction proceeds and not left until all extraction is completed. Mines should be prevented from starting further production phases until rehabilitation milestones of open cast pits or well head pads have been achieved; • Key areas such as CBAs, conservancies and stewardship areas and visually sensitive landscapes contributing to long term heritage and tourism opportunities should be off limits to mining and shale gas exploration; • As can be seen from Figures 5.1.1 (Wyoming) and 5.1.2 (New 	79

	<p>Mexico) the visual impact on the Karoo landscapes could be severe considerably diminishing their long term tourism appeal unless they are properly rehabilitated;</p> <ul style="list-style-type: none"> • One of the potential impacts of shale gas exploration is the anthropogenic contamination of underground water aquifers; • It should be noted that both Beaufort West and Nelspoort are in a state of potential and, from time to time, actual crisis regarding their water supplies. These are increasingly dependent on groundwater as surface water sources have been inadequate for a number of years in spite of wide ranging water demand management efforts although there is not much evidence of rainwater harvesting, especially in new low income housing areas; • However, in recent years water demand has increased while recharge has decreased due in part to below average rainfall (<250mm p.a.) Beaufort West's boreholes have experienced a one metre per annum drop in the water table; (Water Services Development Plan 2011/2012, p 28); • Nelspoort is reliant on the Sout River aquifer whose recharge is considerably weakened by the highly degraded soil and vegetation conditions in the basin above. This is an important motivating factor for the biodiversity restoration of this bio-region; • Beaufort West is exploring aquifers such as Rystkuil to the south of the town. However, this also underlies a potential open cast uranium mine; - Clearly if the water supplies of these settlements is undermined or compromised their future will be in question; and, • Short term impacts of shale gas extraction will include transport and traffic and issues around accommodating mining crews (roughnecks), physically (housing) and socially (employment, recreation, entertainment. schooling, health-HIV, alcohol, drugs; crime and prostitution) 	
	<p>The mining industry, particularly with regards to shale gas extraction, and uranium mining, if their various challenges regarding visual impact, bio-diversity rehabilitation, water resource protection and social impact can be resolved, may also become an important user of air travel.</p>	83
	<p>Ensure proper mine rehabilitation plans including top soil stockpiling are in place before mining commences and that mines are prevented from future phases of mining until agreed rehabilitation milestones are achieved.</p>	91
	<ul style="list-style-type: none"> • Tasman Pacific Minerals Ltd. Holds prospecting rights to two areas in the Beaufort West Municipality, Areas 1 and 2 as depicted on Figure 3.2.9.1. • Drilling has occurred in these locations to determine the viability of mining the molybdenum and high-grade uranium. 	163

	The findings thus far have been very positive and could lead to the extraction of these minerals through open pit mining, in the near future. Should mining commence at the two sites the intention would be to locate a central processing facility near Area 1, south of Beaufort West.	
Planning	If the various potential mining activities take off in the next decade Beaufort West town's growth could rapidly accelerate. In this case it will be extremely important to ensure that the correct planning and management policies and activities are in place to avoid the unplanned and unmanaged growth currently being experienced by towns under this kind of pressure in the northern cape and elsewhere;	119
Environment	River corridors and wetlands, including ephemeral pans, must be protected from urban, agricultural and mining activities to a distance of at least 32 metres from their banks unless closer setback lines have been determined by a geohydrologist and freshwater ecologist.	94

5.3 Landscape Planning Policy Fit

Policy fit refers to the degree to which the proposed landscape modifications align with International, National, Provincial and Local planning and policy.

In terms of international best practice, the proposed landscape modification will **not** trigger any issues as there are no significant cultural/ landscape visual resources found on the site or immediate surrounds that are flagged by international landscape guidelines.

In terms of regional and local planning fit for planned landscape and visual related themes, the **expected visual/ landscape policy fit of the landscape change is rated Medium to High**. Both the District and Local Municipality planning documents are well informed about the opportunities and threats of mining in the region. Opportunities for employment and economic growth are supported, but only with a clear recognition of risks such that can be more effectively addressed. Specifically, the risks from negative impacts to environmental health and human wellbeing. Also highlighted as a risk, is the importance of effective rehabilitation of the post-closure mine-scapes to ensure that landscape degradation does not take place in a post mining scenario, such that tourism related landscapes are visually degraded.

As the regional planning also falls within the Beaufort West REDZ11 area, renewable energy projects are being attracted to the area. There are also a number of large-scaled wind farms proposed to the southwest of the proposed mine site. While the Solar PV developments would result in limited cumulative effects, intervisibility of the wind turbines has the potential to result in significant change to the current 'wilderness' sense of place. **Careful landscape planning and design are critical to avoid undermining the aesthetic and cultural values that define this distinctive region.**

6 BASELINE VISUAL INVENTORY

6.1 Local 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, landform, soils, vegetation, land use and human settlement'. It creates the specific sense of place or essential character and 'spirit of the place' (IEMA, 2002). This section of the VIA identified the main landscape features that define the landscape character.

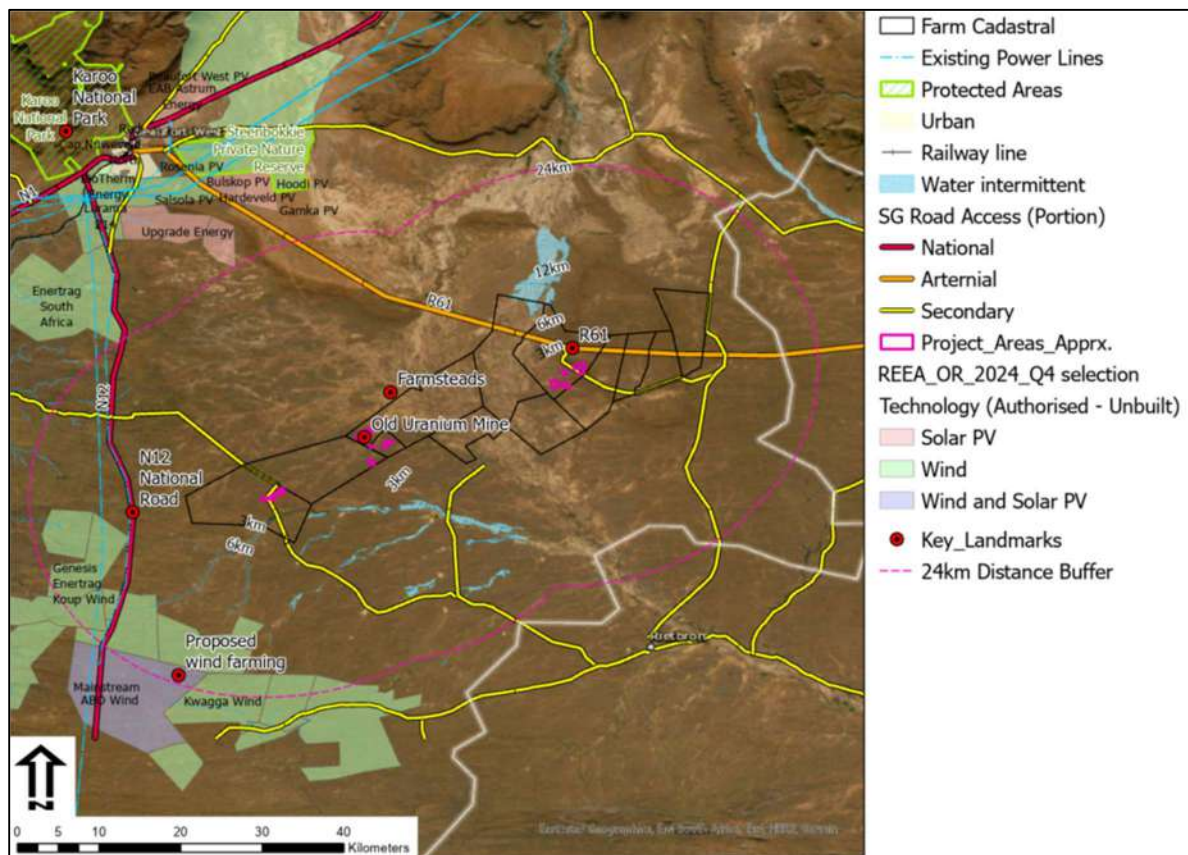


Figure 23. Local landscape themes map.

The following summary was taken from the previous LVIA Scoping report and outlines the broad landscape character, land usage as well as the likely difference of opinion that is placed on the karoo sense of place.

“The landscape between Beaufort West and Aberdeen is characterized by the flat, expansive plains of the Central Karoo, underlain by horizontally bedded, fossil-rich shales and mudstones of the Beaufort Series. These formations are intersected by dolerite dykes, creating seasonal springs and pans. The terrain south of the R61 is notably flat, with limited elevation changes, aside from occasional ridges. Natural vegetation is sparse and low-growing, with acacia trees often marking seasonal riverbeds. Human presence is minimal, marked by scattered infrastructure, wind pumps, and farmhouses—often clustered in exotic trees and visible from a distance. Remnants of historical uranium mining from the 1970s

remain locally visible across the proposed mine site but are not a regional landscape influence.

The area forms part of the Central Karoo, one of the world's most distinctive arid zones, renowned for its extensive fossil record and vast, low-density sheep farms. The unique regional identity is defined by uninterrupted horizons, flat-topped mesas, and conical hills with significant geological features. This stark landscape supports a strong **sense of place** associated with wilderness, solitude, and natural beauty—qualities that are central to the region's growing tourism appeal. Research indicates a growing appreciation among visitors for the area's undeveloped, peaceful character, while some local residents view potential development, including mining, as a source of much-needed economic opportunity.


The “sense of place” is complex and subjective, varying by community group and socio-economic background. While tourists and lifestyle migrants may resist industrial encroachment, others welcome the prospect of employment and infrastructure. Nonetheless, large-scale development, such as mining or energy infrastructure, can profoundly disrupt this sense of place by introducing population influx, traffic, and environmental degradation.

Sense of Limits refers to the point at which the visual capacity of the landscape is exceeded. In the Karoo, this is particularly sensitive due to the open, unscreened nature of the terrain. The visual absorption capacity is low, and vertical structures such as power lines and telecommunication towers create pronounced visual contrasts, especially when placed on ridgelines.

Further to the 2008 landscape summary, the **sense of landscape change** also needs to be recognised. The greater Karoo landscape is also possibly a natural gas area with a Strategic Environmental Plan undertaken for Shale Gas ‘fracking’ in 2015. Further the possible gas mining infrastructure, the area also falls within the Beaufort West Renewable Energy Development Zone (REDZ11). The author has been involved in numerous Solar PV assessments in the greater region, many of which have been authorised but non constructed. There are also two large scaled wind farms proposed to the west of the proposed mine site. While the Solar PV would result in limited cumulative effects, intervisibility of the wind turbines has the potential to result in significant change to the current ‘wilderness’ sense of place. Careful landscape planning and design are critical to avoid undermining the aesthetic and cultural values that define this distinctive region”. (VRM Africa, 2008)

As mapped in Figure 23 above, the key landscape themes within the Foreground / Middle Ground (6km) distance are tabled on the following page:

Table 12:Key Landscape Themes

Theme	Description
<p>Karoo National Park</p>	<p>The Karoo National Park, located just outside Beaufort West in the Western Cape, is a vast semi-arid conservation area showcasing the unique biodiversity and stark beauty of the Nama-Karoo biome. Encompassing rugged mountains, expansive plains, and fossil-rich geology, the park is home to a variety of wildlife including Cape mountain zebra, black rhino, and numerous bird species. It also plays a significant role in conserving the ecological integrity and cultural heritage of the Karoo region, offering visitors opportunities for scenic drives, hiking, and stargazing in one of South Africa’s most distinctive landscapes.</p>
	
<p>N12 National Road & R61 Tourist View Corridors</p>	<p>The N12 National Road and the R61 are important tourist view corridors that traverse some of South Africa’s most iconic and visually striking interior landscapes. The N12 offers expansive views of the Karoo’s open plains, distant mountain ridges, and historic farming settlements, making it a key route for tourists seeking an authentic rural experience. The R61, which links the interior to the Eastern Cape coast, provides a scenic journey through diverse terrain, including arid landscapes, river valleys, and culturally significant towns. Both routes enhance the tourism value of the region by shaping how travellers experience and engage with the visual and cultural character of the Karoo.</p>



Old Uranium Mine

Uranium was first identified in the Main Karoo Basin in 1967 during radiometric borehole logging by SOEKOR, originally in search of inland oil and gas. Interest in the region grew when Union Carbide Exploration Corporation (UCEX) discovered uranium mineralisation on the farm Grootfontein near Beaufort West in 1970, leading to the delineation of the Rietkuil deposit. This discovery sparked a broader "uranium rush," with major companies such as Esso, JCI, and Anglo American acquiring exploration rights. Prospecting activity in the Southern Karoo continued extensively over a 17-year period from 1969 to 1985 with only the Ryst Kuil Mine being established. Due to low ore grade, the mine was subsequently closed and been closed and partially rehabilitated.



<p>Karoo Farmsteads</p>	<p>The isolated farmsteads scattered across the Greater Karoo are often regarded as having cultural landscape significance. Situated in regions with minimal man-made modification, these farmsteads contribute to higher levels of scenic quality and help define the visual character of the Karoo. As such, they form an important part of the regional landscape resource, frequently associated with eco- and agri-tourism due to their authenticity, remoteness, and strong sense of place.</p>
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<p>Wind Farming</p>	<p>The Karoo holds considerable value for wind farming due to its expansive open landscapes, consistent wind patterns, and low population density. The region's flat to gently undulating terrain offers ideal conditions for turbine placement and access infrastructure, while minimal visual clutter enhances turbine efficiency and spacing. Additionally, the relatively low intensity of existing land use—primarily extensive grazing—allows for co-existence between wind energy development and agricultural activities, making the Karoo a strategically favourable location for sustainable wind energy generation.</p>
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6.2 Visual Absorption Capacity

Land use and vegetation are a crucial factor in determining landscape character, especially regarding the Visual Absorption Capacity (VAC) of the landscapes. Oberholzer defines VAC as the potential of the landscape to conceal the proposed project (Oberholzer, 2005). i.e.

- High VAC – e.g., effective screening by vegetation and structures.
- Moderate VAC - e.g., partial screening by vegetation and structures.
- Low VAC - e.g., little screening by vegetation or structures.

Vegetation type is a large factor in determining the scenic quality of the site in terms of colour and texture, as well as influencing the local ability of the landscape to absorb the landscape change if larger trees species or prolific vegetation is located on the site or within the local region. The map below outlines the vegetation type based on BGIS mapping (South African National Biodiversity Institute, 2018).

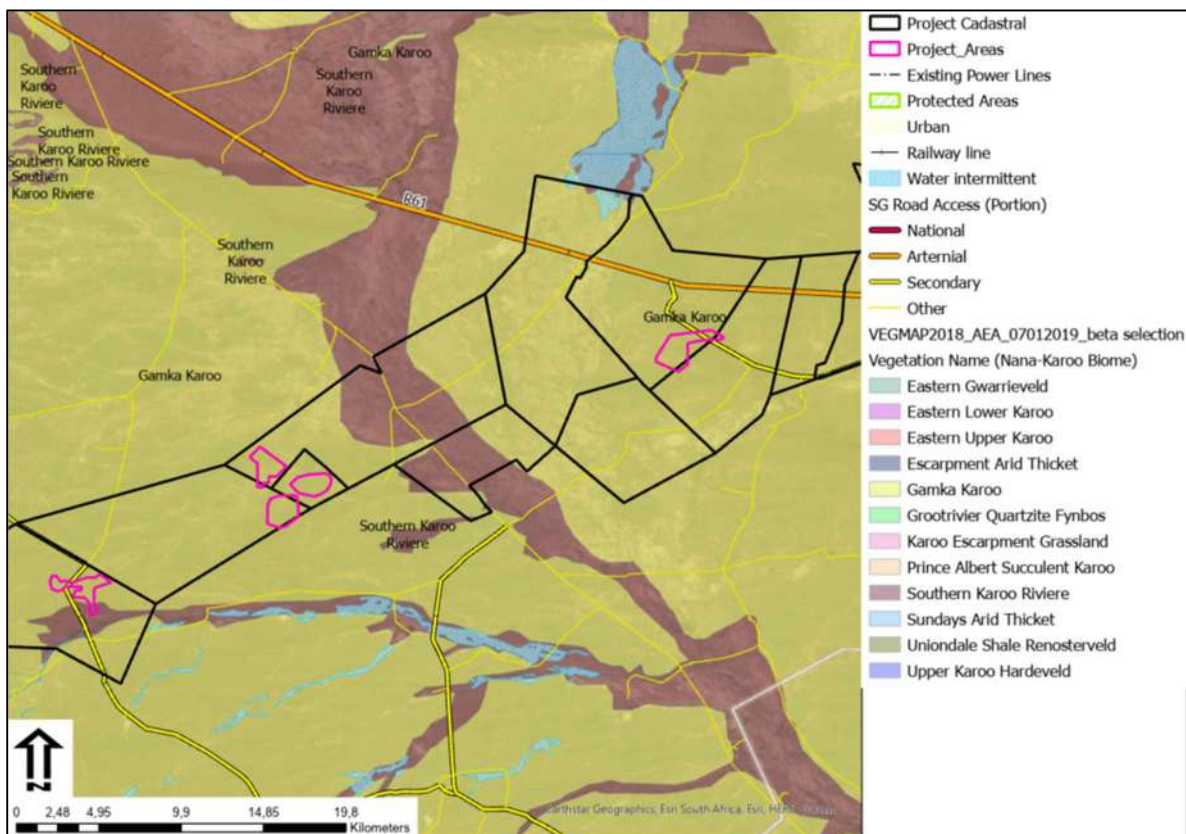


Figure 24. BGIS Biome and Vegetation Type Map (South African National Biodiversity Institute, 2018)

According to the South African National Biodiversity Institute (SANBI) 2012 Vegetation Map of South Africa, Lesotho and Swaziland (South African National Biodiversity Institute, 2012) the project area is located in the Nama-karoo Biome with the main vegetation types being Gamka Karoo for the majority of the study area, with two sections of Southern Karoo Riviere following low-lying drainage areas. As depicted in the photograph below, the Gamka Karoo vegetation is sparse and offers very little visual screening. Other than the small waste rock dump from the old Uranium Mine, the existing deep arid area and sheep farming land use offer very limited structural development.



Figure 25. Photograph of Gamka Karoo vegetation.

Of relevance to the project is that the flat nature of the landscape in relation to the sparseness of the karoo vegetation limits the VAC. As such, the VAC is rated as Low as there is minimal screening by vegetation or built environment factors.

6.3 Landscape Topography

Landform is a key variable informing the aesthetic nature of the landscape within the VRM methodology. The viewshed is strongly associated with the regional topography where topographic screening from undulating terrain would restrict views of the proposed landscape change. The site-specific characteristics are also analysed by gradient analysis to determine if any steep slopes are located on the proposed development site.

6.3.1 Regional Landscape Topography

Making use of the NASA STRM digital elevation model, profile lines were generated for the area within 12km on either side of the project area predominantly in the North to South and East to West compass reference points. The map depicting the regional elevation profile lines can be viewed on the following page.

The general topography of the area where the mine is proposed, is defined as gently undulating with minimal gradient and limited landform variation. According to the *Ryst Kuil Scoping Report (2025)*, the proposed mining area lies within the Main Karoo Basin, a vast physiographic region in central South Africa characterised by elevations ranging from 800 to 2500 metres above sea level. The terrain slopes gently from east to west, featuring predominantly flat to undulating topography punctuated by flat-topped hills and escarpments, often capped by resistant dolerite or sandstone layers. Surface cover such as calcrete, windblown sand, and colluvium conceals much of the geology between these hills. Although not prevalent on the proposed mine site, the broader landscape does depict prominent dolerite sills, dykes, and ring-complexes define the visual and structural character of the landscape, often forming topographic highs. The combination of the flatter, open plains with the rugged mountains in the background, adds value to the area as a visual resource.

Due to the dispersed and elongated nature of the proposed mine site, which follows a southwest to northeast alignment, a single longitudinal profile was generated along this axis.

Additionally, three cross-sectional profiles were developed along a northwest to southeast orientation to represent the three primary mining zones.

All of the generated profiles illustrate gently undulating terrain that appears relatively flat within the broader landscape, with occasional small ridgelines and elevated points contributing limited topographic variation. Importantly, most of the proposed mine areas are situated within broadly shallow or recessed landscape settings, which naturally reduce visual prominence. Only the northern portion of the proposed mine is located on slightly more elevated terrain. As a result, the overall viewshed of the development is expected to be relatively contained to the larger water catchment area.

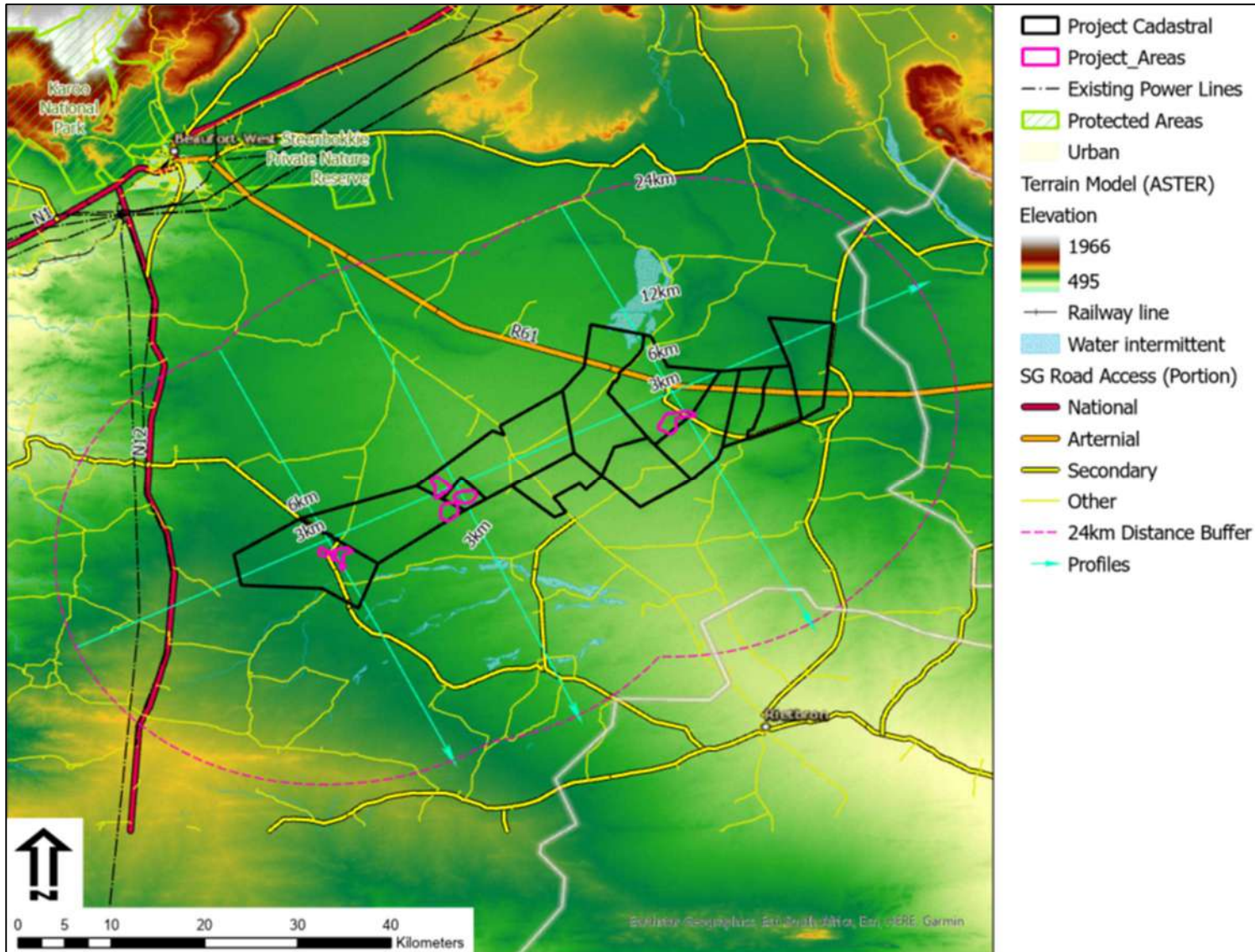


Figure 26: Regional Digital Elevation Mapping and Profiles map.

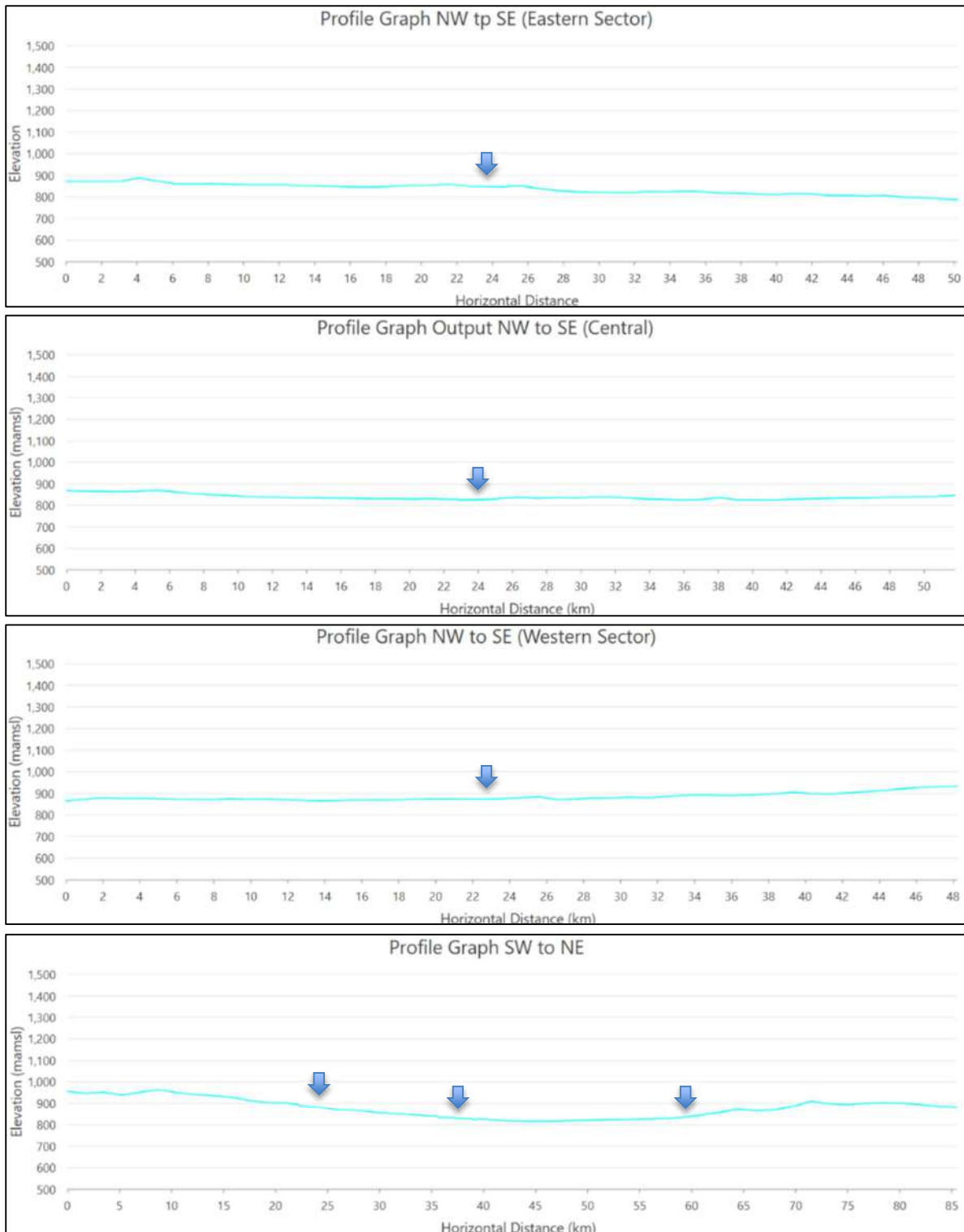


Figure 27: Profiles Graphs with approximate mine location depicted.

6.3.2 Key local topographic features and site slopes analysis

To ensure that significant landforms related to steep slopes are not located on the site or surrounds, a slopes analysis was undertaken. See Figure 28 below where it is clear that no steep slope areas are located on the proposed mining development areas. There is a small ridgeline located to the northeast of the Haanekuil that will result in some topographic screening from R61 and local farm resident receptors. A smaller excavation pit is proposed on the western slopes of the ridgeline.

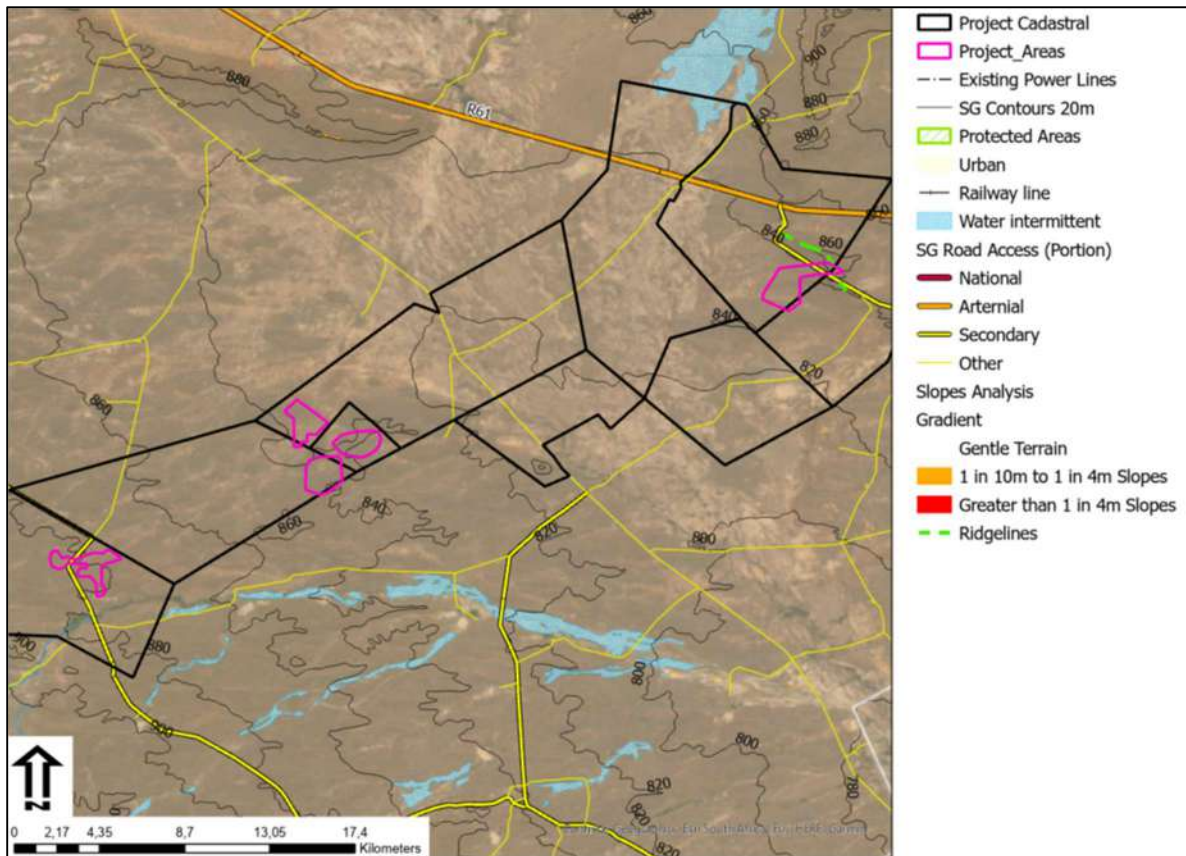


Figure 28: Key topographic features map (No moderate or steep slopes).

6.4 Project Zone of Visual Influence

The visible extent, or viewshed, is “the outer boundary defining a view catchment area, usually along crests and ridgelines” (Oberholzer, 2005). In order to define the extent of the possible influence of the proposed landscape change, a viewshed analysis was undertaken from the proposed site at a specified height above ground level. This is to assess the **theoretical extent** where the proposed landscape change could be visible from. This theoretical viewshed excludes vegetation, structural development as well as distance from the location where atmospheric influence would reduce visual clarity over increasing distance. The viewshed analysis makes use of open-source NASA ASTER Digital Elevation Model data (NASA, 2009).

Based on the theoretical viewshed and the site visit appraisal of the nature of the landscape, an assessment of the **Zone of Visual Influence (ZVI)** is made. The ZVI is the area where the proposed landscape change is most likely to be noticed by the casual observer, taking the site visit into account where vegetation, existing development and distance is taken into consideration. This is a subjective appraisal but informed by the viewshed and the other factors mentioned.

6.4.1 Viewshed Analysis

A viewshed analysis was undertaken for the site making use of an Offset value representing the height of the proposed development as reflected in the table below. The model extent of the viewshed analysis was restricted to a defined distance from the site that represents the expected zone of visual influence (ZVI) of the proposed activities. This takes the scale, and size of the proposed projects into consideration in relation to the natural visual absorption capacity of the receiving environment. The maps are informative only as visibility tends to diminish exponentially with distance, which is well recognised in visual analysis literature (Hull & Bishop, 1988).

Table 13: Proposed Project Heights table

Proposed Activity	Height (m)	Model Extent	Motivation
General Mining	30m	32km	General mining heights is expected to be around 25m height. However, as there could be structures/ large tipping vehicles on top of the WRDs, the average height of 30m was used to represent the general height of the mine. Due to the lights at night having the potential for large area coverage, the extent of the viewshed was capped at 32km (full extent).
Waste Rock Dump (WRD)	30m	32km	

The viewshed is mapped and can be viewed in Figure 29 on the next page. This depicts the theoretical area where the proposed landscape change could be visible. As the project areas are spatially dispersed, with an average distance of approximately 17 km between them, three separate viewsheds have been generated. The **Haanekuil Site** exhibits a viewshed primarily oriented to the west, constrained to the northeast by a small ridgeline, but extending broadly due to the relatively flat surrounding terrain. The **Ryst Kuil Extension Site** has a viewshed that is spatially skewed towards the northwest, with additional exposure to the southwest where the terrain is moderately elevated. The **Ryst Kuil Site** generates the most extensive viewshed, encompassing the broad, flat drainage basin in which the three mining sites are situated. However, its extent does not exceed the outer boundaries of the Haanekuil and Ryst Kuil Extension Site viewsheds.

Due to the large scale and extent of the proposed mining activities, some degree of intervisibility between the sites is expected, despite the 17 km spacing. This will occur primarily in the vicinity of the central Ryst Kuil Site. To minimise the cumulative visual impact and reduce the potential for regional landscape degradation, it is recommended that mitigation measures be implemented. These should include strategies to reduce colour contrast, control dust emissions, and minimise light spillage from mining infrastructure and operations.

The Zone of Visual Influence (ZVI) is classified as regional in scale and rated as **moderate in visual extent**, based on the following considerations:

- The relative height of the mine infrastructure and Waste Rock Dumps (WRDs), when contrasted with the generally flat Karoo terrain, results in clear visual incidence within the foreground and mid-ground zones. While the viewshed becomes fragmented beyond approximately 6 km—particularly to the north, east, and south due to

intervening higher terrain—it extends up to 12 km in flatter terrain, primarily to the north and south.

- The ZVI is largely contained within the broader regional watershed, with the visual extent unlikely to exceed a 12 km radius from the proposed mine site.

Due to the close proximity of receptors located on isolated farmsteads and along the R61 road, visual exposure is rated as High. However, some moderation of this exposure is expected as a result of the average 1 km setback from most receptors. Taking this into account, the **overall visual exposure is rated as Medium to High**.

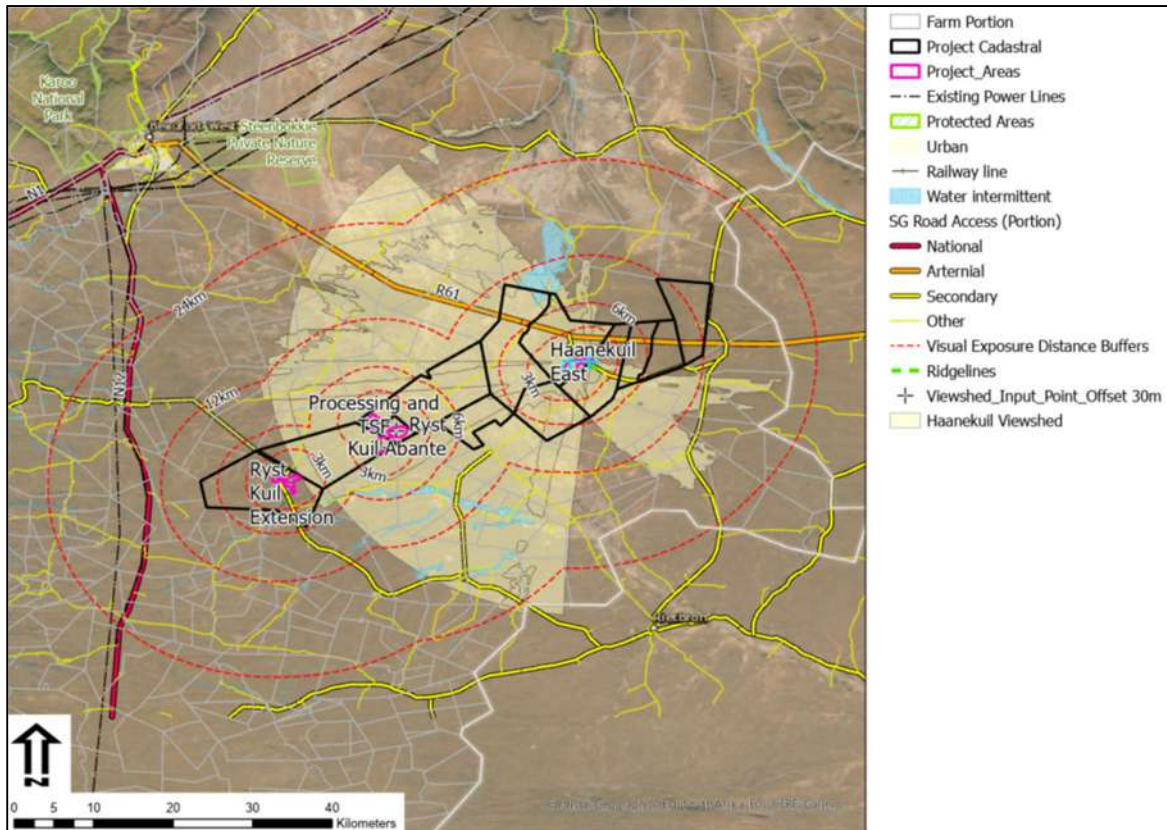


Figure 29: Viewshed analysis map of proposed project: Haanekuul.

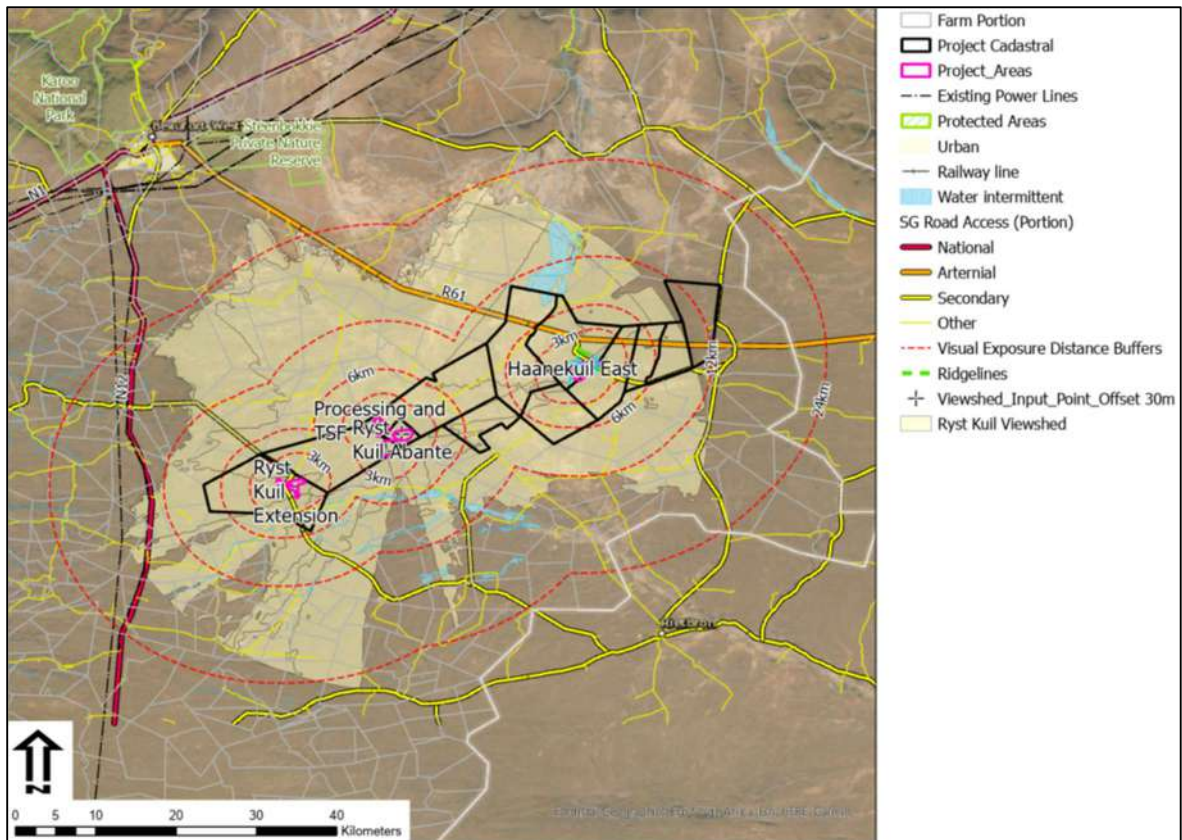


Figure 30: Viewshed analysis map of proposed project: Ryst Kuil Mine, Abente and Processing Plant (Combined).

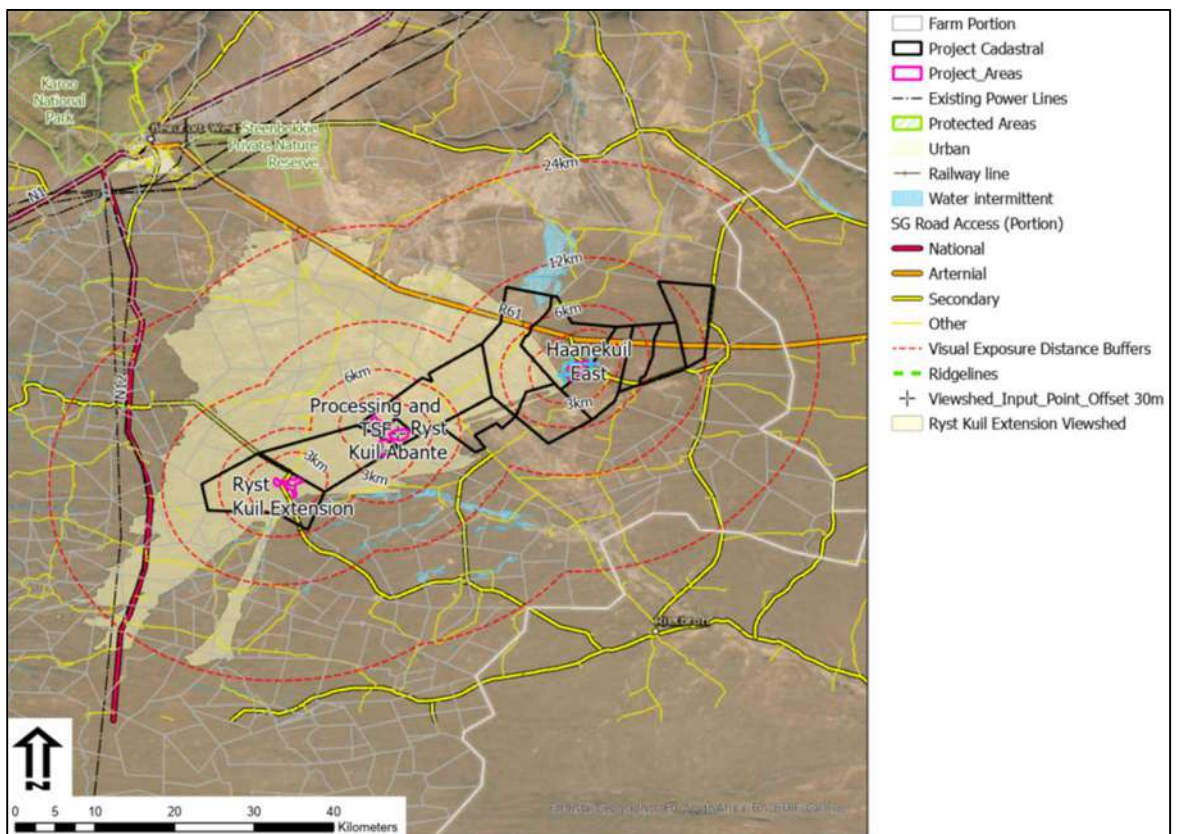


Figure 31: Viewshed analysis map of proposed project: Ryst Kuil Extension.

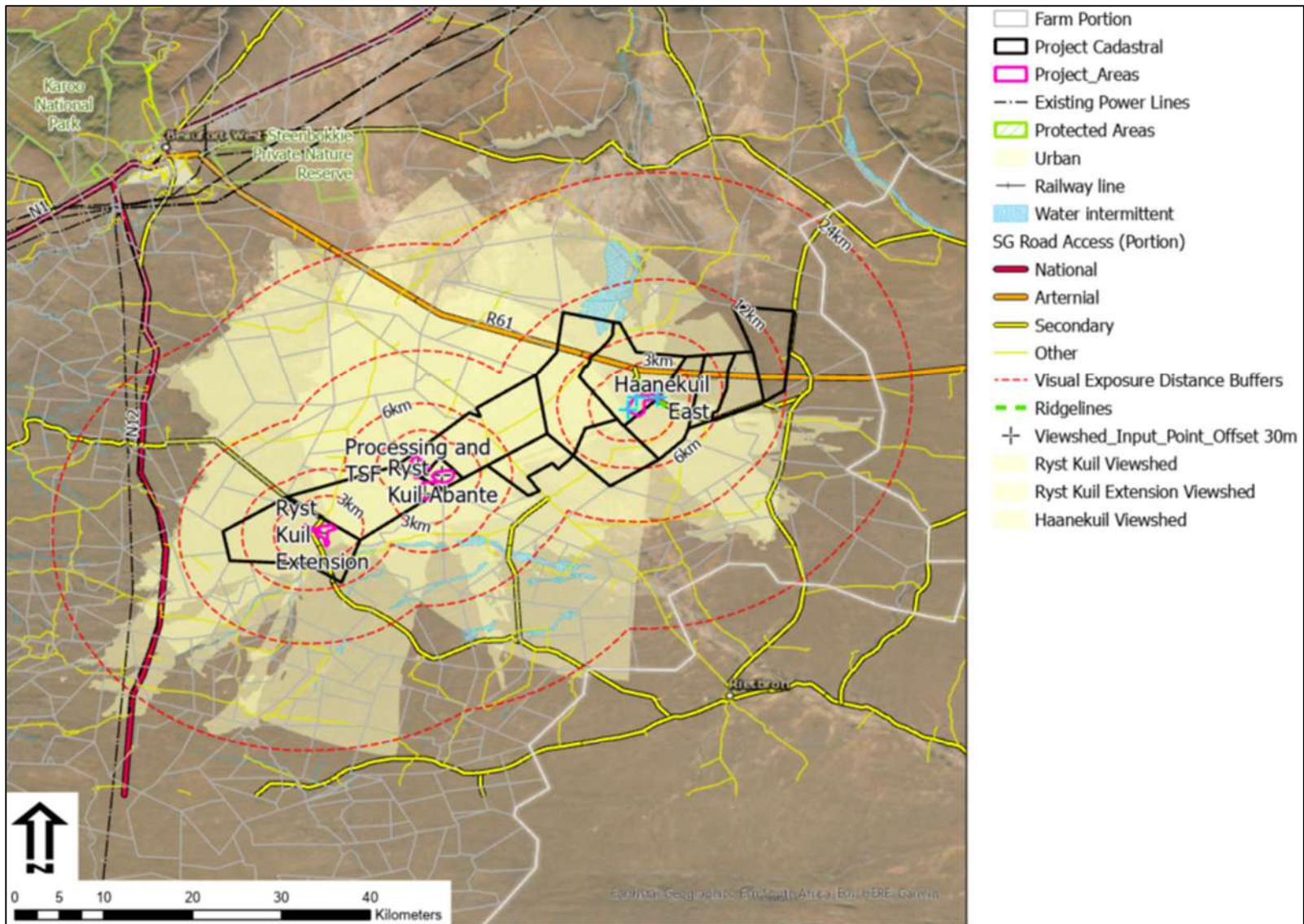


Figure 32: Viewshed analysis map of proposed project: Combined projects.

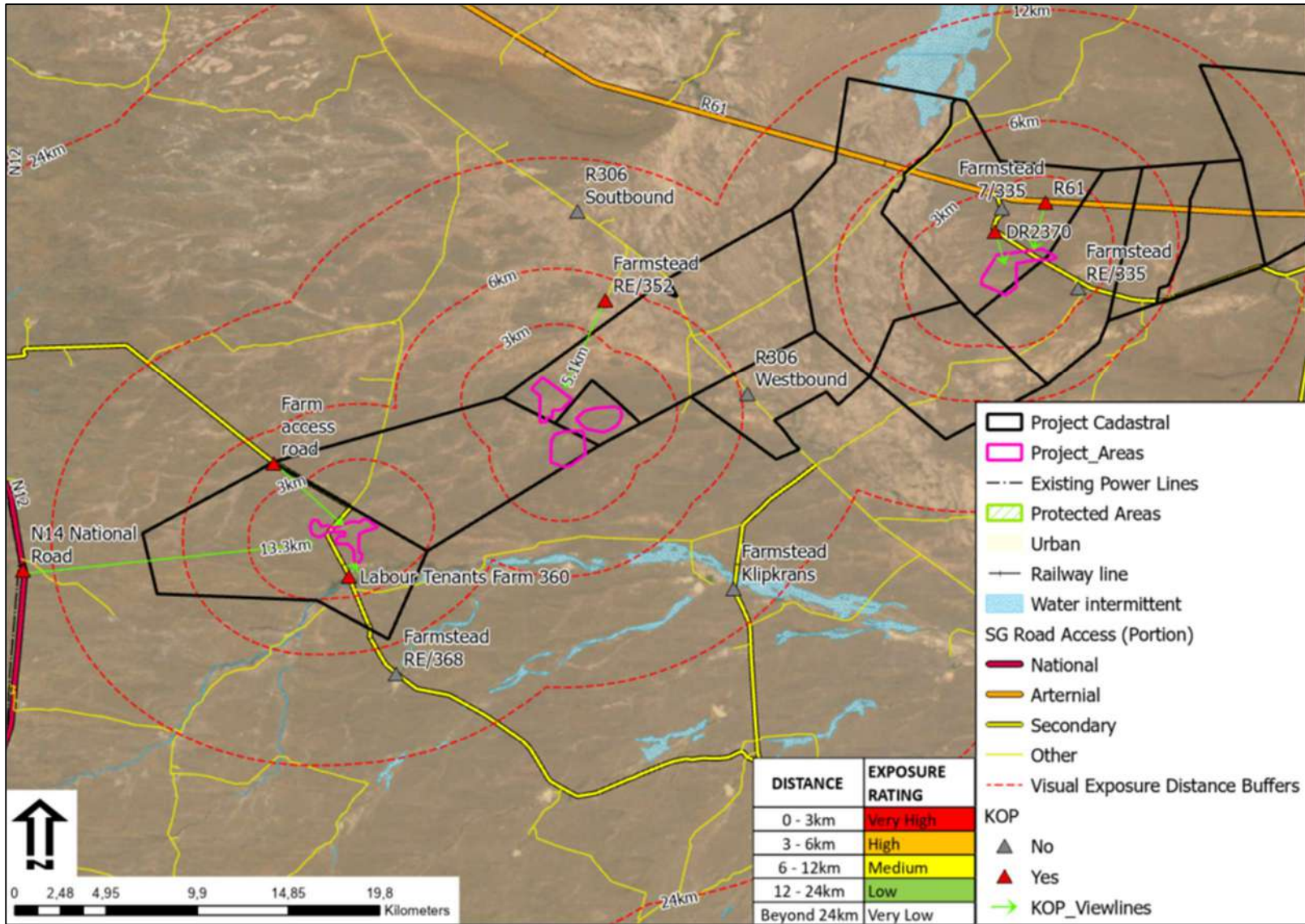


Figure 33: Receptor Key Observation Point and Visual Exposure Map.

Table 14: KOP Motivation table

Receptor	Landuse	Exposure	KOP	Motivation
N14 National Road	Tourist View Corridor	Low	Yes	Tourist view corridor
Ryst Kuil Extension Access Road	Road	High	Yes	No eco-tourism activities but will have very high Visual Exposure to the Ryst Kuil Extension Mine site.
Farm 360 Labour Tenants	Residential	Very High	Yes	Very High visual exposure but with views partially screened by shade trees.
Farmstead RE/368	Residential	High	No	7,9km distance will reduce the visual clarity to some degree. Local tree screening.
Farmstead 2/365	Residential	Low	No	Low VE and partial garden tree shading.
Farmstead Klipkrans	Residential	Medium	No	10km distance approx. and facing away from site with some topographic screening.
R306 Westbound	Road	Medium	No	Remote and limited landscape resource as well as some topographic screening.
Farmstead RE/352	Residential	High	Yes	High VE with clear views of the proposed mine plant.
R306 Southbound	Road	Medium	No	Remote and limited landscape resource as well as some topographic screening.
Farmstead 7/335	Residential	Very High	No	Vegetation and partial topographic screening from the proposed Haanekuil East mine sites.
Farmstead RE/335	Residential	Very High	No	Partial topographic screening from the proposed Haanekuil East mine sites.
DR2370	Road	Very High	Yes	Closer proximity views of the proposed Haanekuil East mine site that could change the local Karoo sense of place.
R61	Tourist View Corridor	Very High	Yes	

6.4.2 Receptors and Key Observation Points

As defined in the methodology, 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. As motivated in Table 14 and mapped in Figure 33 on the previous page, six receptors have been identified as Key Observation Points and should be used as locations to assess the intensity of the landscape change.

Table 15: KOP Table.

KOP	Landuse	Distance
N14 National Road	National Road Tourist View Corridor	13km
Ryst Kuil Extension Access Road	Farm Access Road	200m
Farm 360 Labour Tenants	Residential	815m
Farmstead RE/352	Residential	5.1km
DR2370	Road	100m
R61	Road / Tourist View Corridor	2.6km

7 VISUAL RESOURCE MANAGEMENT

In terms of the VRM methodology, landscape character is derived from a combination of scenic quality, receptor sensitivity to landscape change, and distance of the proposed landscape modification from key receptor points. Making use of the key landscape elements defined in the landscape contextualisation sections above, landscape units are defined which are then rated to derive their intrinsic scenic value, as well as how sensitive people living in the area would be to changes taking place in these landscapes.

7.1 Physiographic Rating Units

The Physiographic Rating Units are the areas within the proposed development area that reflect specific physical and graphic elements that define a particular landscape character. These unique landscapes within the project development areas are rated to assess the scenic quality and receptor sensitivity to landscape change, which is then used to define a Visual Resource Management Class for each of the site's unique landscape/s. The exception is Class I, which is determined based on national and international policy / best practice and landscape significance and as such are not rated for scenic quality and receptor sensitivity to landscape change. Based on the SANBI vegetation mapping and the site visit to define key landscape features, the following broad-brush areas were tabled and mapped in Figure 34 below.

Table 16: Physiographic Landscape Rating Units

Landscapes	Motivation
Gamka Karoo	The majority of the site is clearly defined by a typical Gamka Karoo landscape with limited vegetation on flat terrain with isolated farmsteads.
Southern Karoo Riviere	Due to the flat terrain of the region, low lying areas form shallow wet areas during rainfall periods that depict Southern Karoo Riviere vegetation. At a broad brush level, this landscape is very similar to the Gamka Karoo but is likely to depict more vegetation growth.
R61 View corridor 2km Buffer	While the R61 is not a significant tourist corridor, the routing is likely to carry some tourist traffic. There are sections along the route that depict higher levels of scenic quality that should be retained in alignment with the local and regional planning for eco-tourism.
Ridgeline Buffer 100m	In the northern portion of the study area, there is a small ridgeline that is 20m in height. The value of this landform is that it creates an opportunity for partial visual screening from the R61 road should mining activities be located to the south of this landform.

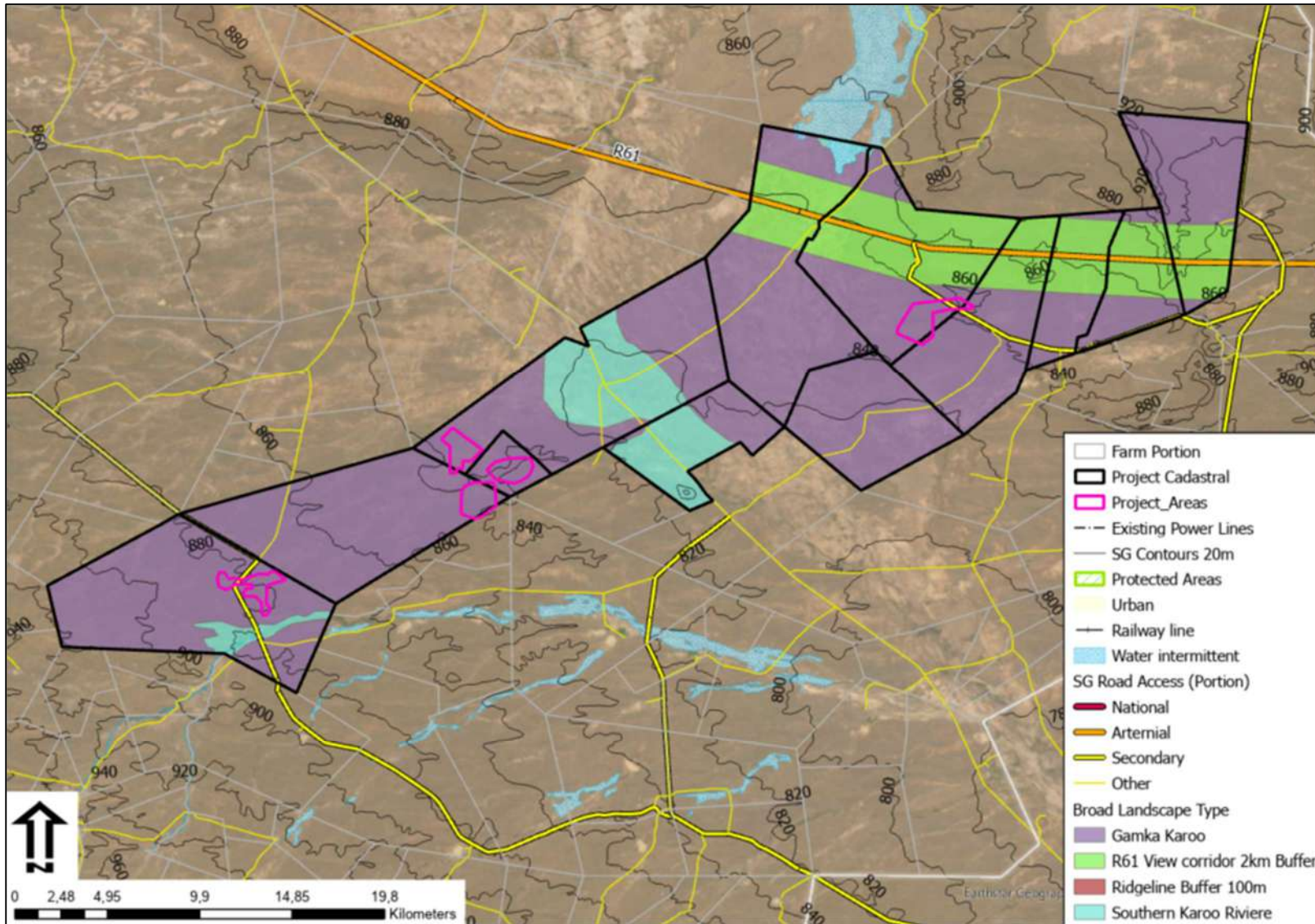


Figure 34: Physiographic Rating Units identified within the defined study area.

Table 17: Scenic Quality and Receptor Sensitivity Rating

Landscape Rating Units	Scenic Quality									Receptor Sensitivity						VRM		
	A= scenic quality rating of ≥19; B = rating of 12 – 18, C= rating of ≤11									H = High; M = Medium; L = Low								
Attribute	Landform	Vegetation	Water	Colour	Scarcity	Adjacent Landscape	Cultural Modifications	Sum	Rating	Type of Users	Amount of Use	Public Interest	Adjacent Land Uses	Special Areas	Rating	Inventory Class	Management Class	Development Sensitivity
In general, significant Heritage / Ecological / Hydrology. With specific reference to the project:	(Class I is not rated)															I	NoGo	
<ul style="list-style-type: none"> No applicable Southern Karoo Riviere. R61 View corridor 2km Buffer. Ridgeline Buffer 100m 	1	1	0	3	2	2	4	13	ML	H	H	M	H	L	MH	III	II	Not recommended
<ul style="list-style-type: none"> Gamka Karoo 	1	1	0	1	1	1	4	9	L	L	H	L	L	M	M	IV	III	With mitigation

Red colour indicates change in rating from Visual Inventory to Visual Resource Management Classes motivated in the following section.

The **Scenic Quality** scores are totalled and assigned an A (High scenic quality), B (Moderate scenic quality) or C (Low scenic quality) category based on the following split: A= scenic quality rating of ≥19; B = rating of 12 – 18, C= rating of ≤11 (USDl., 2004).

Receptor Sensitivity levels are a measure of public concern for scenic quality. Receptor sensitivity to landscape change is determined by rating the key factors relating to the perception of landscape change in terms of Low to High (H = High; M = Medium; L = Low).

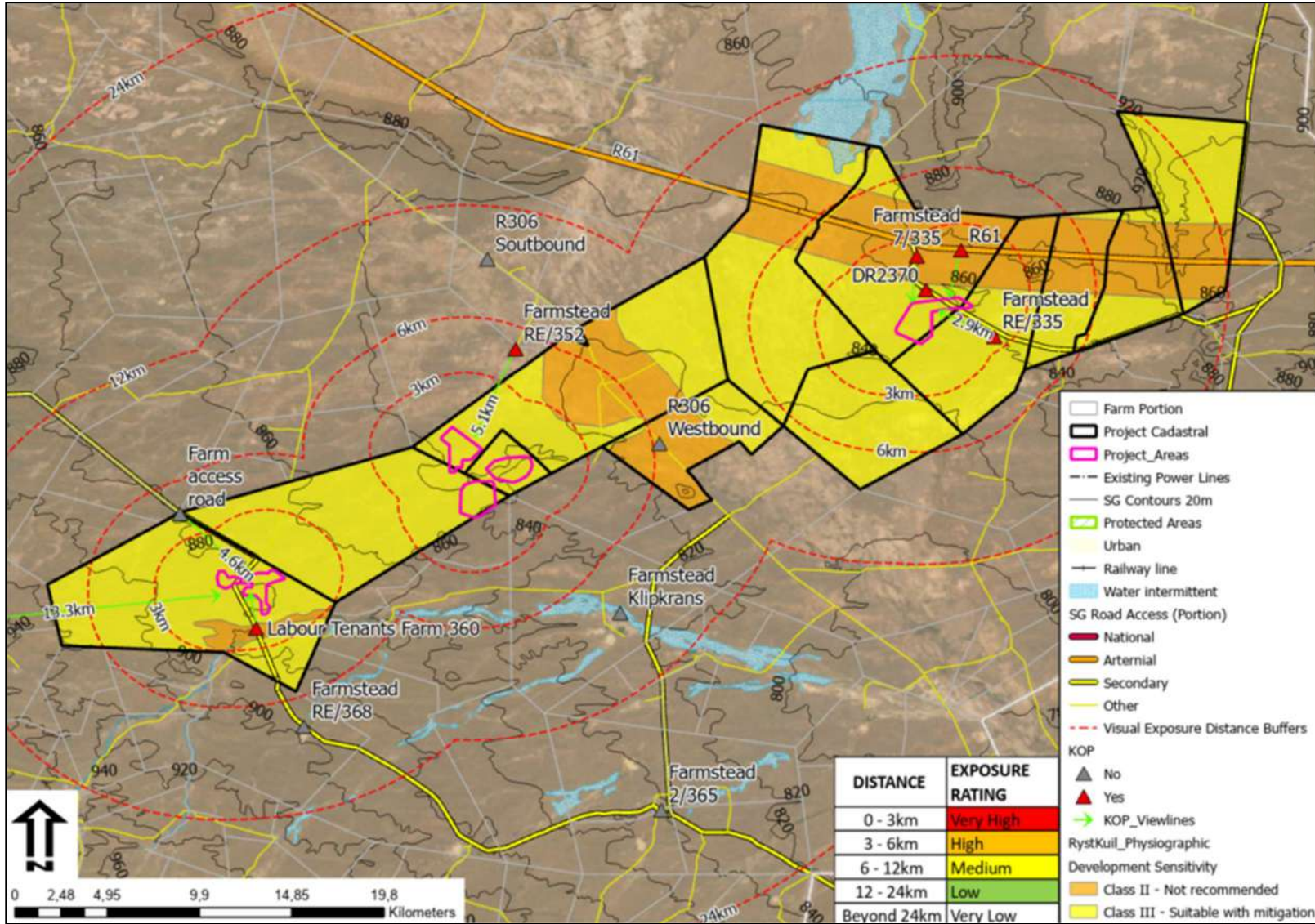


Figure 35: Visual Resource Management Classes map.

7.2 Scenic Quality Assessment

The scenic quality is determined making use of the VRM Scenic Quality Checklist that identifies seven scenic quality criteria which are rated with 1 (low) to 5 (high) scale. Making use of the VRM Matrix classification of Scenic Quality for the different physiographic units, the following table depicts a summary of the combined areas to define a broad-brush appraisal of the property scenic quality.

Table 18: Scenic Quality Rating table

Landscapes	Rating	Motivation
Landform <i>Topography becomes more of a factor as it becomes steeper, or more severely sculptured.</i>	Low	Apart from a few medium to small-sized ridgelines, the area is predominantly characterized by gentle undulations and lacks any prominent landforms that would constitute significant topographic features in the landscape.
Vegetation Primary consideration given to the variety of patterns, forms, and textures created by plant life.	Medium	At a broad scale, the vegetation across the landscape appears relatively uniform, consisting primarily of Gamka Karoo and Southern Karoo Riviere vegetation types of the Nama-Karoo biome. These vegetation types offer limited variation in pattern, form, and texture at a broad level.
Water <i>That ingredient which adds movement or serenity to a scene. The degree to which water dominates the scene is the primary consideration.</i>	Low	Although there are low-lying areas that may become wet during rainy periods, the landscape lacks any substantial water features that serve as dominant scenic focal points.
Colour <i>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.</i>	Medium	The dominant colours in the landscape are primarily associated with the vegetation types typical of the broader Nama-Karoo region. Although seasonal variation occurs, the colour palette—mostly comprising muted grey-browns—does not present as a dominant visual element in the landscape.
Scarcity <i>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.</i>	Medium	No protected or significant landscapes associated with eco-tourism were identified within the project's zone of visual influence. The deep, rural karoo does have value as a landscape resource.
Adjacent Landscapes <i>Degree to which scenery and distance</i>	High	At a regional level, the large expanse of the Nama-karoo, that have very

<i>enhance, or starts to influence, the overall impression of the scenery within the rating unit.</i>		limited man-made modification with isolated karoo farmsteads adding value as a cultural landscape, this is value from the broader landscape.
Cultural Modifications <i>Cultural modifications should be considered and may detract from the scenery or complement or improve the scenic quality of an area.</i>	High	
Scenic Quality	Medium	
The landscape within the project's zone of visual influence is defined by gentle undulations with few prominent landforms. Vegetation is relatively uniform, dominated by Gamka Karoo and Southern Karoo Riviere types, offering limited visual diversity. Water features are minimal and do not act as focal points, and the colour palette—mainly muted grey-browns—has low visual prominence. No protected or eco-tourism landscapes were identified in the area, although the broader Nama-Karoo region holds cultural and scenic value due to its largely unmodified nature and scattered Karoo farmsteads.		

7.3 Receptor Sensitivity Assessment

Different types of receptors are likely to have different responses to the landscape change changes. The following table identified the different criteria used to evaluate a broad understanding of receptor sensitivity to landscape change.

Table 19: Receptor Sensitivity Rating table.

Landscapes	Rating	Motivation
Type of Users <i>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.</i>	Medium to High	The primary landscape users are remote farming communities; however, tourist receptors travelling along the main roads to the north and south of the proposed mining site are likely to exhibit higher sensitivity to landscape degradation associated with mining activities.
Amount of use <i>Areas seen or used by large numbers of people are potentially more sensitive.</i>	Medium to Low	While the northern portion of the mine has high visual exposure, the majority of the mining landscape change areas are spaced and well set back from key receptors, with some sections falling within 'Seldom Seen' landscape zones where the only the very large mining landforms would be visible.
Public interest <i>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.</i>	Medium	While there are landscapes that have value as an iconic karoo cultural landscape, there are likely to be a range of perceptions to the mine, with those seeking employment opportunities viewing the mine landscape change in a positive light.

Landscapes	Rating	Motivation
Adjacent land Users <i>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.</i>	High	Several deep, rural farming communities are located around the proposed mine site, where the landscape change is likely to be negatively perceived due to the significant alteration of the existing Karoo sense of place.
Special Areas Management <i>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.</i>	Low	No protected areas or landscapes of recognized significance, classified as Special Areas, were identified within the site.
Receptor Sensitivity	Medium to High	
<p>The primary landscape users in the area are remote farming communities; however, tourist receptors travelling along the main roads to the north and south of the proposed mining site are likely to demonstrate higher sensitivity to visual degradation resulting from mining activities. While the northern extent of the mine is subject to high visual exposure, the majority of the proposed landscape change areas are set back and spaced from key receptors. Some sections fall within 'Seldom Seen' landscape zones, where only the most prominent mining landforms would be visible. Although the site itself contains no formally protected areas or landscapes designated as Special Areas, the broader setting holds cultural significance as part of the iconic Karoo landscape. As such, a diversity of perceptions is anticipated: some community members—particularly those seeking employment—may view the mine as a positive development, while others, particularly long-established rural communities, are likely to perceive the landscape change negatively due to the disruption of the established Karoo sense of place. Together, these factors support the assignment of a medium to high sensitivity rating to landscape change within the study area.</p>		

7.4 Visual Resource Management (VRM) Classes

The BLM has defined four Classes that represent the relative value of the visual resources of an area and are defined in terms of the VRM Matrix as follows:

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

VRM Class I

Class I is assigned when legislation restricts development in certain areas, or when very high visual intrusion or loss of significant landscape resources is likely to take place. The level of change to the characteristic landscape should be very low and must not attract attention. A Class I visual objective was assigned to the following features within the proposed development area due to their protected status within the South African legislation:

- **Generic Landscape Issues**
 - Rivers / streams, wetlands and associated flood lines buffers identified as found significant by the Aquatic Biodiversity Specialist.
 - Vegetation areas (or plant species) identified as having a high significance by the Botanical Specialists.
 - Heritage area identified as having a high significance as defined by the Heritage Specialist.
- **Landscape Specific Issues**
 - **Not applicable.**

No significant landscapes that are being used as visual resources were identified in the project zone of visual influence.

VRM Class II

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. The proposed development 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.

- **Southern Karoo Riviere.**
- **R61 View corridor 2km Buffer.**
- **Ridgeline Buffer 100m.**

While not significant in their own right, collectively these landscape features do add to the scenic quality and visual resources related to eco-tourism planning emphasised in the local and regional planning documents. Given that this is the first mining to take place in the region, a positive mining framing should be incorporated into the design such that landscape degradation can be reduced to a minimum as seen from scenic routes and isolated Karoo farmsteads that are a key component of the cultural landscape. The recommendation is that a 2km buffer along the R61 is retained as a non development area, and that the northern, low ridgeline is used as a natural topographic screening landform. With the exception of the WRD, most of the mining activities are located to the south of this ridgeline, allowing some retention of the sense of place of the R61 receptors, as well as the two local farmsteads located with Very High Visual Exposure. It is recommended that the WRD is re-located to the south of the ridgeline, as this would allow some nature landform massing to the north of the WRD, reducing the massing effect of the WRD.

VRM Class III

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. The following landscape was defined as having Class III Visual Objectives where development would be most suitable:

- **Gamka Karoo.**

Owing to their moderate scenic value and likely lower receptor sensitivity, these remote areas broadly classified as 'Seldom Seen' are considered suitable for development, subject to the implementation of appropriate mitigation measures. These should include the removal of all

mining structures post-closure, the shaping of the Waste Rock Dump (WRD), effective dust control from vehicular movement throughout the life of mine, and the minimisation of night-time light spillage to reduce visual intrusion.

VRM Class IV

The Class IV objective is to provide for management activities that require major modifications of the existing character of the landscape. The level of change to the landscape can be high, and the proposed development may dominate the view and be the major focus of the viewer's (s') attention without significantly degrading the local landscape character. Due to the degraded sense of place, the following areas were rated Class IV:

- **Not applicable**

With the exception of a small portion of the old Rystkuil Uranium Mine—which has undergone partial rehabilitation—no degraded or industrial-type landscapes were identified within the project's zone of visual influence. In recognition of the need to maintain the broader regional landscape character, no Class IV areas (i.e., areas deemed suitable for development without mitigation) have been defined for either the operational or post-mining phases of the project.

8 VISUALISATION & PHOTOMONTAGES

The following methodology was used to generate the photomontages. It must be noted that the generated photomontages are not claiming to be 100% accurate, as there is some interpretation when matching the 3D model to the photograph. However, as a detailed model proof has been used that included 3D ArcGIS software, the validity of the generated photomontages can be defined as Near Accurate. As such, the photomontages are labelled as ***Scientifically Informed Approximation***.

- Photographs taken during the field visit with the spatial location captured by means of hand-held GPS. The series of portrait photographs reflecting a human eye equivalent zoom, were 'stitched' together into a wide panoramic image using Affinity Photo software.
- Making use of ArcGIS Pro 3D Scene, a 3D model of the proposed development was generated from the 3D generated renders provided by the design engineers.
- Within the 3D model, the replica view from the KOP was rendered in the ArcGIS 3D Scene and then superimposed onto the photograph taken from the KOP in Affinity Photo. Key reference features were also incorporated into the 3D model so that a suitable landscape match can be made.

Only the mining landforms that would be visible from the KOPs were modelled, as the pits are all topographically screened and would only be locally visible from the mine site. The following images from the 3D model of the WRDs, were used to inform the photomontages or site 3D simulations to better understand what the proposed mine landscape change would look like from the relevant KOP.

Assumption Notes:

Due to limited information, the approximate heights of the WRD and TSF are utilised based on general mining specification with 30m above ground used as a worst case scenario

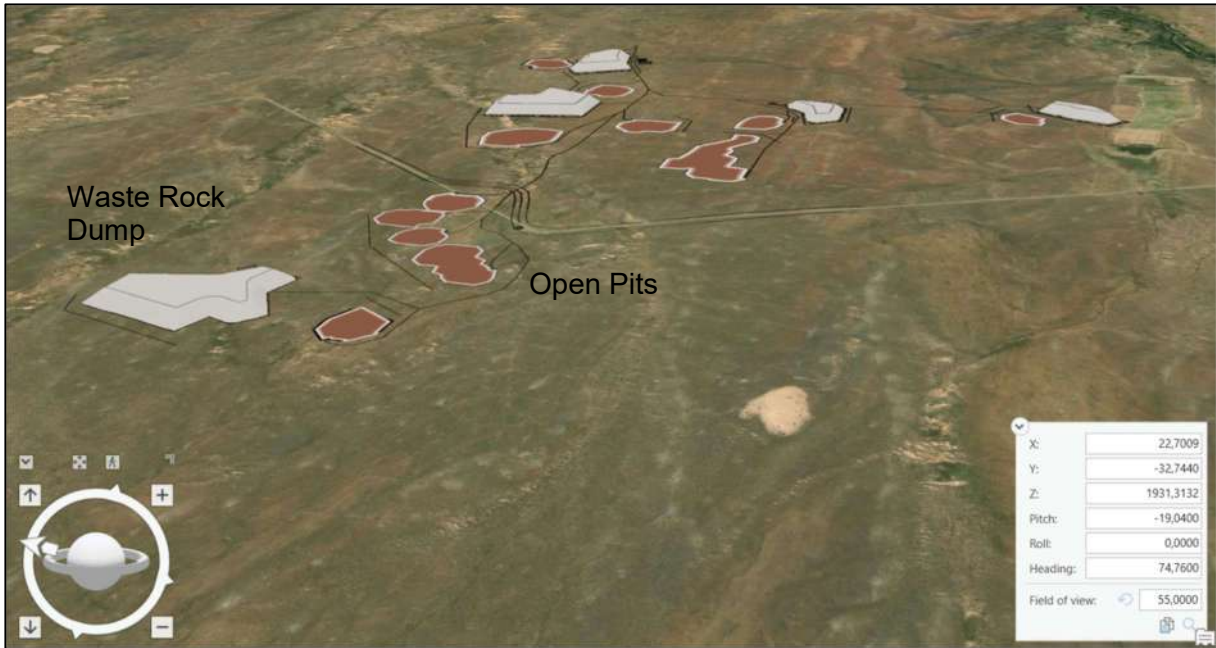


Figure 36. Perspective, Oblique 3D model view of the Ryst Kuil Extension site view North.

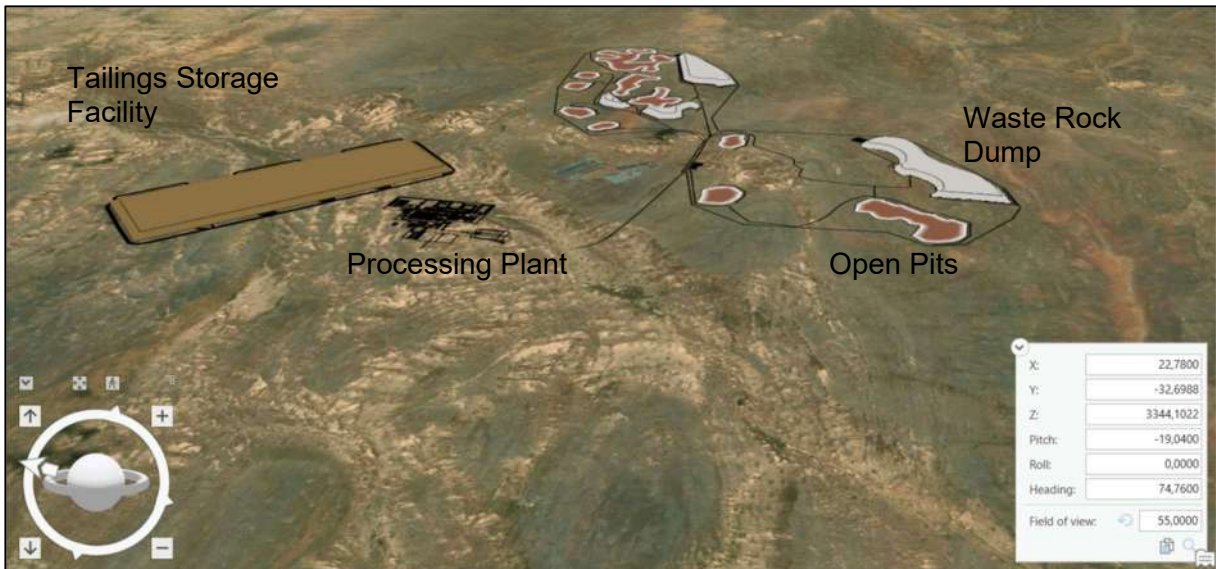


Figure 37. Perspective, Oblique 3D model view of the Ryst Kuil / Abante Mine with Tailings Facility and Processing Plant and site view North.

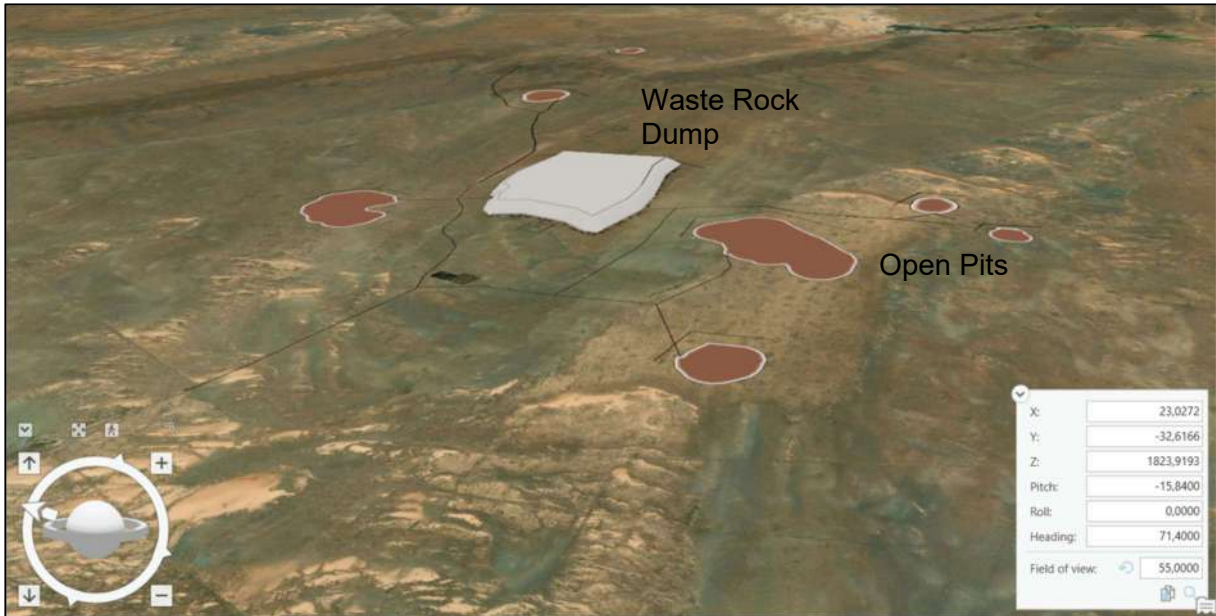


Figure 38. Perspective, Oblique 3D model view of the Haanekuil Mine site view North.



Figure 39. Ground level view of the proposed Haanekuil WRD from 465m with vertical height 30m.

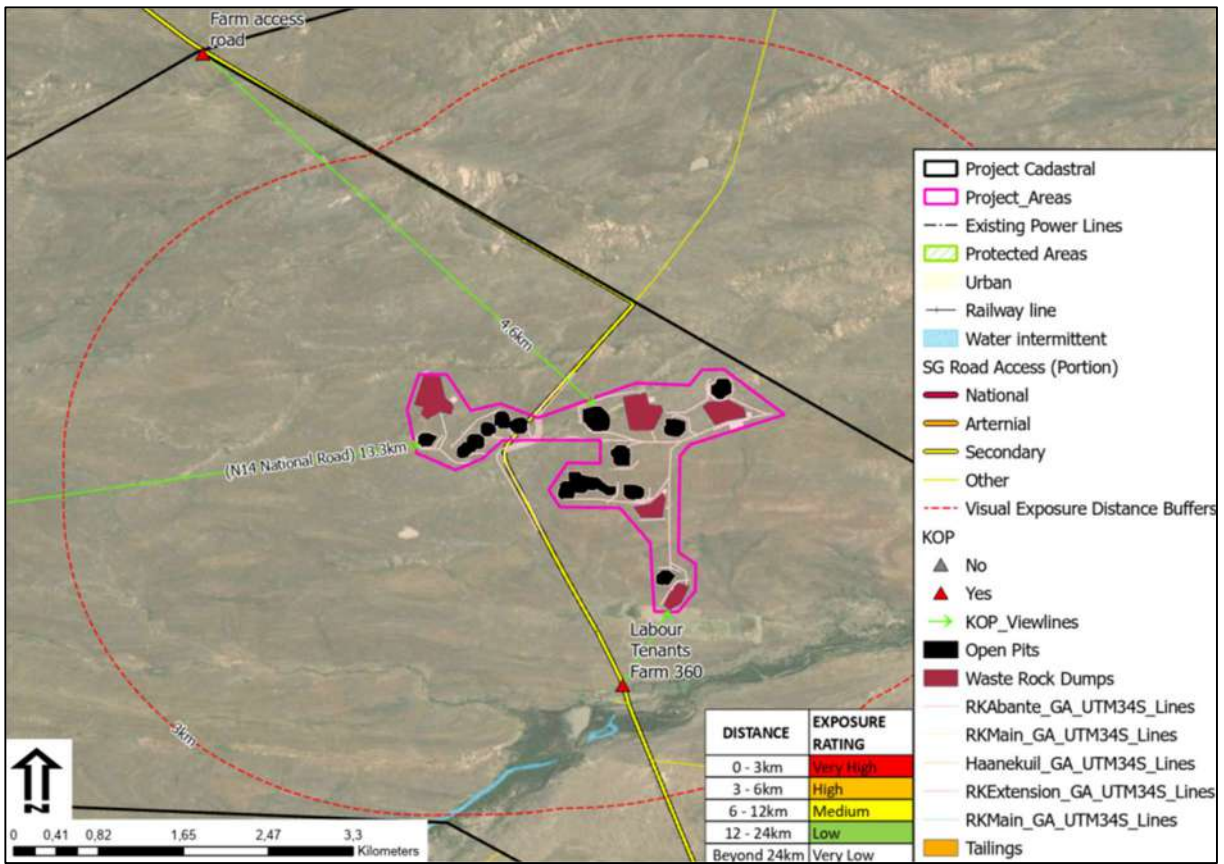


Figure 40. Map depicting the Ryst Kuil Extension KOP location.

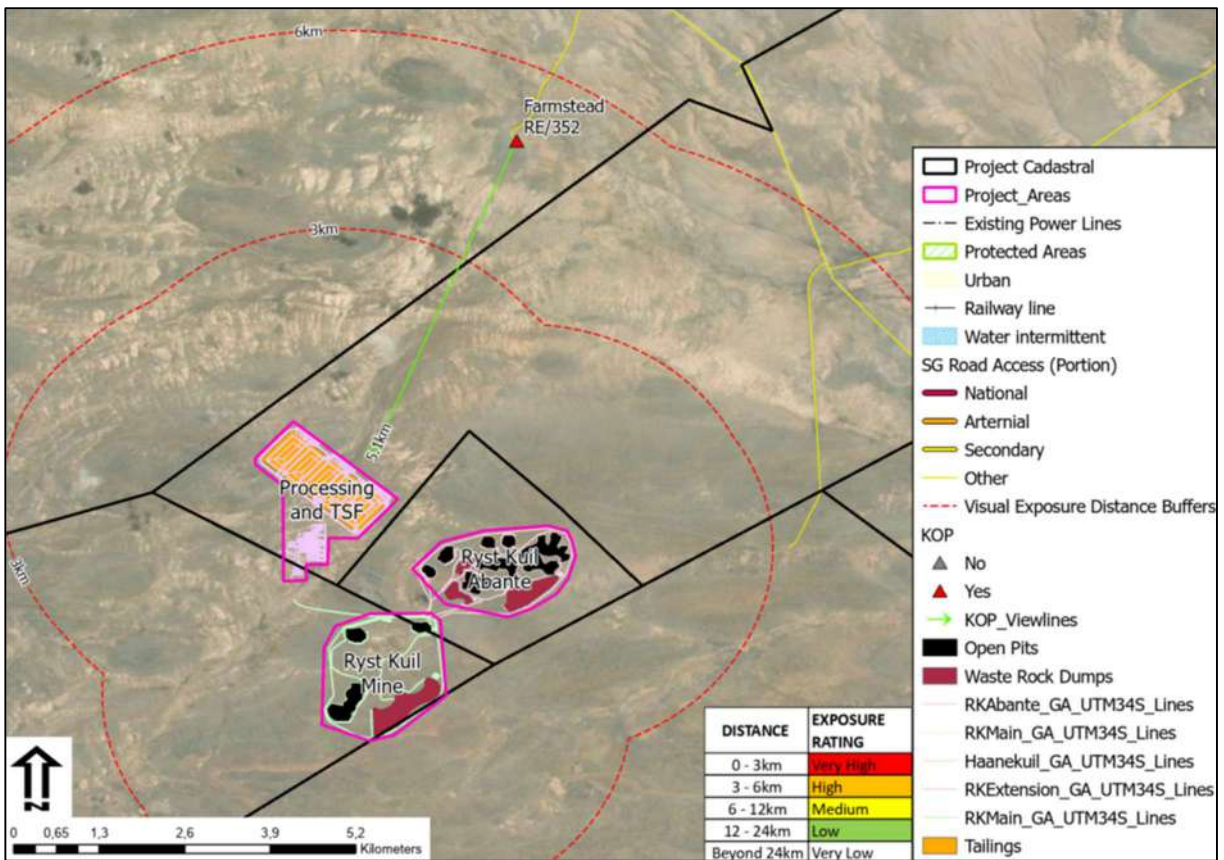


Figure 41. Map depicting the Ryst Kuil / Ryst Kuil Abante/ Processing Plant KOP location.

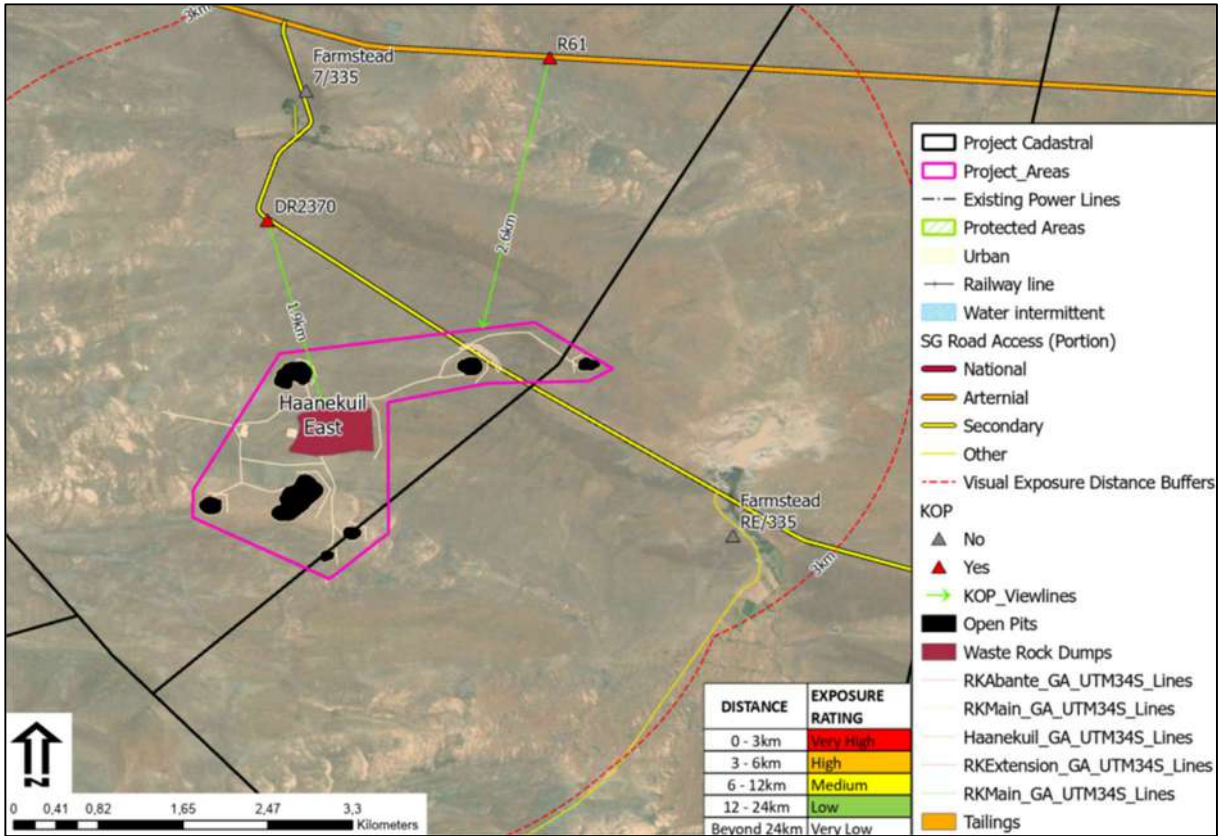


Figure 42. Map depicting the Haanekuil East KOP locations.

8.1 3D Visualisations

Ryst Kuil/ Ryst Kuil Abante/ Processing Plant Visualisations



Figure 43. 3D interpretation of the view as seen from Farmstead RE/352 at 5.2km from the farm residence view Southwest.

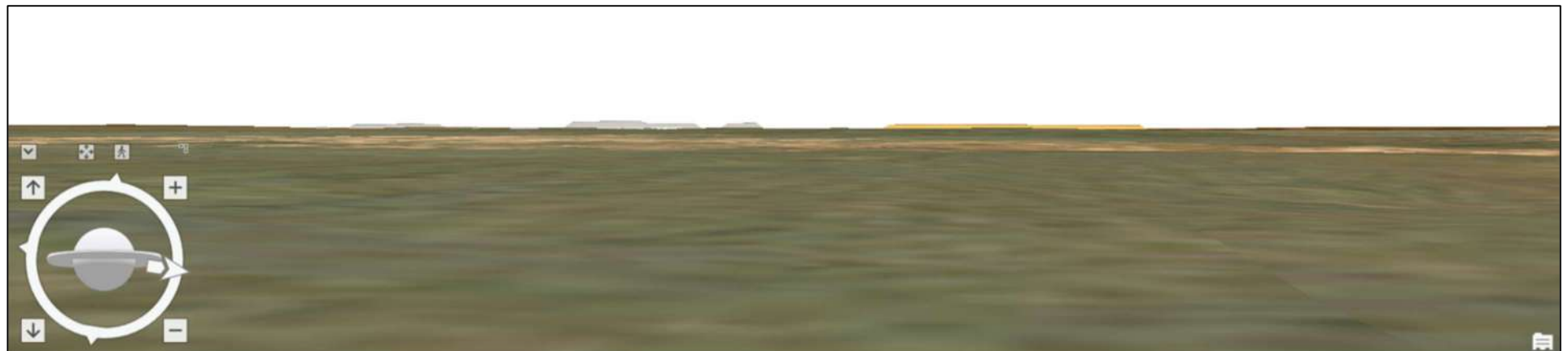


Figure 44. 3D interpretation of the view as seen from R306 Gravel Road view West .

Ryst Kuil Extension Visualisations



Figure 45. 3D interpretation of the view as seen from Farm 360 Labour Tenants dwellings view North.



Figure 46. 3D interpretation of the view as seen from Ryste Kuil Extension access road (westbound).

Haanekuil East Visualisations

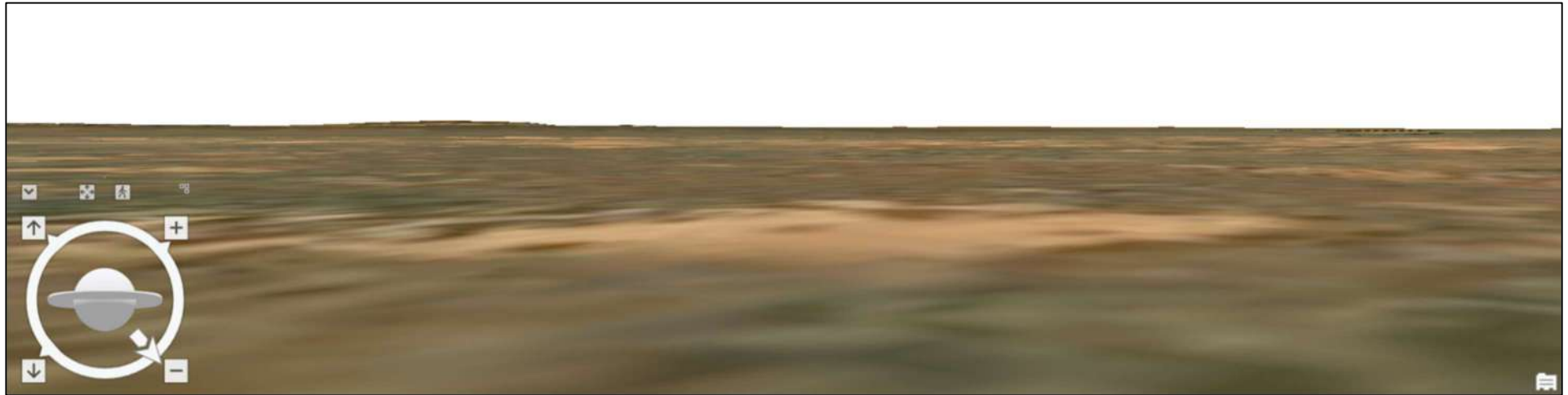


Figure 47. 3D interpretation of the view as seen from R61 view South (Null View).



Figure 48. 3D interpretation of the view as seen from DR2370 Road view South at 1.9km.

8.2 Photomontages



Figure 49. Photomontage as seen from Farm 360 Labour Tenants at 815m.



Figure 50. Photomontage as seen from Haanekuul Mine Site access road at 5km.



Figure 51. Photomontage of the Haanekuil East WRD view Southeast at 1.9km.

9 CONTRAST RATING

Impacts are defined in terms of the standardised impact assessment criteria provided by the environmental practitioner. Using the defined impact assessment criteria, the potential environmental impacts identified for the project were evaluated according to severity, duration, extent and significance of the impact. The potential occurrence and cumulative impact (as defined in the methodology) was also assessed. In order to better understand the nature of the severity of the visual impacts, a Contrast Rating exercise was undertaken, assuming the view of the defined Key Observation Point. Photomontages were generated to reflect the dominant landscape changes as seen from the main view points.

As indicated in the methodology, a contrast rating is undertaken to determine if the VRM Class Objectives are met. The suitability of a landscape modification is assessed by comparing and contrasting the existing receiving landscape to the expected contrast that the proposed landscape change will generate. This is done by evaluating the level of change to the existing landscape by assessing the line, colour, texture and form, in relation to the visual objectives defined for the area.

The following criteria are utilised in defining the degree of contrast (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.

Table 20: Contrast Rating Key Observation Points Table

Key Observation Point	Exposure		Mitigation	Landscape Elements					Visual Objectives Met?
	Distance	Exposure		Form	Line	Colour	Texture	Degree of Contrast	
N14 National Road	13km	Low	W/Out	N	N	W	N	W	Yes
			With	Not applicable					
Farm 360 Labour Tenants	815m	Very High	W/Out	S	S	S	S	S	No
			With	S	S	S	S	S	No
Ryst Kuil Extension Access Road	200m	Very High	W/Out	S	S	S	S	S	No
			With	S	S	S	S	S	No
DR2370	100m	Very High	W/Out	S	S	S	S	S	No
			With	S	S	S	S	S	No
Farmstead RE/352	5.2km	High	W/Out	S	M	S	S	S	No
			With	M	W	M	M	M	Yes
R61 Road	2.6km	Very High	W/Out	S	M	S	S	S	No
			With	M	W	M	M	M	Yes

R306 Road	8km	Medium to Low	W/Out	M	W	M	S	MS	Yes
			With	Not applicable					

* S = Strong, M = Medium, W = Weak, N = None

Contrast Rating Findings

The visual assessment of key observation points indicates that the highest levels of visual exposure occur at close-range receptors such as the Farm 360 Labour Tenants (815m), Ryst Kuil Extension Access Road (200m), DR2370 (100m), and the R61 Road (2.6km), all of which exhibit very high exposure and strong contrast in terms of form, line, colour, and texture without mitigation. Despite the implementation of mitigation measures, these points still retain a strong degree of contrast and fail to meet visual objectives. In contrast, more distant receptors such as the N14 National Road (13km) and R306 Road (8km) show low to medium exposure with weak or medium contrast, and visual objectives are met without the need for mitigation. The Farmstead RE/352 (5.2km) presents high exposure and strong contrast without mitigation, but shows a notable improvement with mitigation, where the degree of contrast reduces to medium and visual objectives are successfully met. Overall, the success of mitigation varies, with improved visual outcomes for more distant viewpoints, but limited effectiveness at closer, highly exposed locations.

The following key mitigations would be required to assist in reducing the visual intensity of the proposed mine landscape change.

- Design waste rock dumps such that they can appear as a more organic form.
- Dust mitigation for moving vehicles.
- Restriction in height of waste rock dumps to less than 40m in height.
- Light spillage mitigation.
- Colour mitigation for structures.
- Effective communication regarding blast timings.
- Shaping of waste rock dump and tailing crests on closure.
- Removal of discussed processing plants/ structures post closure.
- Rehabilitation and restoration of the impacted areas.

10 IMPACT ASSESSMENT

The impacts of the proposed project alternatives are assessed below according to the provided SLR impact assessment criteria. The following impact areas are assessed:

- Open Pits.
- Waste Dumps.
- Processing Plant.
- Tailings Storage Facility.
- Access Roads.

Due to the limited above ground components of the underground mining, this component of mine is not assessed. These areas will be accessed via incline shaft as opposed to vertically and, as such, will not require headgear infrastructure that would be visually intrusive.

The following table outlines the impact assessment criteria.

Table 21. DEA&DP Visual and Aesthetic Guideline Impact Assessment Criteria table

Criteria	Definition
<u>Extent</u>	<p>The spatial or geographic area of influence of the visual impact, i.e.:</p> <ul style="list-style-type: none"> • <i>site-related</i>: extending only as far as the activity. • <i>local</i>: limited to the immediate surroundings. • <i>regional</i>: affecting a larger metropolitan or regional area. • <i>national</i>: affecting large parts of the country. • <i>international</i>: affecting areas across international boundaries.
<u>Duration</u>	<p>The predicted life-span of the visual impact:</p> <ul style="list-style-type: none"> • <i>short term</i>, (e.g., duration of the construction phase). • <i>medium term</i>, (e.g., duration for screening vegetation to mature). • <i>long term</i>, (e.g., lifespan of the project). • <i>permanent</i>, where time will not mitigate the visual impact.
<u>Intensity</u>	<p>The magnitude of the impact on views, scenic or cultural resources.</p> <ul style="list-style-type: none"> • <i>low</i>, where visual and scenic resources are not affected. • <i>medium</i>, where visual and scenic resources are affected to a limited extent. • <i>high</i>, where scenic and cultural resources are significantly affected.
<u>Probability</u>	<p>The degree of possibility of the visual impact occurring:</p> <ul style="list-style-type: none"> • <i>improbable</i>, where the possibility of the impact occurring is very low. • <i>probable</i>, where there is a distinct possibility that the impact will occur. • <i>highly probable</i>, where it is most likely that the impact will occur. • <i>definite</i>, where the impact will occur regardless of any prevention measures.
<u>Significance</u>	<p>The significance of impacts can be determined through a synthesis of the aspects produced in terms of their nature, duration, intensity, extent and probability, and be described as:</p> <ul style="list-style-type: none"> • <i>low</i>, where it will not have an influence on the decision. • <i>medium</i>, where it should have an influence on the decision unless it is mitigated. • <i>high</i>, where it would influence the decision regardless of any possible mitigation.

10.1 Open Pit Assessment

Approximately 28 mini-pits are proposed as opposed to a larger pit. This is due to the dispersed nature of the resource rock that needs to be mined from localised deposits. The advantage of this is that a single very large open pit is not created that requires the large removal of overburden rock. The disadvantage is that the impact areas are then spread over a wider area. However, as the open pits are voids, these features will not be visible from ground level. They are also excavated slowly over time and gradually become permanent features in the landscape. It is also usually not cost effective to dump waste rock back into the

pit. The features are assessed as a combined Construction and Operation Phase, with no Closure Phase.

Table 22: Open Pit Assessment: Construction and Operation.

Landscape degradation from Open Pits		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	All	
Criteria	Without Mitigation	With Mitigation
Intensity	Moderate change (Medium)	Minor change (Low)
Duration	Permanent (> 20 years)	Permanent (> 20 years)
Extent	Beyond site	Beyond site
Probability	Definite / Continuous	Definite / Continuous
Significance	Medium -	Medium to Low -
Additional Assessment Criteria		
Degree to which impact can be reversed	Non-Reversible: As the pit is a permanent feature, the change to the landscape is non-reversible.	
Degree to which impact may cause irreplaceable loss of resources	Low: While the receiving landscape is interesting, it does not constitute a significant landscape feature and is fairly common within the region.	
Degree to which impact can be avoided	Low: Due to the large size of the resultant void, the impact avoidance is rated Low.	
Degree to which impact can be mitigated	Low: Mitigations for addressing the pit impacts are not available.	
Cumulative Impact		
Extent to which a cumulative impact may arise	Possible: Due to the landscape degradation related to the post mining landscape, negative cumulative effects can take place due to landscape sterilisation. Due to the permanent nature of the large pits, there is a residual risk to landscape sterilisation for surrounding areas and land-uses. As adjacent land-uses are agricultural, this is likely to be negligible.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Medium -
Mitigations		
<ul style="list-style-type: none"> • If at all possible, design the blast such that vertical plumes are limited. • Clear communication with surrounding property owners on when blasts will take place. • Ensure that post-closure, the pits are well fenced off to ensure that security is maintained to reduce the risk of injury from those seeking recycling metals. 		

10.2 Waste Rock Dump Assessment

As with the open pits, there are ten waste rock dumps proposed around the open pits where the over-burden, or low grade ore rocks are dumped. These will become established overtime, as the large dump trucks dump ore onto the heap. This does result in an increase in ambient dust in the locality, increasing dust haze effects. As this effect is already present in the semi-arid landscape, this effect is likely to be minimal. The effect also reduces clarity of view from background vantage points. Designing the WRD with organic shapes and rounding of the WRD crest on closure, significantly reduces the visual contrast as the landforms can take on more organic forms that appear to be natural from background view points. Another factor that

does reduce visual intrusion is limiting the height of the air-space. While this does increase the potential of the landform appearing more natural, it can increase the cost as well as increase biodiversity impacts from expanded footprint impacts.

Table 23: Waste Dump Construction and Operation Assessment.

Landscape degradation from Waste Dumps		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction and Operational	
Criteria	Without Mitigation	With Mitigation
Intensity	Moderate change (Medium to High)	Moderate change (Medium)
Duration	Permanent (> 20 years)	Permanent (> 20 years)
Extent	Local area, far beyond site	Local area, far beyond site
Probability	Definite / Continuous	Definite / Continuous
Significance	Medium to High -	Medium-
Additional Assessment Criteria		
Degree to which impact can be reversed	Irreversible: Due to the size of the resultant landform that will become a large form over time, the landscape change will be irreversible but will only be viewed as background landforms.	
Degree to which impact may cause irreplaceable loss of resources	Low: While the receiving landscape is interesting, it does not constitute a significant landscape feature and is fairly common within the region.	
Degree to which impact can be avoided	Low: Due to the large size of the landform, the impact avoidance is rated Low.	
Degree to which impact can be mitigated	Medium: With shaping of the final form to allow for a rounding of the crests, the visual impact of the landform can be reduced after rehabilitation.	
Cumulative Impact		
Extent to which a cumulative impact may arise	Medium: Due to the landscape degradation related to the post mining landscape, negative cumulative effects can take place due to landscape sterilisation. The risk to landscape sterilisation is limited by the remoteness of the location, as well as the topographic screening from the main tourist view corridors.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Low -
Mitigations		
<ul style="list-style-type: none"> • In most cases, the WRDs have been designed to break up strong lines generated by large flat surfaces created by the sides of the WRD. However, there are some WRDs that still depict long line features. Review the design of these WRDs such that they do not have overly straight lines that create pyramid/ non-organic shapes. • If possible during the design phase, the WRD should have an average height of 25m above ground level and should not exceed 30m in height (avg. height above ground level). • The height of the WRD should also vary in height so as to not create a visible platform height for the clusters of dumps. • Continuous dust suppression management on all major haul roads. 		

Table 24: Area 4 Waste Dump Decommissioning and Closure Assessment.

Landscape degradation from Area 4 Waste Dump		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Decommissioning and Closure	
Criteria	Without Mitigation	With Mitigation
Intensity	Moderate change (Medium)	Moderate change (Medium)
Duration	Permanent (> 20 years)	Permanent (> 20 years)
Extent	Local area, far beyond site	Local area, far beyond site
Probability	Probable (High)	Possible / frequent (Medium)
Significance	High -	Medium -
Additional Assessment Criteria		
Degree to which impact can be reversed	Irreversible: Due to the size of the resultant landform that will become a large form over time, the landscape change will be irreversible. However, with mitigation, the intensity of the landscape change can be reduced to some degree.	
Degree to which impact may cause irreplaceable loss of resources	Low: While the receiving landscape is interesting, it does not constitute a significant landscape feature and is fairly common within the region.	
Degree to which impact can be avoided	Low: Due to the large size of the landform, the impact avoidance is rated Low.	
Degree to which impact can be mitigated	Medium: With shaping of the final form to allow for a rounding of the crests, the visual impact of the landform can be reduced after rehabilitation.	
Cumulative Impact		
Extent to which a cumulative impact may arise	Medium: Due to the landscape degradation related to the post mining landscape, negative cumulative effects can take place due to landscape sterilisation. The risk to landscape sterilisation is limited by the remoteness of the location, as well as the topographic screening where the landscape change is highly unlikely to extend to the adjacent main roads.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Low -
Mitigations		
<ul style="list-style-type: none"> • Early appointment of landscape architect to provide input into the final shaping of the resultant landforms. • Shaping of final landform such that the crests are rounded and appear more natural in the landscape. • Shaping of the top of the WRDs to allow for hydrological run-off such that ponding does not occur. • Removal of all structures on top of the WRDs. • Rehabilitation and restoration as per the rehabilitation specialist's recommendations. 		

10.3 Processing Plant

The Processing Plant is industrial in nature and serves to process the uranium from the rock. The structures are large in size but are not prominently located and will be partially visually screened by the northern TSF and eastern WRD landforms. Light spillage from security and operational lights at night are likely to extend the ZVI of the mine. Due to the need to maintain

security and safety during operation, mitigation of lights at night is limited as safety is the primary objective. Reduced colour contrast from bright or highly reflective sheeting materials can also assist in reducing visual intrusion from background receptors.

Table 25: Processing Plant Construction and Operation Assessment.

Landscape degradation from Processing Plant		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction and Operational	
Criteria	Without Mitigation	With Mitigation
Intensity	Prominent change (High)	Moderate change (Medium)
Duration	Long-term (10 to 20 years)	Long-term (10 to 20 years)
Extent	Whole site and nearby surroundings	Whole site and nearby surroundings
Probability	Probable (High)	Possible / frequent (Medium)
Significance	Medium -	Low -
Additional Assessment Criteria		
Degree to which impact can be reversed	Reversible: The structures of the processing plant can be removed post operation.	
Degree to which impact may cause irreplaceable loss of resources	Low: While the receiving landscape is interesting, it does not constitute a significant landscape feature and is fairly common within the region.	
Degree to which impact can be avoided	Low: Due to the size of the plant where there is no other large structure in the local landscape, the impact avoidance is rated Low.	
Degree to which impact can be mitigated	Medium: With the use of earth colours for the structures and light spillage mitigation, the impact can be reduced to some degree.	
Cumulative Impact		
Extent to which a cumulative impact may arise	Medium: Landscape sterilisation could occur to some degree, but due to the very remote location of the site, it is unlikely that this will result in detrimental land use changes to the surrounding areas. The plant also does not fall within the southern tourist related ZVI. There are also few receptors in the area.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Low -
Mitigations		

- Topsoil (if any) should be removed from the site and stockpiled for later use in rehabilitation of areas impacted during construction that are outside the working footprints of the operational phase.
- It is recommended that the plant is painted in grey or grey-brown colours (example: RAL 9007 or RAL 1014). This colour blends well with the surrounding landscape so as to contain the mine ZVI.
- It is recommended that any stacks are painted a mid grey colour.
- All lighting must be kept to an efficient minimum while still keeping within the safety norms required by the mine.
- Dust mitigation measures need to be implemented on access roads to minimise the negative effects of wind blown dust.
- Monitoring will need to be undertaken by the ECO on a regular basis to ensure that dust is adequately managed.
- Littering is to be strictly controlled and be a finable offence. A six-foot mesh wire fence needs to be constructed around the mine camp to catch wind blown litter, and litter cleaned on a monthly basis.

Table 26: Processing Plant Decommissioning and Closure Assessment.

Landscape degradation from Processing Plant		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Decommissioning and Closure	
Criteria	Without Mitigation	With Mitigation
Intensity	Severe change (Very high)	Minor change (Low)
Duration	Permanent (> 20 years)	Short-term (1 to 5 years)
Extent	Local area, far beyond site	Part of site/property
Probability	Definite / Continuous (Very high)	Conceivable (Low)
Significance	High -	Low -
Additional Assessment Criteria		
Degree to which impact can be reversed	Reversible: The structures of the processing plant can be removed post operation.	
Degree to which impact may cause irreplaceable loss of resources	Low: While the receiving landscape is interesting, it does not constitute a significant landscape feature and is fairly common within the region.	
Degree to which impact can be avoided	Low: Due to the moderate size of the plant where there is no other large structure in the local landscape, the impact avoidance is rated Low.	
Degree to which impact can be mitigated	High: With the removal of all the plant structures post closure, the impact can be significantly reduced.	
Cumulative Impact		
Extent to which a cumulative impact may arise	Medium: Landscape sterilisation could occur to some degree, but due to the very remote location of the site, it is unlikely that this will result in detrimental land use changes to the surrounding areas. The plant also does not fall within the southern tourist related ZVI.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	High -	Low -
Mitigations		

- All structures associated with the plant must be broken down and dumped into the pit and covered with rock (unless they contain contaminated material which then needs to be addressed in terms of South Africa legislation).
- The impacted landscapes need to be shaped to appear natural and to allow for natural hydrological flow.
- Rehabilitation of access routes such that a natural vegetation cover takes place to reduce wind blown dust (with the exception of the routes that will not be required for long term monitoring).
- Continuing with dust mitigation measures as per the recommendations defined by the ECO until full mine closure has been achieved.
- Littering is to be strictly controlled and be a finable offence.

10.4 Tailings Storage Facility Assessment

The TSF is not valley contained and as such, will need to be a stand alone land-form that will require engineering to ensure that collapse of the 'dam' does not take place. The resultant colour of the TSF is likely to be darker in colour that will reduce some visual contrast during operational phases. If capping with rock is a requirement post closure, this could change the colour contrast but will have a rough texture that will also reduce contrast to some degree. Due to the size and scale of the TSF, that requires specific engineering to ensure that wall failure does not take place, mitigation by design is limited.

Table 27: TSF Construction and Operation Assessment.

Landscape degradation from TSF		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction and Operational	
Criteria	Without Mitigation	With Mitigation
Intensity	Moderate change (Medium)	Moderate change (Medium)
Duration	Permanent (> 20 years)	Permanent (> 20 years)
Extent	Whole site and nearby surroundings	Whole site and nearby surroundings
Probability	Probable (High)	Possible / frequent (Medium)
Significance	Medium -	Low -
Additional Assessment Criteria		
Degree to which impact can be reversed	Non-Reversible: The TSF will become a permanent feature in the landscape.	
Degree to which impact may cause irreplaceable loss of resources	Low: While the receiving landscape is interesting, it does not constitute a significant landscape feature and is fairly common within the region.	
Degree to which impact can be avoided	Low: Due to the large size of the TSF, the dam wall area will always be visible.	
Degree to which impact can be mitigated	Medium: Continuous rehabilitation of the wall as it is raised and will assist in reducing the burden of the final rehabilitation.	
Cumulative Impact		

Extent to which a cumulative impact may arise	Medium: Landscape sterilisation could occur to some degree, but due to the very remote location of the site, it is unlikely that this will result in detrimental land use changes to the surrounding areas. The TSF also does not fall within the southern tourist related ZVI.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Low -
Mitigations		
<ul style="list-style-type: none"> • Topsoil (if any) should be removed from the site and stockpiled for later rehabilitation of areas impacted during construction that are outside the working footprints of the operational phase. • Continuous rehabilitation on the walls by the planting of water-hardy ground cover vegetation to reduce the burden of the post closure restoration as well as reduce erosional risk from exposed cover soils (subject to rehabilitation specialist's findings). • Dust mitigation measures need to be implemented on all roads to minimise the negative effects of wind blown dust. • All lighting must be kept to an efficient minimum while still keeping within the safety norms required by the mine (refer to generic guidelines in the Addendum). • Monitoring will need to be undertaken by the ECO on a regular basis to ensure that dust is adequately managed. • Littering is to be strictly controlled and be a finable offence. • Desert colours are utilised for any structures located on top of the TSF so as to minimise the colour contrast as seen from the surrounding areas, without compromising safety. 		

Table 28: TSF Decommissioning and Closure Assessment.

Landscape degradation from TSF		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Decommissioning and Closure	
Criteria	Without Mitigation	With Mitigation
Intensity	Moderate change (Medium)	Moderate change (Medium)
Duration	Short-term (1 to 5 years)	Short-term (1 to 5 years)
Extent	Whole site and nearby surroundings	Whole site and nearby surroundings
Probability	Probable (High)	Possible / frequent (Medium)
Significance	Medium -	Low -
Additional Assessment Criteria		
Degree to which impact can be reversed	Non-Reversible: The TSF will become a permanent feature in the landscape.	
Degree to which impact may cause irreplaceable loss of resources	Low: While the receiving landscape is interesting, it does not constitute a significant landscape feature and is fairly common within the region.	
Degree to which impact can be avoided	Low: Due to the large size of the TSF, the dam wall area will always be visible.	
Degree to which impact can be mitigated	Low: Continuous rehabilitation of the wall as it is raised it will assist in reducing the burden of the final rehabilitation. However, this is limited in an arid environment where plant growth is likely to be limited.	
Cumulative Impact		
Extent to which a cumulative impact may arise	Medium: Landscape sterilisation could occur to some degree, but due to the very remote location of the site, it is unlikely that this will result in	

	detrimental land use changes to the surrounding areas. The TSF also does not fall within the southern tourist related ZVI.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Low -
Mitigations		
<ul style="list-style-type: none"> • All structures associated with the TSF must be broken down and dumped into the pit and covered (unless they contain contaminated material which then needs to be addressed in terms of South African legislation). • Rehabilitation and restoration of the TSF as per the rehabilitation specialist recommendations. • Rehabilitation of access routes such that a natural vegetation cover takes place to reduce wind blown dust (with the exception of the routes that will not be required for long term monitoring). • Continuing with dust mitigation measures as per the recommendations of the defined by the ECO until full mine closure has been achieved. • Littering is to be strictly controlled and be a finable offence. 		

10.5 Access Roads

One of the main visual and landscape impacts will be the increased movement of trucks through the areas, with associated dust plumes from the moment of the vehicle drives on gravel roads where dust is likely to be a significant factor. Dust suppressant mitigations are available and should be used to reduce this nuisance effect in general, and more specifically for areas where access roads pass rural residential farmsteads. As no new roads will be created external to the mine, the construction phase is not assessed. There are no residential receptors near the internal roads, with dust mitigation covered within the WRD section for haul roads.

Table 29: Access Roads: Construction and Operation Assessment.

Landscape degradation from TSF		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operational	
Criteria	Without Mitigation	With Mitigation
Intensity	Strong change (High)	Moderate change (Medium)
Duration	Permanent (> 20 years)	Permanent (> 20 years)
Extent	Whole site and nearby surroundings	Whole site and nearby surroundings
Probability	Probable (High)	Possible / frequent (Medium)
Significance	Medium to High -	Medium -
Additional Assessment Criteria		
Degree to which impact can be reversed	Non-Reversible: Movement of large vehicles on the external access roads will become a permanent feature in the landscape.	
Degree to which impact may cause irreplaceable loss of resources	Low: While the receiving landscape is interesting, it does not constitute a significant landscape feature and is fairly common within the region.	
Degree to which impact can be avoided	Low: Due to the number of vehicles, it is unlikely that the impact can be avoided, and residual impacts will remain.	

Degree to which impact can be mitigated	Medium: Continuous dust suppression methods can provide some reduction in the dust from moving vehicles. Speed of the moving vehicles can also reduce dust, but as the roads are outside of the mine site, the speed would be governed by National Road Laws and speed reduction measures would be limited.	
Cumulative Impact		
Extent to which a cumulative impact may arise	Medium: Landscape sterilisation could occur to some degree of farmsteads located in close proximity to the access roads. However, the area is remote and there are few residential farmsteads in close proximity to the main access road.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Low -
Mitigations		
<ul style="list-style-type: none"> Dust mitigation measures need to be implemented on all roads to minimise the negative effects of wind blown dust. Monitoring will need to be undertaken by the ECO on a regular basis to ensure that dust is adequately managed. Littering along the road should be strictly controlled and be a finable offence. 		

Table 30: Access Roads: Decommissioning and Closure Assessment.

Landscape degradation from roads and dust from moving vehicles		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Decommissioning and Closure	
Criteria	Without Mitigation	With Mitigation
Intensity	Moderate change (Medium)	Moderate change (Medium)
Duration	Short-term (1 to 5 years)	Short-term (1 to 5 years)
Extent	Whole site and nearby surroundings	Whole site and nearby surroundings
Probability	Probable (High)	Possible / frequent (Medium)
Significance	Medium -	Low -
Additional Assessment Criteria		
Degree to which impact can be reversed	Reversible: The roads can be rehabilitated to some degree.	
Degree to which impact may cause irreplaceable loss of resources	Low: While the receiving landscape is interesting, it does not constitute a significant landscape feature and is fairly common within the region.	
Degree to which impact can be avoided	Medium: Vehicles will always result in some dust.	
Degree to which impact can be mitigated	High: Dust from moving vehicles can effectively be controlled to some degree, bearing in mind that the receiving landscape is arid and there is an existing precedent for atmospheric dust.	
Cumulative Impact		
Extent to which a cumulative impact may arise	Medium: The area is remote and there are few residential farmsteads in close proximity to the main access road.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Low -
Mitigations		

- Rehabilitation of access routes such that a natural vegetation cover takes place to reduce wind blown dust (with the exception of the routes that will not be required for long term monitoring).
- Continuing with dust mitigation measures as per the recommendations of the defined by the ECO until full mine closure has been achieved.
- Littering is to be strictly controlled and be a finable offence.

11 MANAGEMENT MITIGATION MEASURES AND RECOMMENDATIONS

11.1 Open Pit and Blast Plume

Construction

- Topsoil (if any) should be removed from the site and stockpiled for later use rehabilitation of areas impacted during construction that are outside the working footprints of the operational phase.
- Dust mitigation measures need to be implemented on all roads to minimise the negative effects of wind-blown dust.
- All lighting must be kept to an efficient minimum while still being kept within the safety norms required by mine (refer to generic guidelines in the Addendum).
- Blasts need to be designed such that vertical plumes are limited as much as possible.
- Monitoring will need to be undertaken by the ECO on a regular basis to ensure that dust is adequately managed.
- Littering is to be strictly controlled and be a finable offence.

Operation

- Continuation of dust monitoring by the ECO.
- Littering is to be strictly controlled and be a finable offence.
- Clear and regular notification of blasting events with local communities.

Closure

- All structures associated with the pit must be broken down and dumped into the pit and covered with rock (unless they contain contaminated material which then needs to be address in terms of South African legislation).
- The impacted landscapes need to be shaped into a natural form following natural hydrological patterns.
- Rehabilitation of access routes such that a natural vegetation cover takes place to reduce wind blown dust (with the exception of the routes that will not be required for long term monitoring).
- Continuing with dust mitigation measures as per the recommendations of the defined by the ECO until full mine closure has been achieved.
- Littering is to be strictly controlled and be a finable offence.

11.2 Processing Plant

Construction

- Topsoil (if any) should be removed from the site and stockpiled for later use rehabilitation of areas impacted during construction that are outside the working footprints of the operational phase.

- The site needs to be leveled in such a way that the platform is cut into the ground as much as possible. The cut and fill areas need to be rehabilitated as soon as possible after construction.
- It is recommended that the plant is painted in grey or grey-brown colours (example: RAL 9007 or RAL 1014). This colour blends well with the surrounding landscape so as to contain the mine ZVI.
- It is recommended that any stacks are painted a mid grey colour.
- All lighting must be kept to an efficient minimum while still keeping within the safety norms required by the mine.
- Dust mitigation measures need to be implemented on all roads to minimise the negative effects of wind-blown dust.
- Monitoring will need to be undertaken by the ECO on a regular basis to ensure that dust is adequately managed.
- Littering is to be strictly controlled and be a finable offence.
- A six-foot mesh wire fence needs to be constructed around the mine camp to catch wind blown litter, and litter cleaned on a monthly basis.

Operation

- Continuing with dust and light mitigation monitoring by the ECO.
- Littering is to be strictly controlled and be a finable offence.

Closure

- All structures associated with the plant must be broken down and dumped into the pit (unless they contain contaminated material which then needs to be address in terms of South African legislation).
- The impacted landscapes need to be shaped to appear natural and to allow for natural hydrological flow.
- Rehabilitation of access routes such that a natural vegetation cover takes place to reduce wind blown dust (with the exception of the routes that will not be required for long term monitoring).
- Continuing with dust mitigation measures as per the recommendations defined by the ECO until full mine closure has been achieved.
- Littering is to be strictly controlled and be a finable offence.

11.3 Tailings Storage Facility

Construction

- Topsoil (if any) should be removed from the site and stockpiled for later rehabilitation of areas impacted during construction that are outside the working footprints of the operational phase.
- Dust mitigation measures need to be implemented on all roads to minimise the negative effects of wind-blown dust.
- All lighting must be kept to an efficient minimum while still being kept within the safety norms required by the mine (refer to generic guidelines in the Addendum).
- Monitoring will need to be undertaken by the ECO on a regular basis to ensure that dust is adequately managed.
- Littering is to be strictly controlled and be a finable offence.
- Desert colours are utilised for any structures located on top of the TSF so as to minimise the colour contrast as seen from the surrounding areas, without compromising safety.

Operation

- Continuation of dust mitigation monitoring by the ECO.
- Littering is to be strictly controlled and be a finable offence.
- Limited height of the TSF to 30m above ground level.

Closure

- All structures associated with the TSF must be broken down and dumped into the pit (unless they contain contaminated material which then needs to be address in terms of South African legislation).
- The impacted landscapes need to be shaped into a natural form following natural hydrological patterns.
- Cap with rock from the WRDs (or meet best National practice for TSF closure in terms of South African mine closure legislation).
- Rehabilitation of access routes such that a natural vegetation cover takes place to reduce wind blown dust (with the exception of the routes that will not be required for long term monitoring).
- Continuing with dust mitigation measures as per the recommendations of the defined by the ECO until full mine closure has been achieved.
- Littering is to be strictly controlled and be a finable offence.

11.4 Waste Rock Dumps

Preconstruction

- In most cases, the WRDs have been designed to break up strong lines generated by large flat surfaces created by the sides of the WRD. However, there are some WRDs that still depict long line features. Review the design of these WRDs such that they do not have overly straight lines that create pyramid/ non-organic shapes.
- The WRDs should be constrained to 30m above ground height so as not to create a pyramid shape that protrudes above the undulating terrain.

Construction

- Topsoil (if any) should be removed from the site and stockpiled for later rehabilitation of areas impacted during construction that are outside the working footprints of the operational phase.
- Dust mitigation measures need to be implemented on all roads to minimise the negative effects of wind-blown dust.
- All lighting must be kept to an efficient minimum while still being kept within the safety norms required by the mine (refer to generic guidelines in the Addendum).
- Monitoring will need to be undertaken by the ECO on a regular basis to ensure that dust is adequately managed.

Operation

- Continuing with dust mitigation monitoring by the ECO.
- Littering is to be strictly controlled and be a finable offence.

Closure

- All structures associated with the WRD must be broken down and dumped into the pit (unless they contain contaminated material which then needs to be address in terms of South African legislation). These impacted landscapes need to be shaped into a natural form following natural hydrological patterns.

- The crest area of the WRD needs to be shaped to create a rounded effect so as to appear more natural.
- Rehabilitation of access routes such that a natural vegetation cover takes place to reduce wind blown dust (with the exception of the routes that will not be required for long term monitoring).
- Continuing with dust mitigation measures as per the recommendations of the defined by the ECO until full mine closure has been achieved.
- Littering is to be strictly controlled and be a finable offence.

11.5 Access Road

Construction

- Dust mitigation measures need to be implemented during construction to minimise the negative effects of wind-blown dust and from movement of vehicles.
- Monitoring will need to be undertaken by the ECO on a regular basis to ensure that dust and erosion controls are adequately managed.
- Littering is to be strictly controlled and be a finable offence.

Operation

- Continuing with dust and erosion monitoring by the ECO.

Closure

- NA

12 SUMMARY OF VISUAL IMPACT FINDINGS

A summary of the visual impacts assessed in located on the following page, with the summary table below. The headings below refer to a summary of the identified impact assessment criteria.

Table 31: Impact Significance Summary Table

Project	Phase	Mitig. Status	Significance	Cumulative
Open Pits	Construction	Without	Medium	Medium
		With	Medium to Low	Medium
	Operation	Without	Medium	Medium
		With	Medium to Low	Medium
	Decommissioning	Without	<i>Permanent features</i>	
		With		
Waste Rock Dumps	Construction	Without	Medium to High	Medium
		With	Medium	Low
	Operation	Without	Medium to High	Medium
		With	Medium	Low
	Decommissioning	Without	High	Medium
		With	Medium	Low
	Construction	Without	Medium	Medium

Tailings Dam	Operation	With	Low	Low
		Without	Medium	Medium
	Decommissioning	With	Low	Low
		Without	Medium	Medium
		With	Low	Low

Process Plant	Construction	Without	Medium	Medium
		With	Low	Low
	Operation	Without	Medium	Medium
		With	Low	Low
	Decommissioning	Without	High	High
With		Low	Low	

Access Roads	Construction	Without	Medium to High	Medium
		With	Medium	Low
	Operation	Without	Medium to High	Medium
		With	Medium	Low
	Decommissioning	Without	Medium	Medium
		With	Low	Low

Type of Impact:

The nature of the impact is **Negative**, as the proposed mining activities will lead to the degradation of local landscape resources.

Extent of the Impact:

The extent of the anticipated Zone of Visual Influence (ZVI) is rated as **Regional**, primarily due to the dispersed arrangement of the three mining cluster areas, which collectively contribute to a broader visual footprint. An additional factor likely to extend the ZVI is the visibility of the blast plume. Although episodic and short-lived, the plume—and associated blast noise—will temporarily but significantly alter the local landscape character, reinforcing an industrial mining identity.

Magnitude of the Impact:

The **magnitude** of impact to regional visual resources is assessed as **Medium to Low**, due to the remoteness of the site and the limited number of visual receptors within the ZVI. However, the **local landscape impact** is rated **High**, as natural landforms will be heavily and visibly altered over a prolonged period. During the **construction phase**, magnitude is expected to be **High**, particularly as the processing plant and waste rock dump (WRD) are established. In the **post-operational phase**, the visual intensity may decrease with the removal of infrastructure and rehabilitation measures. Provided that WRD shaping and restoration efforts are implemented effectively, the residual impact is expected to reduce to **Medium to Low**, especially given the site's location within a broad, open Karoo landscape with limited visual prominence.

Duration of the Impact:

The **construction phase** duration will vary, with a relatively short timeframe for the processing plant and a longer period for WRD formation as pit operations expand. The **operational phase** is projected as **Long-term**, likely exceeding 20 years. **Decommissioning and closure** are expected to occur over a shorter timeframe, potentially under 5 years. Notably, the WRD and pit voids will become **permanent** features of the local landscape.

Probability of the Impact:

The **probability** of the visual impact occurring is rated as **Definite**. The mining operations will significantly alter the visual character of the local landscape and will be clearly visible from the R61 road and several surrounding farmsteads.

Confidence in the Assessment:

Following a site visit and the completion of a full Level 4 Landscape and Visual Impact Assessment—supported by photomontages—the **confidence level** in the assessment is rated as **Sure**.

Reversibility of the Impact:

While infrastructure such as the processing plant can be removed, the broader mining-induced landscape transformation will be **largely irreversible**, particularly regarding the WRD and pit areas. As such, **reversibility** is rated **Low**.

Resource Irreplaceability:

The **landscape resource irreplaceability** is rated **Medium**. The area forms part of an expansive, relatively flat Karoo plain that holds value for its sparse vegetation, lack of man-made disturbance, and cultural heritage elements associated with isolated farmsteads. However, the limited presence of distinctive landforms and the absence of eco-tourism activity within the ZVI reduce its overall irreplaceability rating.

Mitigability of the Impact:

The **mitigation potential** is rated **Medium to Low**, primarily due to the limited visual absorption capacity of the receiving landscape. Key mitigation measures should include dust control during construction, the use of low-contrast colours for the processing plant, and effective shaping of the WRD to reduce visual prominence. There is no feasible mitigation for the pits themselves, but WRD contouring may offer relief in mid- and background views.

Cumulative Impact Assessment:

Given the remoteness of the site and the ZVI's orientation away from primary tourist routes, **cumulative landscape degradation** leading to land use change is rated **Medium to Low**. However, intervisibility between the three mining clusters may compound visual impacts, particularly in the central area. Careful management of colour contrasts, dust, and light

spillage—while maintaining mining safety standards—will be essential to minimise cumulative effects.

Visual Significance of the Impact:

Without mitigation, the **visual significance** of the impact is rated **Medium to High**. Construction-phase impacts will be elevated, but regional impacts will be somewhat moderated by the site's isolation and limited visibility from major transport corridors. At the **local scale**, landscape and visual resources will be significantly degraded. Timely implementation of shaping and rehabilitation—particularly rounding of WRD edges and crests—will be critical. With appropriate mitigation and closure planning, the **residual visual impact** is expected to be reduced to **Medium**.

13 OPPORTUNITIES AND CONSTRAINTS

13.1 Ryst Kuil Mine

13.1.1 Opportunities

- Economic benefits at the regional and national levels.
- Increased national energy security.
- Local and regional employment opportunities (especially for Beaufort West).
- Remote location with minimal residential receptors.
- Moderate levels of local scenic quality due to flat terrain and limited landform variation.
- No eco-tourism activities located within the zone of visual influence (24km).

13.1.2 Constraints

- Setting a precedent for mining in the Karoo where at a regional level, the scenic quality is high.
- Local farmers and labour tenants located within the 3km distance will be exposure to significant mine related landscape change that will permanently alter the local sense of place.
- Loss of some dry-land sheep farming.
- Increase in atmospheric dust at a local level.
- Potential for regional landscape degradation is post-closure mitigation is not implemented (low risk given the risk of uranium processing which requires strict environmental management post closure).

13.2 No-Go Option

13.2.1 Opportunities

- Retaining the existing wide open Karoo sense of place that does add to regional tourism economy.

13.2.2 Constraints

- Limited economic benefit at the regional or national level.
- National energy security is not supported.

Summary Findings

The proposed development of the Ryst Kuil Mine presents notable economic and strategic benefits, including regional and national financial gains, enhanced national energy security, and the creation of employment opportunities, particularly for the Beaufort West area. The site's remote setting, absence of eco-tourism activities within a 24 km radius, and moderate scenic value—due to its flat terrain and limited landform variation—help minimise potential visual conflicts.

Nonetheless, the large size of the project introduces significant constraints. It may set a precedent for mining in the broader Karoo landscape, an area known for its regional scenic value. Additionally, communities within a 3 km radius, including local farmers and labour tenants, would be exposed to permanent landscape change and loss of local sense of place. Other concerns include the reduction of dry-land sheep farming (limited risk), increased atmospheric dust at a local level, and potential for post-closure landscape degradation if rehabilitation measures are not adequately implemented. The No-Go alternative would preserve the existing Karoo landscape and its contribution to regional tourism and cultural identity. However, this would result in the loss of economic benefits and would not support national energy security objectives.

In conclusion, given the remote location and the limited use of landscape and visual resources at the local level, the benefits associated with the proposed mine are likely to outweigh the costs of the No-Go alternative. This positive outcome is, however, conditional upon the implementation of effective mitigation measures during operation and post-closure rehabilitation.

14 CONCLUSION

The findings of the Landscape and Visual Impact Assessment **support the authorisation of the proposed mine with appropriate mitigation measures in place**. Owing to the site's remoteness and the undulating regional topography, the visual extent of most mining infrastructure and landform changes is expected to result in lower levels of visual intrusion, with the blast plume/ dust from moving vehicles representing the most visually prominent and regionally influential element. While the broader Karoo landscape holds regional significance, the immediate site area is relatively flat and lacks distinctive landforms, reducing its sensitivity to visual change. Furthermore, the mine is located at a considerable distance from major roads, approximately 2 km (avg.) from the R61 and 13 km from the N14, and is surrounded by a sparse distribution of rural receptors, particularly within the Foreground to Midground viewing zones. As such, the anticipated visual changes are not considered a Fatal Flaw, provided that mitigation measures are implemented to address key visual elements such as blast plumes, Waste Rock Dumps (WRD) shaping, and dust and light management.

Due to the high visual contrast introduced by the Waste Rock Dumps, Tailings Storage Facility, and Process Plant, the proposed mining activities will result in residual impacts to the local landscape character. As such, any decision to authorise the mine should acknowledge that the existing deep Karoo landscape context within a 12 km radius of the site will be irreversibly altered and effectively lost.

In conclusion, the proposed mining activities will result in a definite and largely irreversible negative visual impact, particularly at the local scale, where significant alteration of natural

landforms and the introduction of industrial elements will degrade the landscape character. While the regional impact is moderated by the site's remoteness and limited number of receptors, the Zone of Visual Influence remains extensive due to the dispersed layout of mining clusters and the episodic presence of blast plumes. Visual significance is rated Medium to High without mitigation, especially during construction. However, with effective WRD shaping, dust control, and rehabilitation efforts, the residual impact can be reduced to Medium. Despite the limited mitigability and low reversibility of the pit voids, careful visual management and closure planning will be essential to minimise long-term degradation, particularly given the site's location within a sensitive Karoo landscape.

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16 ANNEXURE A: SITE VISIT PHOTOGRAPHS AND COMMENTS

The following photographs were taken during the field survey as mapped below. The text below the photograph describes the landscape and visual risks flagged during the site survey, if applicable.

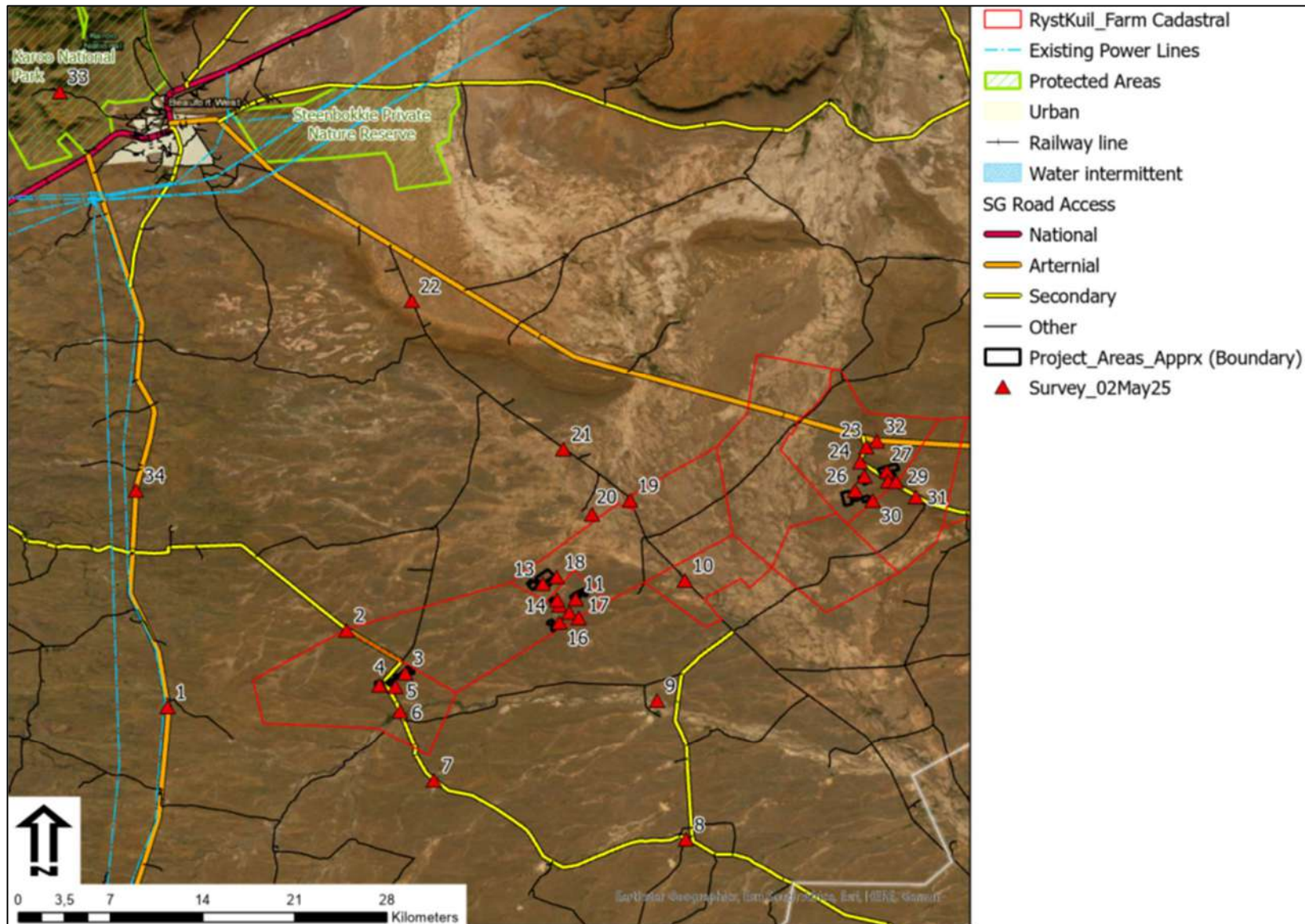


Figure 52: Survey point and project locality map.

ID	1
PHOTO	N14 National Road
LANDUSE	Road infrastructure
RISK	Low
DIRECTION	North East
COMMENT	10km plus distance and side views to the road receptors with mountains forming background to mine . No significant landscape change.
PHOTO NO	/Media/Ryst Kuil Uranium Mine_20250502_102136120.jpg



ID	2
PHOTO	Farm access road
LANDUSE	Infrastructure
RISK	Medium
DIRECTION	South East
COMMENT	Very remote and few receptors. No ecotourism activities. Mitigate for Waste Rock Dump (WRD) shape and rounding of crests post closure.
PHOTO NO	/Media/Ryst Kuil Uranium Mine_20250502_110029066.jpg



ID	3
PHOTO	WRD
LANDUSE	Dryland agriculture
RISK	Low
DIRECTION	South
COMMENT	Remote and no close proximity receptors. Medium scenic quality from flat plain karoo landscape.
PHOTO NO	/Media/Ryst Kuil Uranium Mine_20250502_110925619.jpg



ID	4
PHOTO	WRD
LANDUSE	Dryland agricultural
RISK	Low
DIRECTION	South West
COMMENT	As for previous
PHOTO NO	/Media/Ryst Kuil Uranium Mine_20250502_111326763.jpg



ID	5
PHOTO	Open pit
LANDUSE	Dryland agricultural
RISK	Low
DIRECTION	North
COMMENT	as previous
PHOTO NO	/Media/Ryst Kuil Uranium Mine_20250502_111634252.jpg



ID	6
PHOTO	Labour tenant houses
LANDUSE	Residential
RISK	Medium
DIRECTION	South West
COMMENT	2km distance offers some buffer with views partially screened by shade trees.
PHOTO NO	/Media/Ryst Kuil Uranium Mine_20250502_112402643.jpg



ID	7
PHOTO	Farmstead 1
LANDUSE	Residential
RISK	Medium
DIRECTION	South West
COMMENT	8km distance buffer will reduce visual clarity, but the deep karoo sense of place will partly change.
PHOTO NO	/Media/Ryst Kuil Uranium Mine_20250502_113512638.jpg



ID	8
PHOTO	Farmstead 2
LANDUSE	Dryland agricultural
RISK	Low
DIRECTION	North West
COMMENT	20km distance and partial garden tree shading.
PHOTO NO	/Media/Ryst Kuil Uranium Mine_20250502_115445592.jpg



ID	9
PHOTO	Farmstead Klipkrans
LANDUSE	Residential
RISK	Low
DIRECTION	West
COMMENT	10km distance approx. and facing away from site with some topographic screening.
PHOTO NO	/Media/Ryst Kuil Uranium Mine_20250502_120907665.jpg



ID	10
PHOTO	R306
LANDUSE	Road infrastructure
RISK	Medium
DIRECTION	West
COMMENT	Distance buffering but larger forms will be clearly visible. Remote and limited landscape resource. Some topographic screening.
PHOTO NO	/Media/Ryst Kuil Uranium Mine_20250502_122358436.jpg



ID	11
PHOTO	WRD and open pits
LANDUSE	Dryland agricultural
RISK	Medium
DIRECTION	North West
COMMENT	Slight prominence where WRD will become regionally visible if large in scale as proposed. Mitigate to appear more natural in form with rounding of edges and crests.
PHOTO NO	/Media/Ryst Kuil Uranium Mine_20250502_125516899.jpg



ID	12
PHOTO	Old mine site
LANDUSE	mining
RISK	low
DIRECTION	North West
COMMENT	Limited development without visual footprint
PHOTO NO	/Media/Ryst Kuil Uranium Mine_20250502_130124522.jpg



ID	13
PHOTO	Plant and WRDs
LANDUSE	Dryland agricultural
RISK	Medium
DIRECTION	West
COMMENT	As for previous
PHOTO NO	/Media/Ryst Kuil Uranium Mine_20250502_132045715.jpg



ID	14
PHOTO	Old WRD
LANDUSE	Mining
RISK	low
DIRECTION	West
COMMENT	Small scale and remote
PHOTO NO	/Media/Ryst Kuil Uranium Mine_20250502_132719993.jpg



ID	15
PHOTO	Old mine foundations
LANDUSE	Mining
RISK	Low
DIRECTION	West
COMMENT	Demolished
PHOTO NO	/Media/Ryst Kuil Uranium Mine_20250502_134118808.jpg



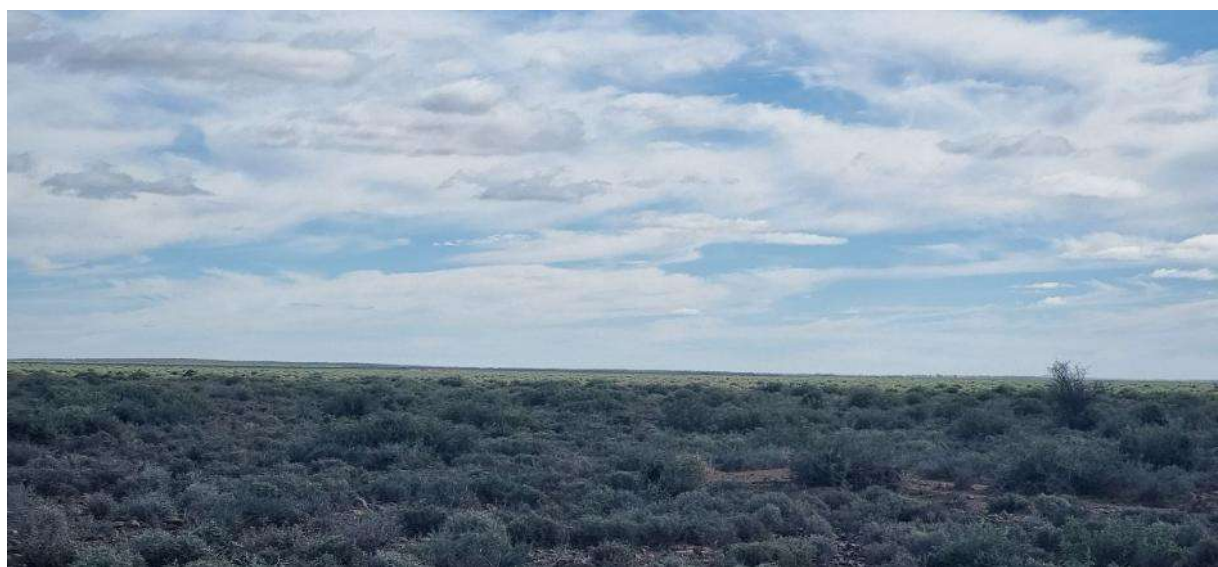
ID	16
PHOTO	Proposed WRD and open pit
LANDUSE	Dryland agricultural
RISK	Medium
DIRECTION	South
COMMENT	As for other WRD comments
PHOTO NO	/Media/Ryst Kuil Uranium Mine_20250502_134510652.jpg



ID	17
PHOTO	Beacon high point
LANDUSE	Dryland agricultural
RISK	NA
DIRECTION	North
COMMENT	Local highpoint that will provide topographic screening to southern receptors.
PHOTO NO	/Media/Ryst Kuil Uranium Mine_20250502_134656680.jpg



ID	18
PHOTO	WRD
LANDUSE	Dryland agricultural
RISK	Medium
DIRECTION	North West
COMMENT	As for previous WRD comment
PHOTO NO	/Media/Ryst Kuil Uranium Mine_20250502_140729285.jpg



ID	19
PHOTO	Farmstead 3 (possibly uninhibited)
LANDUSE	Residential possible
RISK	Medium
DIRECTION	North West
COMMENT	7km buffer will reduce visual intensity but large WRD forms will be visible in midground. Mitigate to Low with WRD design.
PHOTO NO	/Media/Ryst Kuil Uranium Mine_20250502_143314534.jpg



ID	20
PHOTO	Toornitzkuil Farmstead
LANDUSE	Residential
RISK	High
DIRECTION	South
COMMENT	5km from active mine site where clear views of the mining activities will take place, changing the deep karoo sense of place.
PHOTO NO	/Media/Ryst Kuil Uranium Mine_20250502_143642



ID	21
PHOTO	R306 Southbound
LANDUSE	Road infrastructure
RISK	Medium to Low
DIRECTION	South
COMMENT	Medium visual exposure and mine location in lower lying lands.
PHOTO NO	/Media/Ryst Kuil Uranium Mine_20250502_144614137.jpg



ID	22
PHOTO	R306
LANDUSE	Road infrastructure
RISK	High
DIRECTION	North
COMMENT	Dust from large moving vehicles a significant risk to Farmsteads adjacent to the road. Dust mitigation for life of mine.
PHOTO NO	/Media/Ryst Kuil Uranium Mine_20250502_150106134.jpg



ID	23
PHOTO	DR2370 access/ farmstead
LANDUSE	Dryland agricultural
RISK	Medium
DIRECTION	South
COMMENT	Some distance but clear visibility of the larger WRD forms. Mitigate for WRD form for rounding of crest edges.
PHOTO NO	/Media/Ryst Kuil Uranium Mine_20250502_152353553.jpg



ID	24
PHOTO	DR2370
LANDUSE	Road infrastructure
RISK	High
DIRECTION	West
COMMENT	Clear visibility of large-scaled mining modifications.
PHOTO NO	/Media/Ryst Kuil Uranium Mine_20250502_152739564.jpg



ID	25
PHOTO	WRD
LANDUSE	Dryland agricultural
RISK	Medium
DIRECTION	South
COMMENT	Medium landscape resource and remote.
PHOTO NO	/Media/Ryst Kuil Uranium Mine_20250502_153039926.jpg



ID	26
PHOTO	WRD
LANDUSE	Dryland agricultural (background)
RISK	Medium
DIRECTION	South West
COMMENT	As previous
PHOTO NO	/Media/Ryst Kuil Uranium Mine_20250502_153245972.jpg



ID	27
PHOTO	South West
LANDUSE	Dryland agricultural
RISK	High
DIRECTION	North East
COMMENT	Located over ridgeline clearly visible from R61. Mitigate by design to south of ridgeline.
PHOTO NO	/Media/Ryst Kuil Uranium Mine_20250502_153535131.jpg



ID	28
PHOTO	Dr2370
LANDUSE	Road infrastructure
RISK	High
DIRECTION	South
COMMENT	Loss of access road due to open pit. Reroute road for continuing farm access.
PHOTO NO	/Media/Ryst Kuil Uranium Mine_20250502_153839205.jpg



ID	29
PHOTO	Open pit
LANDUSE	Dryland agricultural
RISK	Low
DIRECTION	North
COMMENT	Located south of ridgeline
PHOTO NO	/Media/Ryst Kuil Uranium Mine_20250502_154116611.jpg



ID	30
PHOTO	Drainage line
LANDUSE	Dryland agricultural
RISK	Medium
DIRECTION	East
COMMENT	Medium scenic quality of landscape resource. Remote and few receptors
PHOTO NO	/Media/Ryst Kuil Uranium Mine_20250502_154404748.jpg



ID	31
PHOTO	Farmstead
LANDUSE	Residential
RISK	Low
DIRECTION	East
COMMENT	Topographically screened from the mine if located to the south and west of ridgeline.
PHOTO NO	/Media/Ryst Kuil Uranium Mine_20250502_154821555.jpg



ID	32
PHOTO	R61
LANDUSE	Road infrastructure
RISK	High
DIRECTION	South
COMMENT	WRD wraps over the ridgeline generating very high levels of visual intrusion. R61 has high levels of scenic quality. Mitigate with setback south of ridgeline.
PHOTO NO	/Media/Ryst Kuil Uranium Mine_20250502_155826930.jpg



ID	33
PHOTO	Karoo National Park
LANDUSE	Conservation
RISK	Low
DIRECTION	South East
COMMENT	Distance and higher visual absorption capacity (VAC) from town in midground. mitigate for lights at night.
PHOTO NO	/Media/Ryst Kuil Uranium Mine_20250503_151925053.jpg



ID	34
PHOTO	N14 Southbound
LANDUSE	Road infrastructure
RISK	Low
DIRECTION	West
COMMENT	Distance and outside of main receptor view sector.
PHOTO NO	/Media/Ryst Kuil Uranium Mine_20250504_080446907.jpg



17 ANNEXURE B: SPECIALIST INFORMATION

17.1 Professional Registration Certificate



17.2 Curriculum Vitae (CV)

1. **Position:** Owner / Director
2. **Name of Firm:** Visual Resource Management Africa cc (www.vrma.co.za)
3. **Name of Staff:** Stephen Stead
4. **Date of Birth:** 9 June 1967
5. **Nationality:** South African
6. **Contact Details:** Cell: +27 (0) 83 560 9911
Email: steve@vrma.co.za
7. **Educational qualifications:**
 - University of Natal (Pietermaritzburg):
 - Bachelor of Arts: Psychology and Geography
 - Bachelor of Arts (Hons): Human Geography and Geographic Information Management Systems
 - MSc Geography, University of KwaZulu-Natal (2023)
8. **Professional Accreditation**
 - Association of Professional Heritage Practitioners (APHP) Western Cape
 - Accredited VIA practitioner member of the Association (2011)
9. **Association involvement:**
 - International Association of Impact Assessment (IAIA) South African Affiliate
 - Past President (2012 - 2013)
 - President (2012)
 - President-Elect (2011)
 - Conference Co-ordinator (2010)
 - National Executive Committee member (2009)
 - Southern Cape Chairperson (2008)
10. **Conferences Attended:**
 - International Geographical Congress, Lisbon (2017)
 - IAIAAsa 2012
 - IAIAAsa 2011
 - IAIA International 2011 (Mexico)
 - IAIAAsa 2010
 - IAIAAsa 2009
 - IAIAAsa 2007
11. **Continued Professional Development:**
 - Integrating Sustainability with Environment Assessment in South Africa (IAIAAsa Conference, 1 day)
 - Achieving the full potential of SIA (Mexico, IAIA Conference, 2 days 2011)

- Researching and Assessing Heritage Resources Course (University of Cape Town, 5 days, 2009)

12. Countries of Work Experience:

- South Africa, Mozambique, Malawi, Lesotho, Kenya and Namibia

13. Relevant Experience:

Stephen gained six years of experience in the field of Geographic Information Systems mapping and spatial analysis working as a consultant for the KwaZulu-Natal Department of Health and then with an Environmental Impact Assessment company based in the Western Cape. In 2004 he set up the company Visual Resource Management Africa that specializes in visual resource management and visual impact assessments in Africa. The company makes use of the well-documented Visual Resource Management methodology developed by the Bureau of Land Management (USA) for assessing the suitability of landscape modifications. Stephen has assessed of over 150 major landscape modifications throughout southern and eastern Africa. The business has been operating for eighteen years and has successfully established and retained a large client base throughout Southern Africa which include amongst other, Rio Tinto (Pty) Ltd, Bannerman (Pty) Ltd, Anglo Coal (Pty) Ltd, Eskom (Pty) Ltd, NamSolar and Vale (Pty) Ltd, Ariva (Pty) Ltd, Harmony Gold (Pty) Ltd, Millennium Challenge Account (USA), Pretoria Portland Cement (Pty) Ltd.

14. Languages:

- English – First Language
- Afrikaans – fair in speaking, reading and writing.

15. Projects:

Table 32: VRM Africa Projects Assessments Table

DESCRIPTION	COUNT	DESCRIPTION	COUNT
Dam	1	UISP	8
Mari-culture	1	Structure	8
Port	1	OHPL	12
Railway	1	Industrial	12
Power Station	3	Wind Energy	22
Hydroelectric	4	Battery Storage	14
Resort	4	Mine	20
Golf/Residential	1	Residential	45
Road Infrastructure	5	Solar Energy	62
Substation	5	TOTAL	237

18 ANNEXURE C: METHODOLOGY DETAIL

18.1 Baseline Analysis Stage

In terms of VRM methodology, landscape character is derived from a combination of **scenic quality**, **receptor sensitivity** to landscape change and **distance** from the proposed landscape change. The objective of the analysis is to compile a mapped inventory of the visual resources found in the receiving landscape, and to derive a mapped Visual Resource sensitivity layer from which to evaluate the suitability of the landscape change.

18.1.1 Scenic Quality

The scenic quality is determined making use of the VRM Scenic Quality Checklist that identifies seven scenic quality criteria which are rated with 1 (low) to 5 (high) scale. The scores are totalled and assigned an A (High), B (Moderate) or C (low) based on the following split:

A = scenic quality rating of ≥ 19 ;

B = rating of 12 – 18,

C = rating of ≤ 11

The seven scenic quality criteria are defined below:

- **Land Form:** Topography becomes more of a factor as it becomes steeper, or more severely 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 an area.

18.1.2 Receptor Sensitivity

Receptor sensitivity to landscape change is determined by rating the following factors in terms of Low to High:

- **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 or 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.

18.1.3 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.

Distance from a landscape modification influences the size and clarity of the landscape modification viewing. The Bureau of Land Management defines three distance categories:

- Foreground / Middle ground***, up to approximately 6km, which is where there is potential for the sense of place to change;
- Background areas***, from 6km to 24km, 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
- 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.

18.1.4 Key Observation Points

During the Baseline Inventory Stage, Key Observation Points (KOPs) are identified. 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 Degree of Contrast (DoC) that the proposed landscape modifications will make to the existing landscape be measured from these most critical locations, or receptors, surrounding the property. 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; and
- Distance from property.

18.2 Assessment and Impact Stage

The analysis stage involves determining whether the potential visual impacts from proposed surface-disturbing activities or developments will meet the management objectives established for the area, or whether design adjustments will be required. This requires a contrast rating to assess the expected DoC the proposed landscape modifications would generate within the receiving landscape in order to define the Magnitude of the impact.

18.2.1 Contrast Rating

The contrast rating is undertaken to determine if the VRM Class Objectives are met. The suitability of landscape modification is assessed by comparing and contrasting existing receiving landscape to the expected contrast that the proposed landscape change will generate. This is done by evaluating the level of change to the existing landscape by assessing 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 proposed landscape activities that allow for 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.

Based on the findings of the contrast rating, the Magnitude of the Landscape and Visual Impact Assessment is determined.

18.2.2 Photomontages

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 Interested & Affected Parties 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, VRMA subscribes to the Proposed Interim Code of Ethics for Landscape Visualisation developed by the Collaborative for Advanced Landscape Planning (CALP) (Sheppard, 2000). 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 and 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, 2000).

19 ANNEXURE D: I&AP COMMENTS AND RESPONSES

30 July, 2025

Support Centre for Land Change

“Historical evidence from uranium mines worldwide demonstrates that promises of environmental rehabilitation often fall short, leaving landscapes scarred and communities exposed to enduring risks”.

VRMA Response

This represents a relevant visual risk and is clearly observable in established mining regions such as Mpumalanga and the North West Province, where widespread landscape sterilisation has occurred. In these areas, the cumulative impact of multiple, continuously visible coal and gold mining operations has entrenched a distinctive mining sense of place, marked by extensive infrastructure, including prominent headgear associated with deep vertical shaft mining.

However, there are important distinctions between these regions and the proposed uranium mining site. The uranium operation features a dispersed layout with limited vertical intrusion, including a waste rock dump height below 25 metres, and is set back from major transport routes. As a result, the zone of visual influence is expected to be contained, and the broader Karoo landscape character is unlikely to be significantly degraded.

Additionally, the remoteness of the site and the absence of multiple visible mining operations help limit cumulative visual impacts. Crucially, the radioactive nature of uranium introduces a higher standard of post-closure rehabilitation, likely to be more stringent than for conventional coal or gold mines. This is expected to support more effective long-term containment and landscape recovery.

In conclusion, while the risk of visual landscape sterilisation is valid, it is anticipated to remain localised and manageable, particularly given the heightened regulatory oversight associated with radiation safety and environmental closure requirements.