Basic Assessment Report

Basic Assessment for the proposed Square Kilometre Array (SKA) fibre optic cable between Beaufort West and Carnarvon

Applicant:
South African National Research Network

Prepared by:
CSIR Environmental Management Services

Reviewed by:
SLR Consulting South Africa

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South African National Research Network

SKA AFRICA
SQUARE KILOMETRE ARRAY

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Summary

Introduction

The Square Kilometre Array (SKA) will be the largest radio telescope ever built and will produce science that changes our understanding of the universe. The telescope is being constructed in Australia and in the Northern Cape province of South Africa.

A high-speed fibre optic internet connection is required between the SKA core site in the Northern Cape and an existing facility in Cape Town where the data is processed. Fibre optic infrastructure already exists between the SKA core site and Carnarvon, and between Beaufort West and the existing data processing facility in Cape Town. To complete the SKA-Cape Town connection, a new fibre optic cable needs to be installed between Beaufort West and Carnarvon. The proposed route for the new fibre optic cable follows the R381 and R63 roads for a length of approximately 183 km in the Karoo Biome, from Beaufort West, via Loxton, to Carnarvon, and spans the Western Cape and Northern Cape Provinces (Figure i).

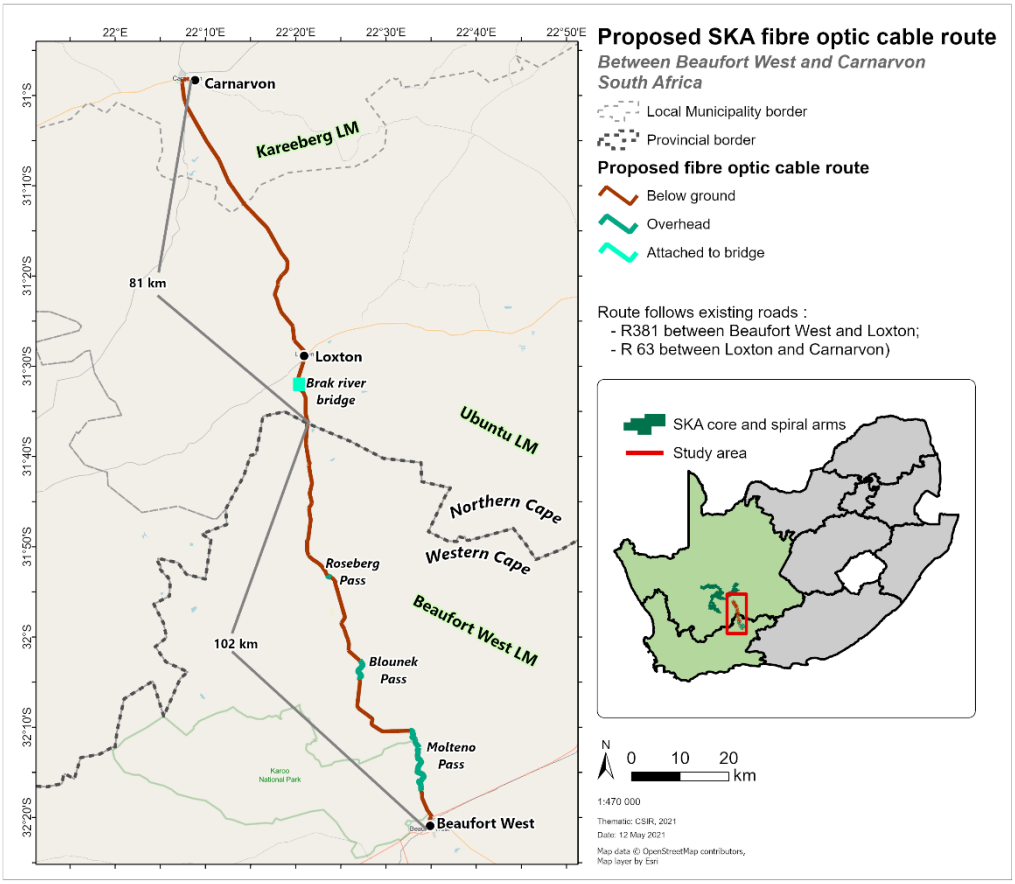
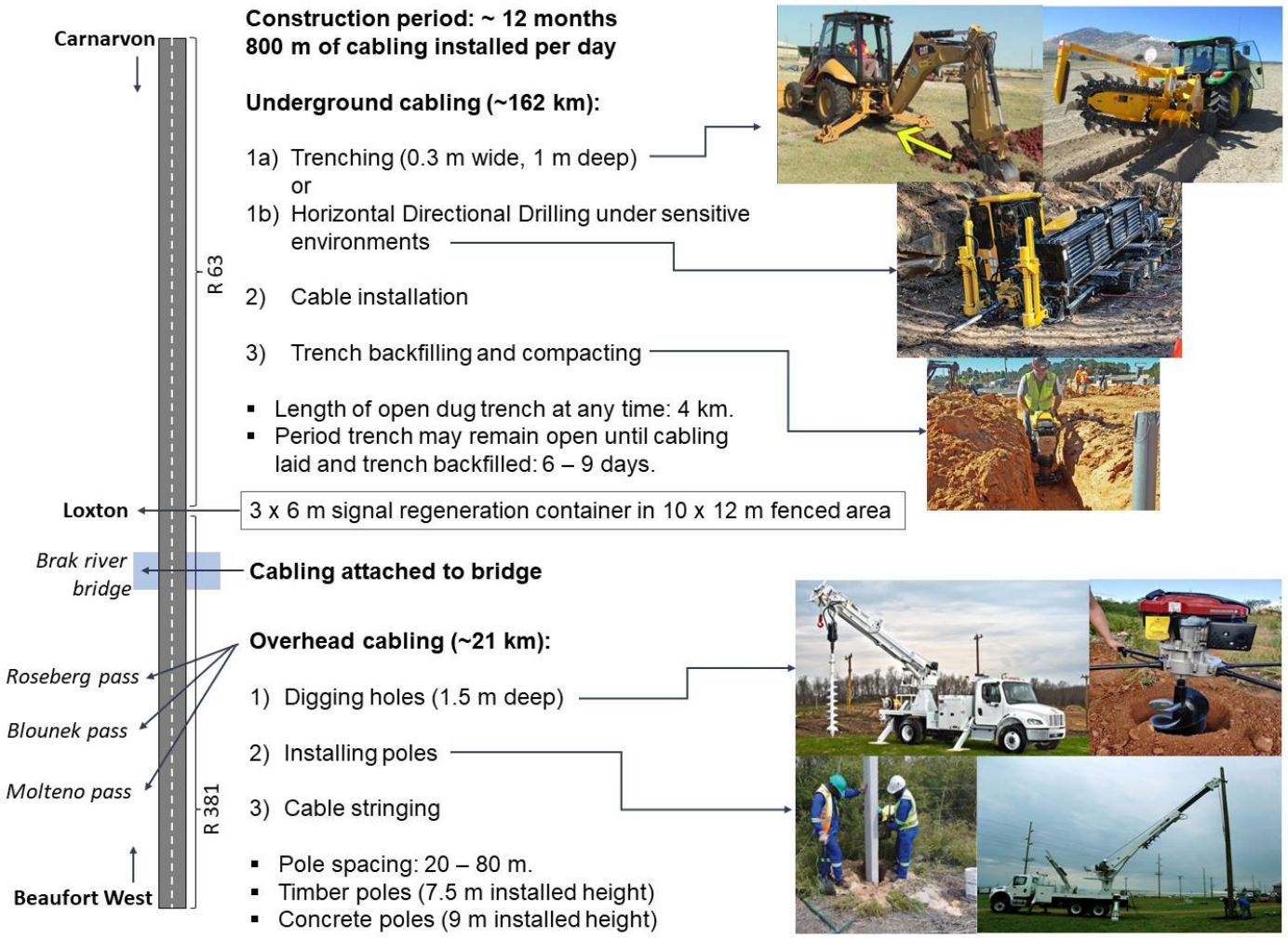


Figure i: The proposed SKA fibre optic cable route starts in Beaufort West, follows the existing R381 and R63 roads via Loxton and terminates in Carnarvon.

The South African National Research Network (SANReN) has been tasked by the South African Radio Astronomy Observatory (SARAO), who spearheads South Africa's activities in the SKA Radio Telescope, to facilitate the installation of the new fibre optic cable between Beaufort West and Carnarvon. The proposed Fibre Optic Project is a critical part of realising the global SKA mega-science project. The SKA will be an advanced radio telescope linked to research infrastructure and high-speed Information and Communications Technology (ICT) capacity, and provides an opportunity for South Africa to contribute towards global science projects. Additionally, the SKA is a Strategic Integrated Project (SIP 16: SKA & MeerKAT) prioritised in the National Development Plan (NDP).

Project description



The proposed fibre optic cable installation will start in Beaufort West at the Transnet building (corner of 2nd Avenue and Kerk Street), via Loxton where a 3 m x 6 m container for regeneration of signal will be established in a 10 x 12 m fenced area, to Carnarvon where the cabling will terminate at the existing SKA internet Point of Presence site (just off Stasieweg Street). The total length of the proposed cable route is approximately 183 km.

The cabling will predominantly be installed underground, using a combination of trenching and Horizontal Directional Drilling (HDD). Where trenching is technically unfeasible the cable will be installed overhead on poles. At one river crossing – the Brak river south of Loxton – the cabling will be attached to the bridge (Figure ii). The majority of activities related to the proposed Fibre Optic Project will take place in the construction phase.

Figure ii: Schematic summary of the main activities to install the fibre optic cable between Beaufort West and Carnarvon.

The spatial extent of the proposed Fibre Optic Project, for which EA is being sought, is defined as follows:

- Underground sections: a 30 m corridor around the centre line of the roads (i.e. the road reserve) where the cabling will be installed underground.
- Overhead sections, outside of the road reserve: a 30 m corridor around the engineering Low Level Design (LLD) (latest technically feasible engineering design at the time of writing this report).

It is proposed that the EA (if granted) applies to the entirety of the corridor. Within this corridor, the fine-scale routing of the fibre optic cable may be adjusted as required to avoid or compensate for any technical difficulties or environmental sensitivities identified in the field during construction.

Need for Environmental Authorisation

In terms of the National Environmental Management Act (NEMA) Environmental Impact Assessment (EIA) Regulations (2014, as amended, 2017), Environmental Authorisation (EA) is required for the proposed fibre optic cable installation through the undertaking of a Basic Assessment (BA) process. This requirement is triggered by the NEMA Listed Activities presented in Table i. Since the proposed fibre optic cable route traverses both the Western Cape and Northern Cape Provinces, the National Department of Forestry, Fisheries and the Environment (DFFE)[1] has been identified as the Competent Authority in terms of Section 24C of the NEMA. The CSIR Environmental Management Services (EMS) group has been appointed to undertake the required BA Process and will serve as the Environmental Assessment Practitioner (EAP). Additionally, an external independent reviewer, SLR Consulting South Africa, has been appointed as the independent peer-review EAP.

Table i: Listed Activities (NEMA EIA Regulations, 2014, as amended) applicable to the proposed SKA fibre optic cable project and which require an Environmental Authorisation.

Listed Activity		**Relevant project aspect**
Listing Notice 1 (GN R327), Activity 19	*The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse*	The proposed approach is to avoid sensitive areas, particularly watercourses, via HDD 2 m below the riverbed starting 32 m from the riverbanks. In some areas, dry watercourses may be trenched and backfilled, in accordance with measures identified and included in the Environmental Management Programme (EMPr).
Listing Notice 3 (GN R324), Activity 12	*The clearance of an area of 300 square metres or more of indigenous vegetation:* *(a) Northern Cape,* *(ii) within critical biodiversity areas identified in bioregional plans.* *(i) Western Cape,* *(ii) within critical biodiversity areas identified in bioregional plans.* *(iv) On land, where, at the time of the coming into effect of this Notice or thereafter such land was zoned open space, conservation or had an equivalent zoning.* *(v) On land designated for protection or conservation purposes in an Environmental Management Framework adopted in the prescribed manner, or a Spatial Development Framework adopted by the MEC or Minister.*	CBAs: Although the development is predominantly proposed within the road reserves of the R381 and R63, the total cumulative approximate construction footprint of the proposed fibre optic cable, within Critical Biodiversity Areas (CBAs) in the Northern Cape (37 803 m^2) and Western Cape (19 814 m^2) Provinces, exceeds the 300 m^2 clearance threshold. Land zoned as conservation or designated for conservation purposes: The Beaufort West SDF (2013, adopted 2017 for 2017-22) (BMLM, 2013; 2018) recognises the Karoo National Park, as well as the Sakriver, Brakriver, Kromriver and Wagenaarskraal conservancies between Beaufort West and Loxton (in the Northern Cape and Western Cape provinces). Within the Karoo National Park, the proposed fibre optic cable will be installed overhead on timber and concrete poles for a total distance of approximately 4.7 km. The 'clearance' of

[1] Previously Department of Environment, Forestry and Fisheries (DEFF) and Department of Environmental Affairs (DEA).

Listed Activity		Relevant project aspect
		vegetation for the holes within which the poles are planted, will be approximately 80 m^2, cumulatively. Within the Sakriver, Brakriver, Kromriver and Wagenaarskraal conservancies the fibre optic cable will be installed in the road reserve of the R381 road for a distance of approximately 62 km, which would result in cumulative clearance of vegetation in the road reserve of 18 600 m^2.

Need for water use authorisation

The fibre optic cable route entails multiple watercourse (rivers and associated wetlands) crossings in the Lower Orange Water Management (WMA) (156 km) and Gouritz WMA (27 km)[2]. The watercourse crossings qualify as non-consumptive water uses in terms of Section 21 of the National Water Act (NWA) and necessitate the need for a Water Use License (WUL) (Table ii). The watercourse crossings have been found to pose a low risk to the watercourses and thus qualifies for a water use General Authorisation (GA). This approach has been accepted by the Competent Authority – Regional Department Water and Sanitation (DWS) of the Lower Orange WMA[2] and GA has been obtained.

Table ii: Water Uses (Section 21 of the NWA) applicable to the proposed SKA fibre optic cable project and which require a water use GA.

Water use		Relevant project aspect
Section 21 (c)	*Impeding or diverting the flow of water in a watercourse.*	The proposed approach is to avoid sensitive areas, particularly watercourses, via HDD 2 m below the riverbed starting 32 m from the riverbanks. In some areas, dry watercourses may be trenched and backfilled, thus constituting Section 21 (c) and (i) water uses.
Section 21 (i)	*Altering the bed, banks, course or characteristics of a watercourse.*	

SANParks approval

Part of the fibre optic cabling is proposed within the eastern section of the Karoo National Park next to the R381 road, specifically to traverse the difficult terrain associated with the Molteno Pass. In terms of the National Environmental Management: Protected Areas Act (NEM:PAA), prior written approval of the Park management authority is required for any development, construction or farming in a national park, nature reserve or world heritage site. South African National Parks (SANParks) and the Karoo National Park management have approved the proposed Fibre Optic Protect in line with the NEM:PAA requirements.

Basic Assessment Process

A BA process in terms of the NEMA EIA Regulations, 2014, as amended, entails a detailed description of the project and an assessment of the potential impacts that the project may have on the environment. Furthermore, it also includes the development of an Environmental Management Programme (EMPr) which outlines the environmental management practices that need to be implemented to avoid and minimise any potential damage to the environment, and to enhance any potential positive impacts that may arise for the proposed project. An Application for an EA is being lodged with the Competent Authority. The draft BA Report (BAR) (this report, including water use GA

[2] Since the majority of the proposed Fibre Optic Project is located within the Lower Orange Water Management (WMA) Area, the Regional Department Water and Sanitation (DWS) of the Lower Orange WMA will act as Competent Authority for the entire water use General Authorisation (GA) application.

aspects) is released to Interested and Affected Parties (I&APs), Stakeholders and Departments (including the Competent Authority) for a 30-day comment period as part of a Public Participation Process (PPP). Thereafter, the final BAR will be compiled taking relevant comments received into account, and will be submitted to the Competent Authority (DFFE), who then decides on whether the EA may be issued for the proposed project. Similarly, the water use GA applications will be completed after the PPP and submitted to the Competent Authority (Regional DHSWS) for decision-making.

Specialist assessments undertaken

The following specialist assessments were undertaken as part of the SKA fibre optic cable BA:

1) Terrestrial Ecology, Biodiversity and Species.
2) Aquatic Ecology, Biodiversity and Species, including a Risk Assessment in terms of the NWA to determine whether a water use GA applies.
3) Visual and Aesthetic Resources for the proposed overhead cabling sections (Molteno, Blounek and Rosenberg passes).
4) Heritage, Archaeology and Palaeontology (Heritage Impact Assessment (HIA)) as required in terms of Section 38(8) of the National Heritage Resources Act (NHRA).

Environmental sensitivity

Even though the fibre optic cable is predominantly proposed within the road reserves of the R381 and R63 roads, several sensitive environmental features were identified (Table iii).

Table iii: Summary of the main sensitive environmental features within the SKA fibre optic study area.

Specialist assessment	Main environmental sensitivity
▪ **Terrestrial Ecology, Biodiversity and Species.**	▪ Riverine rabbit habitat; ▪ Rocky areas and outcrops where Species of Conservation Concern (SCC) may occur.
▪ **Aquatic Ecology, Biodiversity and Species.**	▪ Valley-bottom wetlands; ▪ Riverine systems, with or without riparian vegetation or that formed part of an alluvial system.
▪ **Visual Impact Assessment.**	▪ Topographic and geological features (ridges, peaks, scarps, rocky outcrops); ▪ Scenic water features (rivers, large dams); ▪ National Parks (Karoo National Park); ▪ Scenic passes and poorts (along the R381 road).
▪ **Heritage, Archaeology and Palaeontology.**	▪ None (All recorded heritage features (archaeology and palaeontology) non-graded, Not Conservation Worthy and grade IIIC).

Impact assessment

The impacts of the underground fibre optic cable sections are expected to be most pronounced on aspects of terrestrial ecology, aquatic ecology, and heritage features since the cumulative disturbance footprint of the dug trenches in which the cabling is installed will be approximately 11 ha. However, the road reserves are previously disturbed due to road construction and maintenance. Additionally, the dug trenches will be backfilled after the cabling has been installed, allowing vegetation to re-establish. The significance of impacts associated with the underground cabling is expected to be **Very Low, after mitigation** (Table iv). The key mitigation measures include taking care in areas flagged as potentially sensitive (terrestrial ecology and aquatic ecology), and implementing Alien and Invasive Species management, erosion control, and chance fossil / heritage feature finds protocols.

Table iv: Construction phase impact assessment summary.

Construction phase		**Impact significance**	
Theme	**Impact**	**Pre-mitigation**	**Post-mitigation**
Terrestrial ecology, biodiversity and species	Clearance of natural vegetation and resultant loss of faunal habitat.	**Low**	**Low**
	Loss of threatened, protected and endemic plants / animals.	**Low**	**Low**
	Faunal mortalities due to construction, trench digging and increased traffic.	**Low**	**Low**
	Increased dust generation and deposition.	**Very low**	**Very low**
	Increased human activity and noise levels.	**Very low**	**Very low**
	Establishment and spread of alien invasive vegetation.	**Low**	**Very low**
	Increased erosion and water runoff.	**Low**	**Very low**
Aquatic ecology, biodiversity and species	Clearance of vegetation within wetland crossings.	**Low**	**Very low**
	Clearance of vegetation within riverine (with riparian and or alluvial systems) crossings.	**Low**	**Very low**
	Loss of aquatic SCCs.	**Low**	**Very low**
	Compromised localised surface water quality through spills and leaks from construction vehicles and equipment.	**Low**	**Very low**
	Erosion and sedimentation.	**Low**	**Very low**
Heritage, archaeology & palaeontology	Damage to or destruction of significant heritage resources.	**Very low**	**Very low**
Visual, aesthetic and scenic resources	Visual effect of spoil heaps from underground cable trenches, dust and noise.	**Very low**	**Very low**

In some sections, i.e. the Molteno, Blounek and Rosenberg passes, the cabling is proposed **overhead** on timber and concrete poles. The overhead sections will have minimal impact on aspects of terrestrial ecology, aquatic ecology, and heritage features since the physical permanent disturbance footprint is limited to the dug holes (**Very Low, after mitigation**) (Table v). However, the overhead sections will result in impact to visual, aesthetic and scenic resources. The options to mitigate the visual impacts are constrained by the practical and technical feasibility of installing the cabling in the difficult terrain associated with these sections. As such, the impact of greatest significance for the overhead cabling sections is to visual, aesthetic and scenic resources (**Moderate, after mitigation**) (Table v).

Table v: Operations and maintenance phase impact assessment summary.

Operations and maintenance phase		**Impact significance**	
Theme	**Impact**	**Pre-mitigation**	**Post-mitigation**
Terrestrial ecology, biodiversity and species	Faunal mortalities.	**Low**	**Very low**
	Establishment and spread of alien invasive vegetation.	**Low**	**Very low**
Aquatic ecology, biodiversity and species	Creation of hard surfaces, resulting in runoff, erosion and sedimentation.	**Low**	**Very low**
Visual, aesthetic and scenic resources	Visual intrusion of overhead cables in the landscape, and visual clutter of poles where cable is routed close to the road.	**Moderate**	**Moderate**

In the event that the proposed cabling ever needs to be decommissioned, it should be possible to restore the areas to pre-construction condition, if the overhead cabling is dismantled and removed as per the EMPr requirements.

Table vi: Decommissioning phase impact assessment summary.

Decommissioning phase		**Impact significance**	
Theme	**Impact**	**Pre-mitigation**	**Post-mitigation**
Terrestrial ecology, biodiversity and species	Clearance of natural vegetation.	**Very low**	**Very low**
	Faunal mortalities.	**Low**	**Very low**
	Establishment and spread of alien invasive vegetation.	**Very low**	**Very low**
Aquatic ecology, biodiversity and species	Clearance of vegetation within wetland crossings.	**Low**	**Very low**
	Clearance of vegetation within riverine (with riparian and or alluvial systems) crossings.	**Low**	**Very low**
	Loss of SCCs.	**Low**	**Very low**
	Compromised localised surface water quality through spills and leaks.	**Low**	**Very low**
	Erosion and sedimentation of watercourses.	**Low**	**Very low**
Visual, aesthetic and scenic resources	Visual impact of abandoned poles and overhead cabling.	**Moderate**	**Very low**

Cumulative impacts are broadly considered for other proposed developments triggering the same listed activities, and that are leading / may lead to landscape transformation within the study area. The study area, especially in the Gamka Karoo vegetation type around Beaufort West, is vulnerable to vegetation loss due to potential renewable energy, minerals and hydrocarbons exploration and exploitation and urban expansion (**High, after mitigation**) (Table vii). It must be noted that only approximately 9.5 km (~ 5 %) of the fibre optic cabling is proposed in the Gamka Karoo vegetation type. Furthermore, due to the very limited anticipated change caused by the proposed Fibre Optic Project relative to the footprint of other proposed developments, and it predominantly being proposed within previously disturbed road reserves, its contribution to the cumulative impacts of the greater region is **Very low (after mitigation)** to negligible.

Table vii: Cumulative impact assessment summary.

Cumulative impacts		**Impact significance**	
Theme	**Impact**	**Pre-mitigation**	**Post-mitigation**
Terrestrial ecology, biodiversity and species	Vegetation loss and habitat destruction due to main developments in the **Gamka Karoo*** (e.g. renewable energy, minerals and hydrocarbons exploration and exploitation and urban expansion).	**Low**	**Very low**
	Loss of SCCs due to all developments in the **Gamka Karoo***.	**Low**	**Low**
	Compromised integrity of CBAs, Ecological Support Areas (ESAs) and National Protected Areas Expansion Strategy (NPAES) focus areas due to all developments in the **Gamka Karoo***.	**Low**	**Low**
	Increased erosion and water runoff due to all developments in the **Gamka Karoo***.	**Low**	**Low**
	Vegetation loss and habitat destruction due to main developments in the **Gamka Karoo*** (e.g. renewable energy, minerals and hydrocarbons exploration and exploitation and urban expansion).	**Low**	**Very low**

Cumulative impacts		Impact significance	
Theme	**Impact**	**Pre-mitigation**	**Post-mitigation**
Aquatic ecology, biodiversity and species	Disturbance to watercourse flow regimes and aquatic habitats.	**Low**	**Very low**
Heritage, archaeology & palaeontology	Disturbance to or destruction of heritage resources.	**Very low**	**Very low**
Visual, aesthetic and scenic resources	Cumulative visual impacts during the construction phase.	**Very low**	**Very low**
	Cumulative visual impacts during the operations and maintenance phase.	**Moderate**	**Moderate**
	Cumulative visual impacts during the decommissioning phase.	**Moderate**	**Very low**
***** *Approximately 9.5 km (~ 5 %) of the fibre optic cabling is proposed in the Gamka Karoo vegetation type.*			

Environmental Impact Statement

Taking into consideration the findings of this BA process, as well as the nature and importance of the proposed Fibre Optic Project, it is the opinion of the EAP that the proposed project is not expected to result in unacceptable negative environmental impacts. Provided that the specified mitigation and management measures are effectively implemented and monitored, and approval in terms of Section 50(5) of the National Environmental Management: Protected Areas Act (No. 57 of 2003) is received by SANParks (Karoo National Park), it is recommended that the project can receive:

1. EA in terms of the EIA Regulations promulgated under the NEMA.
2. GA in terms of the in terms the NWA for non-consumptive water uses.

I&AP registration and commenting on the draft BAR:
If the SKA fibre optic cable between Beaufort West and Carnarvon is of interest to you and you would like to submit comments on the draft BAR, register as an I&AP and submit comments by:

- Sending an email to ems@csir.co.za (use reference: SKA Fibre Optic);
- Completing an online I&AP Registration & Commenting form at: http://bit.ly/SKAfibre-IAP;
- Sending a letter by post to PO Box 320, Stellenbosch, 7599 (Attention: Luanita Snyman-van der Walt);
- Faxing a letter to 021 888 2693 (Attention: Luanita Snyman-van der Walt).

Report access:
The draft BAR can be accessed online at

- https://bit.ly/SKAfibre-PPP; or
- https://www.csir.co.za/environmental-impact-assessment.

Hard copies of this summary are available at the following locations during the 30 day public commenting period on the draft BAR:

- **Beaufort West:**
  - Klein Karoo Agri (80 Donkin Street).
- **Loxton:**
  - Loxton Library / Municipality (Corner of Margaretha Prinsloo Street and Probart Street).
- **Carnarvon:**
  - SARAO Visitors Centre (Corner of Victoria and Hanau Street).

Commenting period closes on 30 September 2021

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Abbreviations and Acronyms

AIS	Alien and Invasive Species
AZ	Assemblage Zone
BA	Basic Assessment
BAR	Basic Assessment Report
CBA	Critical Biodiversity Area
CHPC	Centre for High Performance Computing
CITES	Convention on International Trade in Endangered Species
CR	Critically Endangered
CSIR	Council for Scientific and Industrial Research
DEA	Department of Environmental Affairs (now Department of Forestry, Fisheries and the Environment)
DEFF	Department of Environment, Forestry and Fisheries (now Department of Forestry, Fisheries and the Environment)
DFFE	Department of Forestry, Fisheries and the Environment, the title used from 01 April 2021 (previously Department of Environmental Affairs; and thereafter Department of Environment, Forestry and Fisheries)
DWS	Department of Water and Sanitation
DIRISA	Data Intensive Research Initiative of South Africa
DWDM	Dense Wavelength Division Multiplexing
e-WULAAS	Electronic Water Use Licence Application and Authorisation System
EAP	Environmental Assessment Practitioner
EAPASA	Environmental Assessment Practitioners Association of South Africa
ECO	Environmental Control Officer
EI	Ecological Importance
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
EMS	Environmental Management Services
EN	Endangered
ES	Ecological Sensitivity
ESA	Early Stone Age (archaeology)
ESA	Ecological Support Area (ecology)
EWT	Endangered Wildlife Trust
GA	General Authorisation
GN	Government Notice
HDD	Horizontal Directional Drilling
HIA	Heritage Impact Assessment
I&AP	Interested and Affected Party
ICT	Information and Communications Technology
IDP	Integrated Development Plan
kW/h	Kilowatt per hour
LC	Least Concern
LLD	Low Level Design
LM	Local Municipality
LSA	Later Stone Age
LT	Least Threatened
MSA	Middle Stone Age
NBA	National Biodiversity Assessment
NCNCA	Northern Cape Nature Conservation Act (No. 9 of 2009)
NDP	National Development Plan
NEM:BA	National Environmental Management: Biodiversity Act (No. 10 of 2004)
NEM:PAA	National Environmental Management: Protected Areas Act (No. 57 of 2003)
NEMA	National Environmental Management Act (No. 107 of 1998)
NewPosa	New Plants of Southern Africa
NHRA	National Heritage Resources Act
NICIS	National Integrated Cyberinfrastructure System
NID	Notice of the Intent to Develop
NPAES	National Protected Areas Expansion Strategy
NRF	National Research Foundation
O&M	Operations and Maintenance
PA	Protected Area
PES	Present Ecological State
PoP	Point of Presence
PRISA CPRP	Public Relations Institute of Southern Africa Chartered Public Relations Practitioner
SABS	South African Bureau of Standards
SACAP	South African Council for the Architectural Profession

SACLAP	South African Council for the Landscape Architectural Profession
SACNASP	South African Council for Natural and Scientific Professions
SANReN	South African National Research Network
SARAO	South African Radio Astronomy Observatory
SDF	Spatial Development Framework
SIP	Strategic Integrated Project (also sometimes referred to as “Strategic Infrastructure Project”)
SKA	Square Kilometre Array
TLB	Tractor Loader Backhoe
ToPS	Threatened or Protected Species
VIA	Visual Impact Assessment
VU	Vulnerable
WCNECO	Western Cape Nature and Environmental Conservation Ordinance (No. 19 of 1974), as amended

CHAPTER 1 INTRODUCTION

1.1 Project overview

The Square Kilometre Array (SKA) will be the largest radio telescope ever built and will produce science that changes our understanding of the universe[3]. The construction of the SKA radio telescope is scheduled to commence in Australia and in the Northern Cape province of South Africa at the end of 2021 (SKA, 2021a).

A high-speed fibre optic internet connection is required between the SKA core site in the Northern Cape and a facility in Cape Town where the data is processed. Fibre optic infrastructure already exists between the SKA core site and Carnarvon, and between Beaufort West and the data processing facility in Cape Town. To complete the SKA-Cape Town connection, a new fibre optic cable needs to be installed between Beaufort West and Carnarvon. The proposed route for the new fibre optic cable follows the R381 and R63 roads for a length of approximately 183 km in the Karoo Biome, from Beaufort West, via Loxton, to Carnarvon, and spans the Western Cape and Northern Cape Provinces (Figure 1).

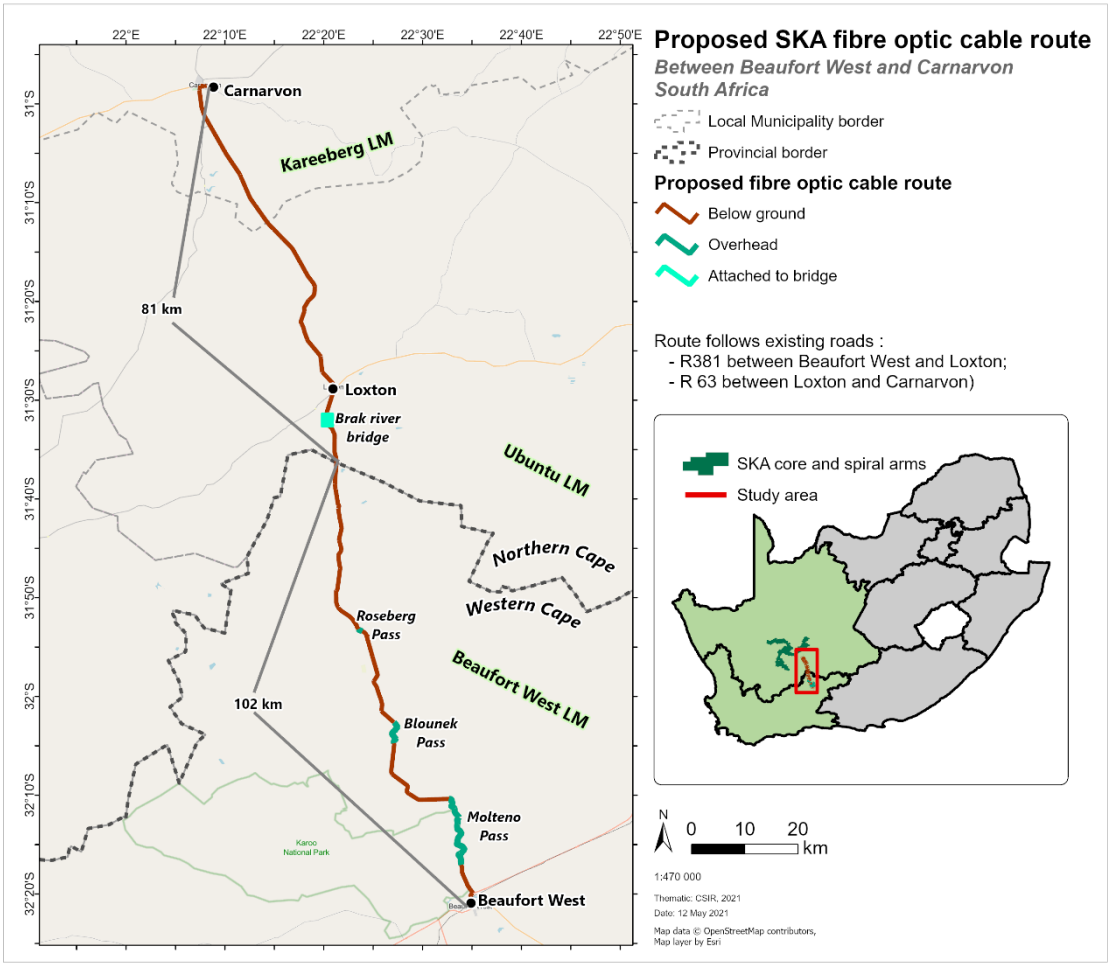


Figure 1: The proposed SKA fibre optic cable route starts in Beaufort West, follows the existing R381 and R63 roads via Loxton and terminates in Carnarvon.

[3] https://www.sarao.ac.za/

1.2 The Applicant – South African National Research Network

SANReN is responsible for the design, acquisition and roll-out of high-speed internet networks dedicated to science, research, education and innovation. It is managed and implemented by the CSIR's Next Generation Enterprises and Institutions cluster and forms part of a comprehensive South African government approach to cyberinfrastructure, geared at ensuring the successful participation of South African researchers in the global knowledge production endeavour. Furthermore, SANReN forms a key component of the National Integrated Cyberinfrastructure System (NICIS), alongside the Centre for High Performance Computing (CHPC) and the Data Intensive Research Initiative of South Africa (DIRISA).

SANReN has been tasked by the South African Radio Astronomy Observatory (SARAO), who spearheads South Africa's activities in the SKA Radio Telescope, to facilitate the installation of the new fibre optic cable between Beaufort West and Carnarvon. SARAO is a National Facility, managed by the National Research Foundation (NRF).

1.3 Need and desirability of the Fibre Optic Project

"Addressing the need and desirability of a development is a way of ensuring sustainable development – in other words, that a development is ecologically sustainable and socially and economically justifiable" (DEA, 2017:1). This section explores the need and desirability of the proposed Fibre Optic Project, including its role in the greater SKA initiative, in relation to the relevant guiding questions posed in the Guideline on Need and Desirability developed by the Department of Environmental Affairs (DEA) (2017). The questions included in the aforementioned guideline have been summarised and key points responded to.

1.3.1 Strategic Importance: The Square Kilometre Array Radio Telescope global mega-science project[4]

"South Africa's ratification of the Convention [Establishing the SKA Observatory] confirms South Africa's strong commitment to the global SKA partnership. We are determined to ensure the success of what will be the first ever large global research infrastructure hosted in Africa"

> Dr Blade Nzimande, South Africa's Minister of Higher Education, Science and Innovation. June 2020[5]

The proposed Fibre Optic Project is a critical part of realising the global SKA mega-science project. The SKA will be an advanced radio telescope linked to research infrastructure and high-speed Information and Communications Technology (ICT) capacity, and will provide an opportunity for South Africa to contribute towards global science projects. Additionally, the SKA is a Strategic Integrated Project (SIP 16: SKA & MeerKAT) prioritised in the National Development Plan (NDP) – see Appendix 1 for confirmation from the SIP 16 coordinator from the Presidential Infrastructure Coordinating Commission (PICC).

[4] https://www.sarao.ac.za/about/faqs/#toggle-id-13 [FAQ: How will the SKA benefit the country at large]
[5] https://www.skatelescope.org/news/south-africa-ratifies-ska-convention/

Africa's share of the iconic SKA project means that the continent is set to become a sought-after science destination. Over the next decades, many top scientists and research students will come to South Africa to do cutting-edge science.

The SKA will collect and process vast amounts of data and will stimulate cutting-edge advances in high-performance computing. Producing the thousands of radio telescope dishes required for the SKA within the project's time scales will also demand an entirely new way of building highly sophisticated and sensitive scientific instruments – which should lead to innovations in manufacturing and construction. This mega-project is therefore an ideal platform to excite young people about a career in science, engineering and technology, and to deliver skills that will be in demand in the global knowledge economy of the future.

For the next ten to twelve years, job opportunities will be created by the building of and support services to MeerKAT and the SKA itself. Following that, the running and maintenance of the SKA will create jobs for the next 50 years.

Furthermore, South Africa's SKA Project (and South Africa's successful bid to host the SKA) is causing a surge of interest in studying mathematics, engineering and astrophysics at local universities, and attracting top students and academics from around the world to South Africa.

The SKA Project invests in developing skills for MeerKAT and the SKA through its dedicated Human Capacity Development Programme. More than 700 people, ranging from artisans to postgraduate students and postdoctoral fellows, have already received bursaries and grants.

The proposed Fibre Optic Project is thus **aligned with strategic planning** in this regard.

1.3.2 Planning context

The most recently available Spatial Development Frameworks (SDFs) and Integrated Development Plans (IDPs) at National, Provincial and District Municipal and Local Municipal level (where obtainable) were drawn on to describe the baseline socio-economic and biophysical environmental context of the study area (see CHAPTER 6). These include the National Spatial Development Framework (NSDF) (DRDLR & DPME, 2019), Western Cape Provincial SDF (DEA&DP, 2014), Karoo Regional SDF (work in progress, DALRRD & SALGA, 2020), Pixley Ka Seme District SDF (PKSDM, 2014) and IDP (PKSDM, 2017), draft Central Karoo District SDF (WCG, 2019), Beaufort West SDF (BWLM, 2013) and IDP (BWLM, 2019), Ubuntu IDP (ULM, 2016), and Kareeberg IDP (KLM, 2018).

Within the consulted SDFs and IDPs, the broader SKA project is recognised as key large-scale project in the Karoo (DALRRD & SALGA, 2020), important contribution to the international scientific community (DRDLR & DPME, 2019), promoting education and training in science, engineering and technology (PKSDM, 2014), a geographic hub for investment (PKSDM, 2017; KLM, 2018) and an opportunity for sub-regional tourism linked to the SKA (BWLM, 2013). The proposed Fibre Optic Project is a critical part of realising the overall SKA Radio Telescope global mega-science project.

No Environmental Management Frameworks were found to exist for the study area, as confirmed by the National Web Based Screening Tool (https://screening.environment.gov.za/) (hereafter referred to as the Screening Tool").

The proposed Fibre Optic Project is thus **desirable and needed** in this regard.

1.3.3 Ecological function and integrity, sensitive environments, conservation targets, and international environmental responsibilities

The proposed Fibre Optic Project has been assessed to have minimal impact (very low, after mitigation) on the terrestrial and aquatic ecological integrity of the project area and broader Karoo region. Refer to CHAPTER 8, Appendix 2 and Appendix 3 for more information.

This is mainly attributed to: i) the limited footprint and duration of construction phase activities to install the fibre optic cable – which entails digging trenches (1 m deep, 0.3 m wide) for underground cabling, and digging holes for planting poles where the cabling will be installed overhead (see CHAPTER 2); and ii) the proposed fibre optic cabling predominantly installed within the road reserves of roads R381 and R63, which has been historically disturbed during road construction.

Relative sensitivity of the receiving environment in which the Fibre Optic Project is proposed has been determined and mapped through specialist investigations (see CHAPTER 7).

None of the habitats / ecosystems within the study area were found to be highly sensitive from a vegetation point of view. However, the area south of Loxton is regarded as prime riverine rabbit habitat, in particular around the Sak and Brak Rivers. Riverine rabbit is Critically Endangered due to fragmentation of its habitat in the semi-arid central Karoo region of South Africa. It is associated with dense, discontinuous vegetation fringing the seasonal rivers of the central Karoo. In general the habitat in the road reserve and at stream crossings where the fibre optic cable will be installed is not suitable habitat for the riverine rabbit. Traffic and other activities would deter them from making burrows in the road reserve. Furthermore, the animals are nocturnal and thus not active while construction work will be in progress during the daytime.

Concerning Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) determined through systematic spatial conservation planning, it is important to take cognisance that the proposed construction of the fibre optic cable will predominantly take place in the road reserve and that the road reserve is not representative of the adjacent land on which the CBA and ESA identification was based. The road reserves within which the fibre optic cable will predominantly be installed have not been found to represent areas that are particularly conservation-worthy or required to meet conservation targets for the affected ecosystem types within the study area. Furthermore, the proposed project does not require clearance of large tracts of lands that would compromise the ability to meet conservation targets. Road reserves have been highly disturbed and degraded and often still contain piles of gravel used for road construction. Due to the limited footprint and duration of construction phase activities to install the fibre optic cable, it is not anticipated that the Fibre Optic Project will significantly alter the ecological processes operating within CBAs and ESAs, nor result in significant loss of CBAs and ESAs or the species they support.

Ecological processes, function and drivers will temporarily be altered by the clearing of the vegetation for digging trenches and holes for planting poles. The impact is expected to be fairly small in relation to the adjacent landscape where no change to the ecological processes is anticipated. Overall, it is unlikely that the Fibre Optic Project will disrupt broad-scale ecological processes such as dispersal, migration or the ability of fauna to respond to fluctuations in climate or other conditions (refer to Section 6.4.2).

An international obligation relating to the environment that is relevant to the proposed Fibre Optic Project is the Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES). CITES aims to ensure that international trade in specimens of wild animals and plants does not threaten their survival. Several CITES-listed species were recorded during the

terrestrial ecology specialist investigation (see Chapter 6.4 and Appendix 2). The Environmental Management Programme (EMPr) includes measures to reduce the risk of protected, CITES-listed or other important species being removed by the construction crews (see Part B: EMPr).

Direct atmospheric emissions from the proposed Fibre Optic Project, which may contribute to climate change, are temporary and limited to emissions from machinery and vehicles (e.g. trenching and pole-planting equipment, and vehicles to transport cabling and construction crews) during construction. Indirect, operational emissions from the Fibre Optic Project is dependent on the South African energy mix as the proposed signal repeater station in Loxton will require an average of 2 kW/h of power, which will be sourced from the National Electricity Grid.

No other specific international environmental responsibilities to which South Africa is a signatory and which relate to the proposed Fibre Optic Project and / or the area in which it is proposed, were identified during this BA.

The global SKA Radio Telescope is committed to implementing the project in an environmentally sustainable manner (SKA, 2021b).

The proposed Fibre Optic Project is thus **not undesirable** in this regard.

1.3.4 Resource use and waste streams

The Fibre Optic Project is not a significantly consumptive development. During construction, fuel (petrol / diesel) will be used to power equipment and vehicles. During operations the Fibre Optic Project is dependent on the South African energy mix as the proposed signal repeater station in Loxton will require an average of 2 kW/h of power, which will be sourced from the National Electricity Grid.

The main activity / aspect of the Proposed Fibre Optic Project that could result in pollution and degradation of the biophysical environment is potential fuel leaks / spills from machinery and vehicles during construction.

The EMPr includes measures to reduce the risk of fuel spills and leaks (e.g. ensuring that equipment operators are well-trained and machinery is serviced regularly).

The main waste stream from the proposed Fibre Optic Cable project is limited to the timber cable drums / reels on which the cabling is delivered to site and other recyclable packaging during construction. Any waste that is not accepted by local recycling facilities, will be returned to the cabling supplier for reuse / proper disposal.

Where Horizontal Directional Drilling (HDD) will be used, the main waste that will be generated includes drill cuttings and excess drilling muds, which are largely inert[6] and not harmful / hazardous. These will be removed from site and disposed of at a suitable landfill facility, with proof of disposal obtained and retained on file.

[6] Inert waste is waste that "does not undergo any significant physical, chemical or biological transformation after disposal; does not burn, react physically or chemically biodegrade or otherwise adversely affect any other matter or environment with which it may come into contact; and does not impact negatively on the environment, because of its pollutant content and because the toxicity of its leachate is insignificant". Inert waster includes "discarded concrete, bricks, tiles and ceramics, discarded glass, discarded soil, stones and dredging spoil" (South Africa, 2008).

Sewage from on-site portable sanitation facilities for use by the construction crews will be managed and removed by a reputable sanitary services provider.

All waste is classified as General; no Hazardous waste will be generated. This includes that no maintenance of vehicles or machinery, e.g. resulting in used oil, will occur on site. In the event of a fuel / oil spill, used spill containment and clean-up kits (hazardous waste) will be disposed of appropriately.

Refer to CHAPTER 2 and Part B: EMPr for more information.

The proposed Fibre Optic Project is thus **not undesirable** in this regard.

1.3.5 Precautionary approach, uncertainty and risk:

A precautionary approach to the proposed Fibre Optic Project has been applied in the following key ways:

- Project planning: 1) the cabling has been planned to follow existing disturbance corridors (i.e. roads and other existing infrastructure such as power- and telephone lines) to minimise new disturbance / greenfield development; 2) the most direct / shortest possible route between Beaufort West and Carnarvon was selected as the preferred alternative (refer to CHAPTER 3) so as to minimise the cumulative construction phase footprint.
- Construction phase: the EMPr specifies the appointment of a qualified ecologist before and during the construction phase to advise on micro-siting of the route to avoid / minimise potential ecological impacts as they arise, especially if unforeseen subsurface technical difficulties are encountered during construction, which could entail cable installation to deviate from the planned route. Refer to Part B: EMPr.

Limitations, assumptions and uncertainties as it pertains to the specialist assessments, have been outlined (refer to Appendix 2 to Appendix 6). These relate primarily to the level of comprehensive information that can be collected in a single field data collection campaign for a large linear study area, and accessibility of difficult terrain. The main risk associated with this is that sensitive features or species that have not been accounted for during the site surveys, may be impacted once the proposed Fibre Optic Project is implemented. To address this risk, the EMPr (see Part B) specifies, for example, a Fossil Finds Protocol and that suitably qualified ecologist/s must be appointed to assist with micro-siting before and during the construction phase.

The proposed Fibre Optic Project is thus **not undesirable** in this regard.

1.3.6 People's environmental rights

Due to the limited and temporary physical footprint of the proposed Fibre Optic Project, the impacts after mitigation to the environment (ecology, heritage, sense of place) has been assessed to be minimal (very low to moderate, after mitigation). This entails that people's environmental rights will not be adversely affected, and the ability of the affected ecosystems (albeit already disturbed by road-building and other linear infrastructure) to deliver ecosystem services will not be further compromised.

The proposed Fibre Optic Project is thus **not undesirable** in this regard.

1.3.7 Socio-cultural needs and employment

The proposed Fibre Optic Cable project will result in approximately 180 short term local job creation during the construction phase where the main construction contractor aims to hire local people to undertake hand trenching instead of machinery where required (see Section 2.3.8).

The proposed Fibre Optic Project is thus **desirable** in this regard.

1.3.8 History, sense of place, and heritage

The proposed Fibre Optic Project has been assessed to have low to moderate impact significance (after mitigation) on the heritage and sense of place / visual aesthetic of the project area and broader Karoo region. Refer to CHAPTER 8, Appendix 5 and Appendix 6 for more information.

This is mainly attributed to: i) the limited footprint and duration of construction phase activities to install the fibre optic cable, and ii) the proposed fibre optic cabling predominantly installed within the road reserves of roads R381 and R63, which has been historically disturbed during road construction.

Relative sensitivity of the receiving environment in which the Fibre Optic Project is proposed has been determined and mapped through specialist investigations (see CHAPTER 7). Recorded heritage features (archaeological and palaeontological) were found to be of low sensitivity / significance (Section 7.2.3). The visual and aesthetic resources of the study area, particularly as it pertains to scenic mountain passes where the cabling will be installed overhead on poles 7.5 – 9 m in height, will have localised visual implications for users of the R 381 road (Section 7.2.4). Although mitigation options for the visual impact of the overhead cabling are constrained by technical aspects relating to the construction and maintenance of the cabling in these areas of difficult terrain, it is not considered a fatal flaw, and existing linear infrastructure (powerlines and telephone lines) will be followed as far as possible.

The proposed Fibre Optic Project is thus **not undesirable** in this regard.

CHAPTER 2 PROJECT DESCRIPTION

2.1 Overview

The proposed fibre optic cable installation will start in Beaufort West at the Transnet building (32°21'02.5"S 22°34'35.3"E, corner of 2nd Avenue and Kerk Street), via Loxton, to Carnarvon where the cabling will terminate at the existing SKA internet PoP site (30°58'12.0"S 22°08'28.7"E, just off Stasieweg Street). The total length of the proposed cable route is approximately 183 km.

The cabling will be installed underground, using a combination of trenching (Section 2.3.1.1 and 2.3.1.2), HDD (Section 2.3.1.3), and overhead on poles (Section 2.3.2) where trenching is technically unfeasible. At one river crossing – the Brak river south of Loxton – the cabling will be attached to the bridge. A repeater station will be established in Loxton, to regenerate the data signal (Section 2.3.3).

2.2 Spatial extent

The spatial extent of the proposed Fibre Optic Project, for which an EA is being sought, is defined as follows:

- Underground sections (total of approximately 162 km): within a 30 m wide corridor around the centre line of the roads (i.e. the road reserve) where the cabling will be installed underground.
- Overhead sections, outside of the road reserve (total of approximately 21 km): a 30 m wide corridor around the engineering Low Level Design (LLD) route (latest technically feasible engineering design at the time of writing this report).

It is proposed that the EA (if granted) applies to the entirety of the corridor. Within this corridor, the fine-scale routing of the fibre optic cable may be adjusted as required to avoid or compensate for any technical difficulties or environmental sensitivities identified in the field during construction. Any deviations to the route within the 30 m wide assessed corridor would not result in an Amendment to the EA (should it be granted). However, any amendments to the route that would result in encroachment outside of the corridor would require an amendment process.

For a list of coordinates detailing the project location and spatial extent, refer to Appendix 7.

2.3 Construction Phase

The construction phase is estimated to take approximately 12 months, with 800 m of cabling being installed per day. The majority of the activities related to the proposed Fibre Optic Project will take place in the construction phase. Two construction crews will work on installing the cable simultaneously: 1) starting in Beaufort West working northwards; and 2) starting in Carnarvon and working southwards.

2.3.1 Underground cabling

The underground fibre optic cabling will be installed at least 1 m from the fence of adjacent private land within the road reserves of the following roads:

Beaufort West:	2nd Ave. → Park Ave. → Kerk Str. →New Str. → Donkin Str. (N1 / N12) →

Beaufort West to Loxton:	R381 →
Loxton:	Fraserburg Str. → Auret Str. / R381 →
Loxton to Carnarvon:	R63 →
Carnarvon:	Biblioteek Str. → Zahn Str. → Van Riebeeck Str. → Stasieweg Str.

2.3.1.1 Trenching

- Trenches will be dug 1 m deep and 200 mm – 300 mm wide.
- A combination of two types of machinery will be used to dig trenches (Figure 2):
-

  - **Tractor Loader Backhoe (TLB)** - used for more difficult terrain; and
  - **Chain Trencher**.

Figure 2: Example of machinery used to dig trenches -Tractor Loader Backhoe (TLB) (left) and Chain Trencher (right).

2.3.1.2 Trench backfilling and compacting

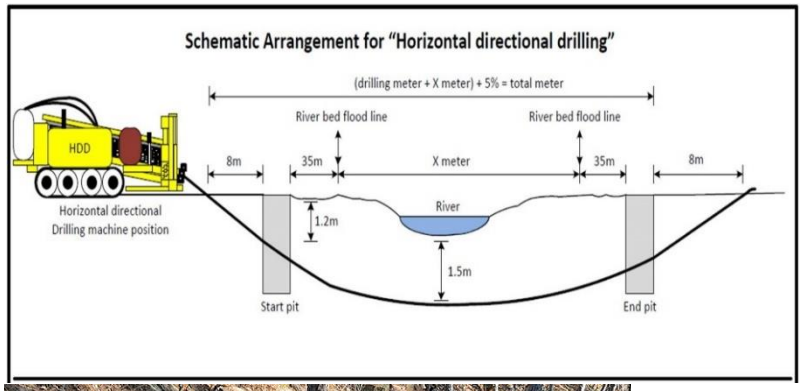
- After the trench is dug, it will be prepared by adding soft soil where sharp rocks may damage the fibre duct.
- The fibre duct with cabling is then laid in the trench.
- The trench is backfilled first with approximately 400 mm of soft soil over the ducting;
- A compacting machine (Figure 3) is used to compact the first 400 mm of the backfill;
- The remainder of the trench is then backfilled to a level slightly above ground surface and then compacted to the same level and density as the surrounding soil.
- Soil density / compaction is tested at intervals using a Dynamic Cone Penetrometer (DCP).
  - A penetration rate of 25 – 50 mm / blow will be compared with adjacent soil (values of 10 mm / blow on soil and 25 mm / blow on the backfilled trench section is sufficient).

- A maximum of 4 km of trench will be dug and be open until the cabling is laid;
- Once the trench is dug, the cabling will be laid within 5 – 7 days;
- Once the cabling is laid, the trench will be backfilled within 1 – 2 days.
- Where the cabling needs to be installed across adjoining roads and property entrances, the trench will be dug and backfilled on the same day.

Figure 3: Example of trench backfilling and compaction.

2.3.1.3 *Horizontal Directional Drilling (HDD)*

- Where the cabling needs to traverse sensitive environments, such as rivers, HDD techniques will be employed.
- Drilling will start 32 m away from the bank of the river, and will continue 2 m below the river bottom.
- The direction of the drill bit is guided by hydraulic fluid or wire line magnetics (see Appendix 8 for an example Safety Data Sheet for hydraulic fluid typically used):
    - A transmitter or steering tool located near the drill head sends a signal to the location engineer giving the exact coordinates of the drill stem.
    - Readings are constantly taken which check the depth, alignment and percent slope of the drill head.
- The drill fluids / muds are not hazardous and do not pose a significant risk to the environment.



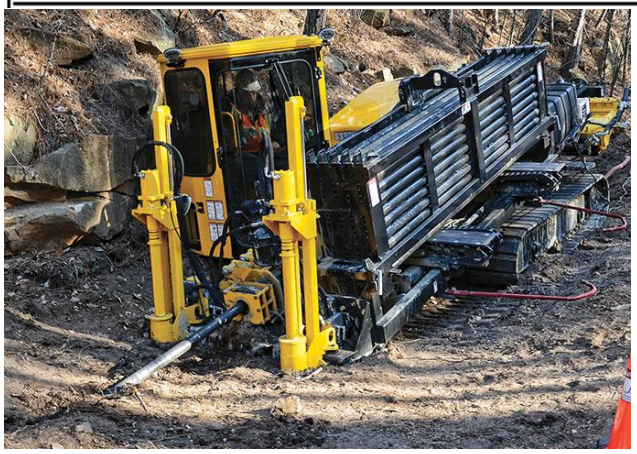


Figure 4: Schematic representation of a HDD operation (top) and example HDD machinery (bottom).

2.3.1.4 Manholes

Manholes (Figure 5) are required to access the cabling for maintenance, and are installed on all underground routes and spaced approximately 970 m apart or as the terrain dictates. Manholes in urban / town areas are all surface manholes, whilst in rural areas surface manholes will be installed approximately 3.9 km apart to facilitate maintenance and repair activities.

Figure 5: Example of a surface manhole to allow access to the underground fibre optic cable during operations and maintenance.

2.3.2 Overhead cabling

Overhead cable installation techniques will be used to traverse difficult terrain along the R381 at the sections indicated in Table 1 below.

Table 1: Location and property details of the proposed overhead sections of the Fibre Optic Project.

Section	Distance (km)	Geographic coordinates (degrees minutes second)	Properties / farm portions
Molteno Pass	15.14	32°17'03.0"S 22°33'55.1"E to 32°10'22.0"S 22°32'41.1"E	• Erf 3545 of the Beaufort West region [C00900010000354500000] (Karoo National Park); • Erf 1707 of the Beaufort West Region [C00900010000170700000] (Karoo National Park); • Portion 9 of the Farm Alwins Gate 186 [C00900000000018600009] (Karoo National Park); • Portion 1 of the farm Matjes Valie 103 [C00900000000010300001] (private property); and • Road reserve of the R381, as far as possible.
Blounek Pass	4.73	32°04'43.9"S 22°27'06.5"E to 32°02'37.1"S 22°27'06.1"E	• Remainder of the Farm Waterval 97 [C00900000000009700000] (private property). • Remainder of the Farm Middle Kraal 98 [C00900000000009800000] (private property); and • Road reserve of the R381, as far as possible.
Rosenberg Pass	0.75	31°53'24.4"S 22°23'54.2"E to 31°53'10.0"S 22°23'32.3"E	• Road reserve of the R381.

At these sections (Table 1) the cabling may be installed outside of the road reserve, following the shortest, most accessible and technically feasible route. Poles will be spaced between 20 m and 80 m apart depending on the terrain.

Two types of poles will be used (Figure 6):

- Timber poles:
    - Total length of 9 m, buried 1.5 m deep, resulting in a total aboveground height of ~ 7.5 m;
    - The majority of the poles will consist of timber poles.

- Concrete poles:

- Hollow concrete poles:
  - Total length of 11 m, buried 2 m deep, resulting in a total aboveground height of ~ 9 m;
  - Installed at end-points where fibre installation changes from underground to overhead and vice versa to let the cable run inside the pole for protection purposes.
- Solid concrete poles:
  - Total length of 11 m, buried 2 m deep, resulting in a total aboveground height of ~ 9 m;
  - Concrete poles are generally preferred due to higher resistance to fire damage and theft. Also installed where the cabling needs to cross to the opposite side of the road.

Figure 6: Examples of fibre optic cables installed on timber (left) and concrete (right) poles.

A combination of two techniques are used to dig holes (Figure 7):

- Drill mounted on the back of a truck;
- Hand-held drill (used in areas inaccessible to the abovementioned truck).

Dug holes may remain open for a maximum of 3 days before the poles are planted.

Figure 7: Holes for installing overhead cabling poles will be dug by truck-mounted (left) or hand-held (right) drills.

Poles are planted using a truck (Figure 8). Alternatively, where poles need to be planted in areas inaccessible by the pole-planting truck, manual labour will be used to plant the poles.

Figure 8: Example of a truck used to plant timber (top) and concrete (bottom) poles.

Once the poles are planted the soil around the pole will be compacted. A dry cement mixture may also be used to secure the pole in place.

2.3.3 Repeater station

A repeater station – a system used to regenerate and extend the data transfer reach of fibre optic cable, and correct any signal distortion – will be located in the town of Loxton. The repeater station consists of a 3 x 6 m container that hosts the repeater equipment, enclosed in a 10 x 12 m fenced area (Figure 9).

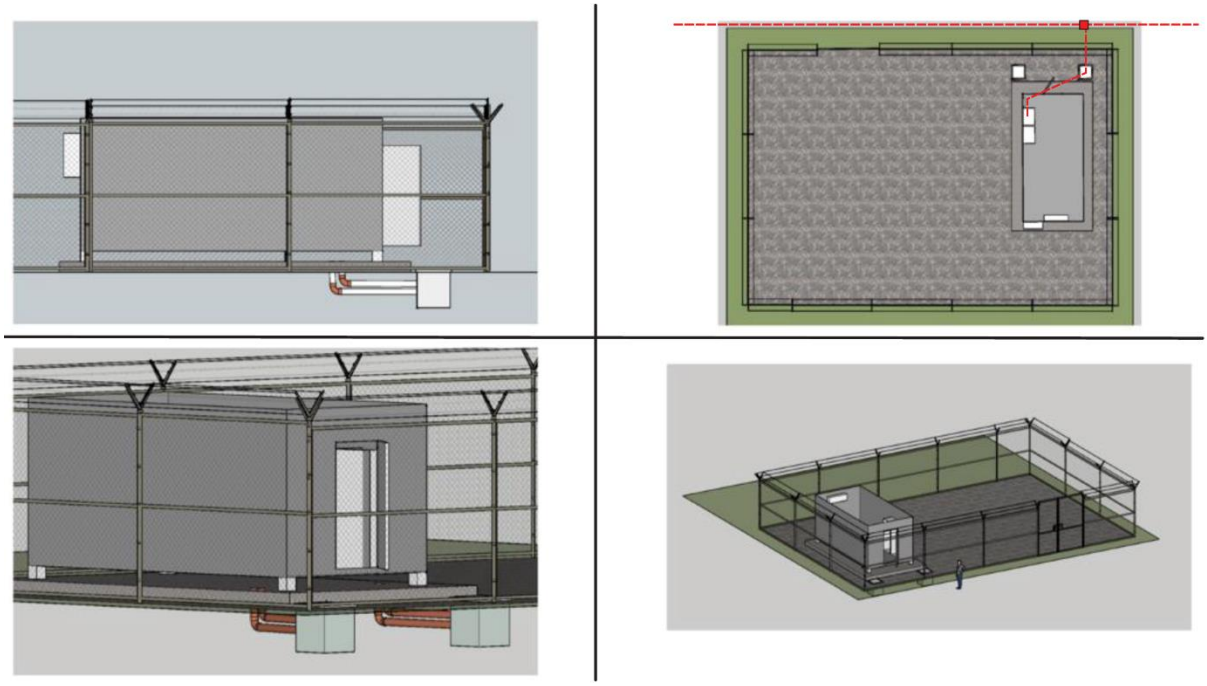


Figure 9: Typical layout of a repeater station used to regenerate the data signal, extend the data transfer reach of the fibre optic cable and correct any data signal distortion.

2.3.4 Laydown areas and construction camps

Two (02) site basecamps, on the outskirts of Beaufort West and Carnarvon, are proposed for storing vehicles and equipment. An air-conditioned container facility to hold meetings and with ablutions will be established. The basecamps will have a footprint of approximately 1 000 m^2 and will be fenced. The exact location of the basecamps along the proposed fibre optic route will be determined at the start of the construction phase. Basecamps may be placed within the 30 m wide corridor and avoid sensitive environments identified in this BA, or will be positioned such that it does not trigger any Listed Activities that require an EA.

Additionally, four (04) temporary laydown areas / material drop-off points are proposed along the route. The exact location of the laydown areas / drop-off points will be determined once at the start of the construction phase, have a footprint of approximately 150 m^2 and will be fenced. These areas may be spaced approximately 40 km apart along the proposed fibre optic route. Laydown areas may be placed within the 30 m wide corridor and avoid sensitive environments identified in this BA, or will be positioned such that it does not trigger any Listed Activities that require an EA.

No temporary accommodation is required. It is envisaged that 90 % of workers will be from the local population, and will be transported back to their homes in Beaufort West / Loxton / Carnarvon

at the end of each day. The remaining 10 % of workers who do not reside in Beaufort West / Loxton / Carnarvon will be housed at guest houses within these towns as required.

2.3.5 Traffic

An estimated twenty-two (22) vehicles will be operating at any given time during the construction phase, each travelling a maximum of 205 – 230 km per day (especially towards the completion of construction at the middle section of the route) (Table 3).

Table 2: Estimated number of vehicles and daily travel distances during the construction phase.

Vehicle type	Distance per day to-and-from site (km)	Distance per day on site during construction (km)	Total distance per vehicle per day (km)	Number of vehicles
Eight ton truck	180	25	205	10
Bakkie	180	50	230	10
Car	180	50	230	2
Total	**540**	**125**	**665**	**22**

2.3.6 Services: waste, water, and fuel

All waste is classified as General waste; no Hazardous waste will be generated. This includes that no maintenance of vehicles or machinery, e.g. resulting in used oil, will occur on site. In the event of a fuel / oil spill, used spill containment and clean-up kits (hazardous waste) will be disposed of appropriately.

The main waste stream from the proposed Fibre Optic Cable project is limited to the timber cable drums / reels on which the cabling is delivered to site and other recyclable packaging during construction. Any waste that is not accepted by local recycling facilities (Beaufort West), will be returned to the cabling supplier for reuse / proper disposal.

Where HDD will be used, the main waste that will be generated includes drill cuttings and excess drilling muds, which are largely inert and not harmful / hazardous. These will be removed from site and disposed of at a suitable landfill facility, with proof of disposal obtained and retained on file.

Excavated material will be reused on site as far as possible to backfill trenches. Excess spoil, if any, will be removed from site and disposed of at a suitable landfill facility, with proof of disposal obtained and retained on file.

Sewage from on-site portable sanitation facilities for use by the construction crews, will be managed and removed by a reputable sanitary services provider.

No water will be used for construction activities[7] due to water scarcity in the region. Backfilled trenches and soils around installed poles will be dry-compacted. Refer to Section 2.3.7 below for non-consumptive water uses associated with watercourse crossings and for which a water use General Authorisation (GA) has been obtained.

[7] In the event that excessive dust is generated, water may be sprayed onto the soil to control dust generation. However, due to prolonged drought and water scarcity in the region, this is the last resort option for dust suppression, and in which case water must be sourced from water-secure areas, with the necessary approvals in place.

Fuel will be transported to site and kept in South African Bureau of Standards (SABS)-approved mobile 1 000 ℓ (1 m^3) fuel trailer (Figure 10) or in 25 ℓ jerry cans (no more than 16 cans (400 ℓ) at a time. No permanent fuel storage tanks will be erected. Drip trays or similar containment measures will be used to avoid contaminated soils from potential spills / leaks.

Figure 10: Example of a mobile fuel trailer for fuel transport and storage.

2.3.7 Non-consumptive water uses (NWA Section 21(c) and (i) water uses)

The National Water Act (NWA) Act No. 36 1998 (South Africa, 1998b) (refer to Section 4.5) defines non-consumptive water uses, which forms part of the construction phase of the proposed Fibre Optic Project. These include:

- Impeding the flow in a watercourse (NWA Section 21(c)); and
- Altering the bed, banks, course or characteristics of a watercourse (NWA Section 21(i)).

The dug trenches, in which the fibre optic cabling will be installed underground and backfilled, are temporary impediments and alteration to the watercourses that need to be traversed along the proposed fibre optic route. In total, fifty-two (52) watercourse crossings (Figure 11) have been identified based on watercourse delineation by the aquatic specialist (see Section 6.5.2 and Appendix 3). The watercourses are predominantly dry, ephemeral and / or alluvial systems. Water use GA was applied for and subsequently approved (refer to Section 4.5 and Appendix 19 for more information).

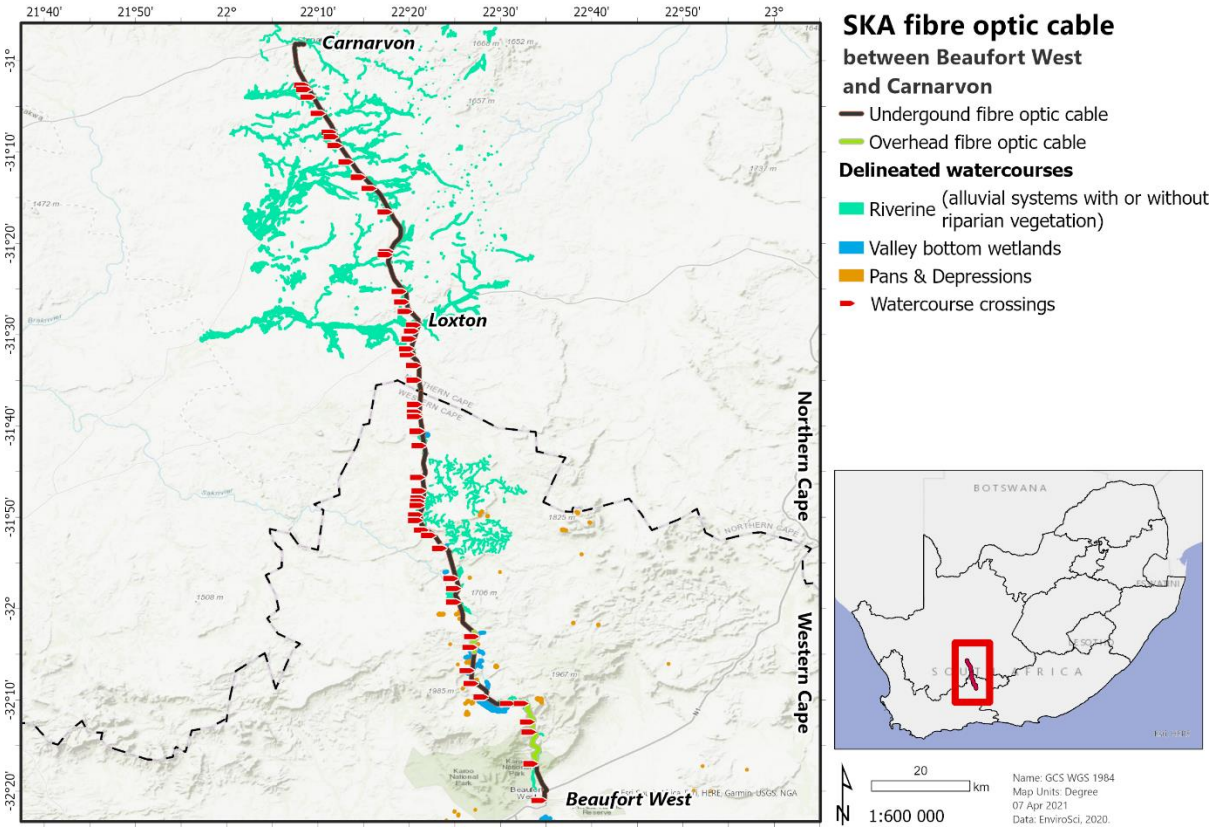


Figure 11: The proposed fibre optic cable will traverse watercourses on fifty-two instances, for which water use General Authorisation in terms of the National Water Act has been obtained.

2.3.8 Employment

It is envisaged that four (04) main contractor teams will be employed, creating approximately 180 construction phase job opportunities. It is estimated that 90 % of workers will be sourced from the local population of Beaufort West / Loxton / Carnarvon and surrounds. The two construction crews, starting at Beaufort West and Carnarvon, will consist of approximately 100 and 80 workers respectively.

2.4 Operations and Maintenance Phase

Activities during the operations and maintenance phase are minimal and limited to specialist technicians periodically driving the length of the fibre optic cable to check for and repair any fibre breaks.

In the event that the underground cabling breaks or is faulty, the location of the fault can be determined accurately. If there are no surface manholes within the vicinity of the break, the closest buried manhole will be excavated in a targeted manner, the cabling repaired, and the excavation backfilled.

If on-site portable sanitation facilities are required during maintenance / repairs activities, the resulting sewage will be managed and removed by a reputable sanitary services provider.

Operations and maintenance of the fibre optic cabling is a specialised service that will not create employment beyond that of the Operations and Maintenance (O&M) manager / technical specialist service provider.

2.4.1 Services: waste, water, fuel and electricity

During the operations phase, minimal waste will be generated. In the event that repairs are to be made to the cabling, waste will be general, non-hazardous, consisting mostly of recyclable packaging.

No water is required for operations and maintenance of the proposed Fibre Optic Project.

The repeater station at Loxton will require 2 kW/h of electricity during operations. Electricity will be sourced from the national grid via an existing transformer / Municipal Power Distribution cabinet. A backup generator will also form part of the regeneration station to supply electricity in the event of a power outage. Approximately 50 ℓ of diesel for the backup generator will be stored in SABS-approved containers at the repeater station.

2.5 Decommissioning Phase

The main aim of decommissioning is to return the land to its original, pre-construction condition. Should the unlikely need for decommissioning arise, underground infrastructure will be left abandoned in place and is not hazardous or harmful to the environment. Overhead fibre optic cable will be recovered. Timber and concrete poles will be removed and re-used for other developments, where possible, or disposed of appropriately. Decommissioning procedures will be undertaken in line with the EMPr and legislative requirements at the time, and the site will be rehabilitated and returned to the pre-construction state.

CHAPTER 3 PROJECT ALTERNATIVES

Sections 24(4) (b) (i) and 24(4A) of the NEMA require an Environmental Assessment to include investigation and assessment of impacts associated with alternatives to proposed projects / development.

The NEMA EIA Regulations, 2014, as amended (South Africa, 2017: 217), defines alternatives as "*different means of meeting the general purpose and requirements of the activity, which may include alternatives to the:*

(b) property on which or location where the activity is proposed to be undertaken;
(c) type of activity to be undertaken;
(d) design or layout of the activity;
(e) technology to be used in the activity;
(f) operational aspects of the activity; or
and includes the option of not implementing the activity."

The proposed Fibre Optic Project has a specific purpose, i.e. high-speed, low latency data transfer between the SKA radio-telescope and the data processing centre in Cape Town. This purpose can only be reasonably achieved through fibre optic technology and the shortest possible route between the required start and end points. As such, no other activity and technology alternatives can be considered as appropriate to meet this goal. Alternatives relevant to and considered for the proposed Fibre Optic Project include the "no-go alternative" (i.e. the Project does not realise – Section 3.1) and "routing (or layout) alternatives" (Section 3.2). Additionally, a requirement for the fibre optic cable is to follow existing roads as far as possible, to enable access to the cabling during the life-cycle of the project, and reduce the financial and environmental costs of constructing new roads for the purpose of the project.

3.1 No-go alternative

The no-go alternative assumes that the proposed Fibre Optic Project does not go ahead. Although the no-go alternative would result in none of the identified environmental impacts associated with the Project (see CHAPTER 8), it would also mean that the SKA radio telescope does not connect to the data processing centre in Cape Town, and that South Africa is not meeting its commitment to the SKA global mega-project. As such, the no-go alternative is not a reasonable or feasible alternative.

3.2 Routing alternatives

Two alternative routes for the proposed Fibre Optic Project (Figure 12) were considered in an Environmental Screening Study undertaken in 2020 before the initiation of this BA process (see Appendix 9):

Option A: Beaufort West – Loxton – Carnarvon (preferred alternative, taken forward in this BA); and

Option B: Beaufort West – Leeu Gamka – Fraserburg – Loxton – Carnarvon (screened out, not taken forward in this BA).

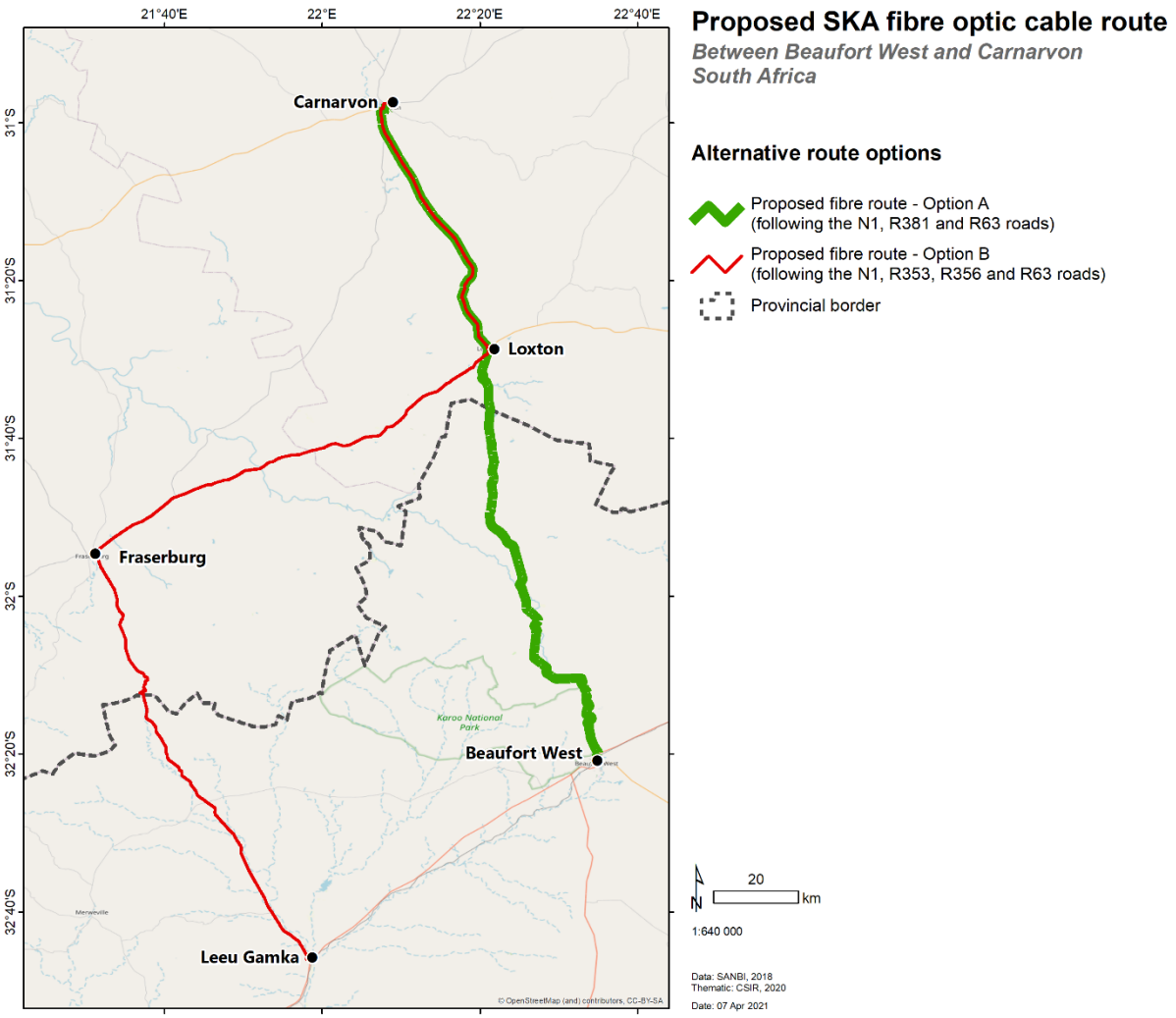


Figure 12: Two alternative routes for the proposed fibre optic cable between the Beaufort West area and Carnarvon were considered.

Option A (Beaufort West – Loxton – Carnarvon) is the most direct and shortest route between the Beaufort West area and Carnarvon and is therefore preferred from an environmental, engineering and technical perspective. Option A is considerably shorter than Option B (by ~170 km) and is, therefore, the preferred option (Table 3). Having a shorter link between end points leads to potentially higher transfer speeds per wavelength on the Dense Wavelength Division Multiplexing (DWDM) system[8] and lower latency. The rate and volume of data that will be transferred from the SKA via the fibre optic cable require high transfer speed and low latency. This is partly achieved by establishing the shortest and most direct route for the fibre optic cable. The shorter length of Option A also results in lower engineering and environmental costs as it has fewer river crossings and a smaller cumulative construction footprint (including within CBAs). The longer Option B route would also require the establishment of an additional repeater station[9], which would require the establishment of another facility (e.g. site, container), extra equipment, electricity supply, cooling system and security. Furthermore, Option B would also require SANReN to redesign the DWDM system that has already been deployed by adding a new add-drop site in Leeu Gamka.

[8] Technology that combines data signals from different sources so they can share a single optical fibre pair while maintaining complete separation of the data streams.
[9] System used to regenerate and extend the reach of a DWDM system and correct any signal distortion.

Route Option A (Beaufort West – Loxton – Carnarvon) is thus taken forward and considered further in this BA.

Table 3: Alternative route selection matrix: summary of the specifications for the two alternative fibre optic cable routes.

Specification	Fibre optic cable route alternatives	
	Option A (Beaufort West – Loxton – Carnarvon)*	**Option B (Beaufort West – Leeu Gamka – Fraserburg – Loxton – Carnarvon)**
Length *[Shorter length translates into technical feasibility in terms of:* • *Lower construction and maintenance costs.* • *High data transfer speeds.]*	183 km	354 km
Total approximate clearance / trenching footprint *[length x 0.3 m]*	5.49 ha	10.62 ha
River crossings (desktop) (SANBI, 2018)	21	37
Total footprint in Critical Biodiversity Areas (CapeNature, 2017; DENC, 2016) *[CBA1 & CBA2]*	57 617 m^2	83 783 m^2
CBA: Critical Biodiversity Area		

** Preferred from an environmental, engineering and technical perspective.*

CHAPTER 4 LEGISLATIVE CONTEXT

4.1 National Environmental Management Act, 107 of 1998

The NEMA (South Africa, 1998a) sets out several principles to give guidance to developers, private land owners, members of the public and authorities. The principles include that any development must be socially, environmentally and economically sustainable. Furthermore, the NEMA principles state that all relevant factors must be considered, inter alia i) that the disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied; ii) that pollution and degradation of the environment are avoided, or, where they cannot be altogether avoided, are minimised and remedied; vi) that the development, use and exploitation of renewable resources and the ecosystems of which they are part do not exceed the level beyond which their integrity is jeopardised; and viii) that negative impacts on the environment and on peoples' environmental rights are anticipated and prevented, and where they cannot be altogether prevented, are minimised and remedied. As the primary South African environmental legislation, the NEMA is further complimented by several sectoral laws governing marine living resources, mining, forestry, biodiversity, protected areas, pollution, air quality, waste and integrated coastal management. It also provides a framework for integrating environmental issues in planning and decision-making, and sets requirements for environmental assessment and EMPrs.

4.2 Environmental Impact Assessment Regulations, 2014, as amended

The NEMA EIA Regulations, 2014, as amended (South Africa, 2017) are promulgated in terms of Chapter 5 of the NEMA. Its purpose is to regulate the preparation, evaluation, submission, processing and consideration of, and decision on, applications for EA for the commencement of activities, subjected to environmental assessment, to avoid or mitigate detrimental impacts on the environment, and to enhance positive environmental impacts.

The BA process for the proposed Fibre Optic Project and resulting Basic Assessment Report (BAR) (i.e. this report) has been completed in adherence to the requirements of the EIA Regulations (see CHAPTER 5).

Furthermore, the EIA Regulations stipulates:

- Listed Activities that require an EA, issued by the Competent Authority, for the activity to be implemented. The Listed Activities triggered by the proposed Fibre Optic Project, and thus indicating the requirement for an EA, are outlined in Section 4.2.1;
- Assessment and minimum criteria for reporting on identified environmental themes, commonly referred to as "protocols". The specialist assessments for the proposed Fibre Optic Project have been completed in accordance with the applicable protocols (i.e. Aquatic Biodiversity and Terrestrial Biodiversity published in GN 320 in March 2020). The Terrestrial Ecology specialist assessment was commissioned before the publication of the Terrestrial Animal Species and Terrestrial Plant Species protocols (30 October 2020), as such these protocols were not applicable at the time (see Section 4.2.2);
- The requirement to submit a report generated by the National Web Based Environmental Screening Tool (see Section 4.2.3 and Appendix 11).

4.2.1 Listed Activities applicable to the proposed Fibre Optic Project

Table 4 provides the Listed Activities, in terms of the NEMA EIA Regulations, 2014, as amended (South Africa, 2017), applicable to the proposed Fibre Optic Project, in terms of:

- Listing Notice 1 (Government Notice (GN) R 327) – Activities requiring a BA process;
- Listing Notice 2 (GN R 325) – Activities requiring a full Scoping and EIA process; and
- Listing Notice 3 (GN R 324) – Activities within specific Provinces, requiring a BA process.

The outcome is that an EA is required for the proposed Fibre Optic Cable, and may be obtainable through a BA process.

Table 4: Listed Activities applicable to the proposed Fibre Optic Cable.

Listed Activity		**Rationale**
Listing Notice 1, Activity 19	*The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse*	The proposed approach to avoid sensitive areas, particularly watercourses, are via HDD 2 m below the riverbed starting 32 m from river banks. In some areas, dry watercourses (as delineated by the aquatic ecology specialist) may be trenched and backfilled, in accordance with measures identified and included in the EMPr.
Listing Notice 3, Activity 12	*The clearance of an area of 300 square metres or more of indigenous vegetation:* *(g) Northern Cape,* *(ii) within critical biodiversity areas identified in bioregional plans.* *(i) Western Cape,* *(ii) within critical biodiversity areas identified in bioregional plans.* *(iv) On land, where, at the time of the coming into effect of this Notice or thereafter such land was zoned open space, conservation or had an equivalent zoning.* *(v) On land designated for protection or conservation purposes in an Environmental Management Framework adopted in the prescribed manner, or a Spatial Development Framework adopted by the MEC or Minister.*	CBAs: Although the development is predominantly proposed within the road reserves of the R381 and R63, the total cumulative approximate construction footprint of the proposed fibre optic cable, within Critical Biodiversity Areas (CBAs) in the Northern Cape (37 803 m^2) and Western Cape (19 814 m^2) Provinces, exceeds the 300 m^2 clearance threshold. Land zoned as conservation or designated for conservation purposes: The Beaufort West SDF (2013, adopted 2017 for 2017-22) (BMLM, 2013; 2018) recognises the Karoo National Park, as well as the Sakriver, Brakriver, Kromriver and Wagenaarskraal conservancies between Beaufort West and Loxton (in the Northern Cape and Western Cape provinces). Within the Karoo National Park, the proposed fibre optic cable will be installed overhead on timber and concrete poles for a total distance of approximately 4.7 km. The 'clearance' of vegetation for the holes within which the poles are planted, will be approximately 80 m^2, cumulatively. Within the Sakriver, Brakriver, Kromriver and Wagenaarskraal conservancies the fibre optic cable will be installed in the road reserve of the R381 road for a distance of approximately 62 km, which would result in cumulative clearance of vegetation in the road reserve of 18 600 m^2. Refer to Figure 22, Section 6.4.5 for the spatial distribution of CBAs, the Karoo National Park and conservancies in the proposed Fibre Optic Project study area.

4.2.2 Assessment and minimum criteria for reporting on identified environmental themes

GN 320 (South Africa, 2020a) prescribes general requirements for undertaking site sensitivity verification and for protocols for the assessment and minimum report content requirements of environmental impacts for environmental themes for activities requiring EA. The Specialist Assessments undertaken as part of this BA Process, specifically Terrestrial Biodiversity and Aquatic Biodiversity, comply with GN 320. The remaining specialist studies (Heritage and Visual) comply with Part A of GN 320, which contains site sensitivity verification requirements where a Specialist Assessment is required but no specific assessment protocol has been prescribed, but refers to Appendix 6 "Specialist reports" requirements of the NEMA EIA Regulations, 2014, as amended.

GN 1150 (South Africa, 2020b) prescribes protocols in respect of specific environmental themes for the assessment of, as well as the minimum report content requirements on, the environmental impacts for activities requiring EA – specifically as it relates to a) terrestrial animal species and b) terrestrial plant species. The requirements of these protocols apply from the date of publication (i.e. from 30 October 2020), except where the Project Applicant provides proof to the competent authority that the specialist assessment affected by these protocols had been commissioned by the date of publication of these protocols in the Government Gazette, in which case Appendix 6 of the NEMA EIA Regulations, 2014, as amended, will apply to such applications. The Terrestrial Biodiversity and Ecology specialist assessment (Appendix 2) was commissioned in early September 2020 (see Appendix 10) and the field investigations undertaken 29 September – 02 October 2020, before the publication of GN 1150 for implementation, and as such was not applicable.

4.2.3 National Web Based Environmental Screening Tool Report

The use of the National Web Based Screening Tool (https://screening.environment.gov.za/) (hereafter referred to as the Screening Tool") is mandatory for planning developments that require an EA, and the Report generated by the Tool must be submitted together with an EA application (GN 960 – South Africa, 2019). The Screening Tool specifies which specialist studies must be undertaken in the EIA (see Section 5.4), and provides protocols that guide how specialist assessments must be undertaken. It is the responsibility of the Environmental Assessment Practitioner undertaking the EIA to confirm identified specialist assessment and to motivate in the assessment report, the reason for not including any of the identified specialist studies.

The proposed Fibre Optic Project has been run through the National Web Based Environmental Screening Tool, and associated reports generated and attached to the Applications for EA. The National Sector Classification Category found applicable to the proposed Fibre Optic Project and thus used in the Screening Tool was "Any activities within or close to a watercourse"[10], since the cabling needs to traverse multiple watercourses (ephemeral rivers and drainage lines). Based on this classification the Screening Tool identified required specialist assessments that could be

[10] None of the other National Sector Classification Categories were found to match the proposed Fibre Optic Project. Under "Utilities Infrastructure/Telecommunications" the subclass of "Radio broadcasting" is not applicable since the fibre optic cable does not broadcast any signals, and does not constitute a "Tower", "Mast" or a "Receiver".
Utilities Infrastructure/Telecommunications/ Radio Broadcasting - Tower
Utilities Infrastructure/Telecommunications/ Radio Broadcasting - Mast
Utilities Infrastructure/Telecommunications/ Radio Broadcasting – Receivers

relevant to the proposed activities. These studies are listed in Section 5.4 together with a motivation for including / not including certain assessments in the BA process.

4.3 National Environmental Management: Biodiversity Act, 10 of 2004

The National Environmental Management: Biodiversity Act (NEM:BA) (South Africa, 2004) provides for the management and conservation of biological diversity, as well as the use of indigenous biological resources in a sustainable manner. It includes provisions for threatened ecosystems (see Section 4.3.1), ToPS (see Section 4.3.2), and Alien and Invasive Species (AIS) (see Section 4.3.3).

4.3.1 Threatened ecosystems

GN 1002 (South Africa, 2011) provides a list of threatened terrestrial ecosystems categorised as Critically Endangered (CR), Endangered (EN), Vulnerable (VU) and protected ecosystems. The recent 2018 National Biodiversity Assessment (NBA) (SANBI, 2018) includes the updated extent and status of threatened ecosystems, although not yet formally adopted under the NEM:BA.

There are six ecosystems / vegetation types found within the proposed Fibre Optic Project study area, none of them are listed as threatened (see Section 6.4.1).

4.3.2 Threatened or Protected Species

The ToPS Regulations (South Africa, 2007) of the NEM:BA declares species of high conservation value, national importance or that are considered threatened and in need of protection, categorised as CR, EN, and VU. Furthermore, the ToPS Regulations provide for the prohibition of specific restricted activities involving specific listed threatened or protected species.

No ToPS plant species were recorded during the site survey of the proposed Fibre Optic Project study area. Several mammals, avifauna and one amphibian ToPs species are listed for the region (see Section 6.4).

4.3.3 Alien and Invasive Species

The Alien and Invasive Species Regulations (South Africa, 2014; 2020c) of the NEM:BA provides for the protection of biodiversity through the control and eradication of listed alien and invasive species categorised as follows (South Africa, 2016a):

- Category 1a Listed Invasive Species – must be combatted or eradicated;
- Category 1b Listed Invasive Species – must be controlled or 'contained' in accordance with the requirements of an Invasive Species Management Programme;
- Category 2 Listed Invasive Species – require a permit to carry out a restricted activity e.g. cultivation within an area;
- Category 3 Listed Invasive Species – species that are less-transforming invasive species, but introduction, trade or transportation should be limited. Category 3 plant species are automatically Category 1b species where located within riparian and wetland areas;

- Exempted Alien Species – species that are not regulated; and
- Prohibited Alien Species – species for which a permit for restricted activities (e.g. *inter alia* hunting, gathering, breeding, cultivating, trading, transporting) may not be issued.

Sixteen (16) AIS are listed for the proposed Fibre Optic Project study area, of which ten (10) were recorded during site surveys (see Section 6.4.3 and Box 2).

4.4 National Environmental Management: Protected Areas Act, 57 of 2003

The National Environmental Management: Protected Areas Act (NEM:PAA) (South Africa, 2003) provides for the protection and conservation of ecologically viable areas representative of South Africa's biodiversity and its natural landscapes and seascapes as Protected Areas (PAs), as well as the management of PAs.

Part of the fibre optic cabling is proposed within the eastern section of the Karoo National Park next to the R381 road to traverse the difficult terrain associated with the Molteno Pass. Before any development, construction or farming may be permitted in a national park, nature reserve or world heritage site, prior written approval of the Park management authority is required to go ahead (NEM:PAA S 50 (5)).

Additionally, Section 19 (2) of the NEM:PAA regulations for the proper administration of special nature reserves, national parks and world heritage sites (GN R1061 in Government Gazette 28181) (South Africa, 2005) stipulates that the management authority of a National Park must consider and approve the environmental impact assessment to grant Section 50 (5) approval; and that this must be finalised before submission of the environmental impact assessment (i.e. this report) before submission to the relevant authority for approval (i.e. the DFFE).

Refer to Section 5.7.3 for details on SANParks consultation undertaken thus far and Appendix 13 for the NEM:PAA Section 50 (5) approval granted by the Karoo National Park Management to the proposed Fibre Optic Project.

4.5 National Water Act, 36 of 1998

The NWA (South Africa, 1998b) is concerned with the protection and sustainable management of South Africa's water resources. It stipulates activities or water uses that need to be licenced by the Competent Authority.

Due to several watercourse crossings by the proposed fibre optic cable, including rivers and drainage lines, the following water uses listed in Section 21 of the NWA apply to the proposed Fibre Optic Project:

- S 21 (c): impeding or diverting the flow of water in a watercourse; and
- S 21 (i): altering the bed, banks, course or characteristics of a watercourse;

GN 509 (South Africa, 2016b) makes provision for Section 21 (c) and (i) water uses to be issued a GA, provided that the water use is within the limits and conditions stipulated for GA. This applies specifically, *inter alia*, to water uses that have been determined through a standardised Risk Matrix,

undertaken by a suitably qualified specialist, to be of low risk. A Risk Matrix was undertaken for the proposed Fibre Optic Project (see Appendix 4), and found that the risk of Sections 21 (c) and (i) water uses as it relates to the receiving environment and proposed Fibre Optic Project is **low**. As such, a GA approach was recommended as being an appropriate water use authorisation mechanism. This was accepted by the Competent Authority – Regional Department of Human Settlements, Water and Sanitation (DHSWS) of the Lower Orange Water Management Area (WMA). Water use GA has been obtained for the proposed Fibre Optic Project (see Appendix 19).

4.6 National Heritage Resources Act, 25 of 1999

The National Heritage Resources Act (NHRA) (South Africa, 1999) provides for the identification, assessment, management and conservation of heritage resources in South Africa. Section 38 (8) of the NHRA stipulates that when a Heritage Impact Assessment (HIA) is required in terms of legislation other than the NHRA (in this case the NEMA), the HIA requirements stipulated in S 38 (3) of the NHRA must be fulfilled. The HIA undertaken for the proposed Fibre Optic Project (see Appendix 5) has been completed in accordance to the requirements of the NHRA and the NEMA EIA Regulations.

The Competent Authorities on heritage matters for the proposed Fibre Optic Project is the South African National Heritage Resources Agency (SAHRA) for the Northern Cape section of the fibre optic cable, and Heritage Western Cape (HWC) for the Western Cape section of the fibre optic cable.

4.7 Provincial Nature Conservation legislation

4.7.1 Northern Cape Nature Conservation Act, 9 of 2009

The Northern Cape Nature Conservation Act (NCNCA) (Northern Cape Province, 2009) provides for the sustainable use of biodiversity, the implementation of CITES, and the issuing of related permits and authorisations in the Northern Cape.

Sections 49 to 51 of the NCNCA stipulates that no person may pick specially protected or protected plants (listed in Schedules 1 and 2) without a permit. The definition of “pick” includes to collect, to cut, to chop off, to take, to gather, to pluck, to uproot, to break, to damage or to destroy.

During the site survey of the proposed Fibre Optic Project study area five (05) specially protected plant species and ninety (90) protected plant species were recorded (see Appendix 2). As such protected species permits are required and are being sought for the proposed Fibre Optic Project.

4.7.2 Western Cape Nature and Environmental Conservation Ordinance, 19 of 1974 (as amended)

The Western Cape Nature and Environmental Conservation Ordinance (WCNECO) (Province of the Cape of Good Hope, 1974), as amended by the Western Cape Nature Conservation Laws Amendment Act, 3 of 2000 (Western Cape Province, 2000), provides for the sustainable use of biodiversity, the implementation of the CITES, and the issuing of related permits and authorisations in the Western Cape.

In terms of Section 63 the WCNECO no person may pick endangered or protected plants (listed in Schedules 3 and 4) without a permit.

During the site survey of the proposed Fibre Optic Project study area fifty-eight (58) protected plant species were recorded (see Appendix 2). As such protected species permits are required and are being sought for the proposed Fibre Optic Project.

CHAPTER 5 BASIC ASSESSMENT APPROACH

This BA is conducted per the requirements of the NEMA EIA Regulations, 2014, as amended, and meets the reporting requirements for BA processes (see Table 5).

The abovementioned information is collated in this BAR and considered by the Competent Authority to make an informed decision on an EA Application.

Table 5: Summary of where the requirements of Appendix 1 of the NEMA EIA Regulations, 2014, as amended (GN R326), are met in this Basic Assessment Report.

Appendix 1	**BAR reference**
Objective of the basic assessment process	
2. The objective of the basic assessment process is to, through a consultative process-	Section 5.7 Section 5.6
(a) determine the policy and legislative context within which the proposed activity is located and how the activity complies with and responds to the policy and legislative context;	CHAPTER 4
(b) identify the alternatives considered, including the activity, location, and technology alternatives;	CHAPTER 3
(c) describe the need and desirability of the proposed alternatives;	Section 1.3
(d) through the undertaking of an impact and risk assessment process inclusive of cumulative impacts which focused on determining the geographical, physical, biological, social, economic, heritage, and cultural sensitivity of the sites and locations within sites and the risk of impact of the proposed activity and technology alternatives on these aspects to determine-	CHAPTER 8
(i) the nature, significance, consequence, extent, duration, and probability of the impacts occurring to; and	
(ii) the degree to which these impacts-	
(aa) can be reversed;	
(bb) may cause irreplaceable loss of resources; and	
(cc) can be avoided, managed or mitigated; and	
(e) through a ranking of the site sensitivities and possible impacts the activity and technology alternatives will impose on the sites and location identified through the life of the activity to-	CHAPTER 7
(i) identify and motivate a preferred site, activity and technology alternative;	CHAPTER 3
(ii) identify suitable measures to avoid, manage or mitigate identified impacts; and	CHAPTER 8 Part B: EMPr
(iii) identify residual risks that need to be managed and monitored.	
Scope of assessment and content of basic assessment reports	
3) (1) A basic assessment report must contain the information that is necessary for the competent authority to consider and come to a decision on the application, and must include: (a) details of: (i) the EAP who prepared the report; and	Section 5.2
(ii) the expertise of the EAP, including a curriculum vitae;	Appendix 14
(b) the location of the activity, including:	CHAPTER 2
(i) the 21-digit Surveyor General code of each cadastral land parcel;	Appendix 7
(ii) where available, the physical address and farm name;	
(iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;	
(c) a plan which locates the proposed activity or activities applied for as well as associated structures and infrastructure at an appropriate scale; or, if it is-	N/A
(i) a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or	Appendix 7
(ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken;	N/A
(d) a description of the scope of the proposed activity, including all listed and specified activities triggered and being applied for; and a description of the activities to be undertaken including associated structures and infrastructure;	CHAPTER 2 Section 4.3
(e) a description of the policy and legislative context within which the development is proposed including-	CHAPTER 4

Appendix 1	**BAR reference**
(i) an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks, and instruments that are applicable to this activity and have been considered in the preparation of the report; and	Section 1.3.2 CHAPTER 4 CHAPTER 6
(ii) how the proposed activity complies with and responds to the legislation and policy context, plans, guidelines, tools frameworks, and instruments;	Section 1.3.2 CHAPTER 6
(f) a motivation for the need and desirability for the proposed development including the need and desirability of the activity in the context of the preferred location;	Section 1.3
(g) a motivation for the preferred site, activity and technology alternative;	CHAPTER 3
(h) A full description of the process followed to reach the proposed preferred alternative within the site, including -	
(i) details of all the alternatives considered;	
(ii) details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs;	Section 5.6 Appendix 15 Appendix 16
(iii) a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them;	Section 5.6.3 (to be added after the 30-day public commenting period). Section 5.7 summarises authority consultation to date.
(iv) the environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	CHAPTER 6 CHAPTER 7
(v) the impacts and risks identified for each alternative, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated;	CHAPTER 8
(vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives;	Section 5.5
(vii) positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	CHAPTER 3
(viii) the possible mitigation measures that could be applied and level of residual risk;	CHAPTER 8
(ix) the outcome of the site selection matrix;	Section 3.2
(x) if no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such; and	CHAPTER 3
(xi) a concluding statement indicating the preferred alternatives, including preferred location of the activity.	CHAPTER 3
(i) a full description of the process undertaken to identify, assess and rank the impacts the activity will impose on the preferred location through the life of the activity, including-	Section 5.5
(i) a description of all environmental issues and risks that were identified during the environmental impact assessment process; and	CHAPTER 8
(ii) an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures;	
(j) an assessment of each identified potentially significant impact and risk, including-	
(i) cumulative impacts;	
(ii) the nature, significance and consequences of the impact and risk;	
(iii) the extent and duration of the impact and risk;	
(iv) the probability of the impact and risk occurring;	
(v) the degree to which the impact and risk can be reversed;	
(vi) the degree to which the impact and risk may cause irreplaceable loss of resources; and	

Appendix 1	BAR reference
(vii) the degree to which the impact and risk can be avoided, managed or mitigated;	
(k) where applicable, a summary of the findings and impact management measures identified in any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final report;	CHAPTER 6 CHAPTER 7 CHAPTER 8
(l) an environmental impact statement which contains-	CHAPTER 9
(i) a summary of the key findings of the environmental impact assessment;	CHAPTER 8
(ii) a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers; and	CHAPTER 7
(iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives;	CHAPTER 8
(m) based on the assessment, and where applicable, impact management measures from specialist reports, the recording of the proposed impact management outcomes for the development for inclusion in the EMPr;	Part B: EMPr
(n) any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation;	CHAPTER 9
(o) a description of any assumptions, uncertainties, and gaps in knowledge which relate to the assessment and mitigation measures proposed;	Section 5.3 Appendix 2 Appendix 3 Appendix 5 Appendix 6
(p) a reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;	CHAPTER 9
(q) where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required, the date on which the activity will be concluded, and the post construction monitoring requirements finalised;	CHAPTER 9
(r) an undertaking under oath or affirmation by the EAP in relation to -	Appendix 14
(i) the correctness of the information provided in the reports;	
(ii) the inclusion of comments and inputs from stakeholders and l&APs;	
(iii) the inclusion of inputs and recommendations from the specialist reports where relevant; and	
(iv) any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested and affected parties; and	
(s) where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;	N/A
(t) any specific information that may be required by the competent authority; and	None thus far
(u) any other matters required in terms of section 24(4)(a) and (b) of the Act.	N/A
2) Where a government notice *gazetted* by the Minister provides for the basic assessment process to be followed, the requirements as indicated in such a notice will apply.	Section 5.4 Screening Tool Report - Appendix 11

5.1 Competent Authorities

5.1.1 Environmental Authorisation

The Competent Authority has been identified and confirmed as the National Department of Forestry, Fisheries and the Environment (DFFE) in terms of Section 24C (2) of the NEMA since the proposed Fibre Optic Project:

- S24C (2) (c): has a development footprint that falls within the boundaries of more than one province or traverses international boundaries;

- S24C (2) (d) (iii): is undertaken, or is to be undertaken, by — a statutory body, excluding any municipality, performing an exclusive competence of the national sphere of government; and
- S24 (2) (e): will take place within a national proclaimed protected area or other conservation area under control of a national authority.

5.1.2 Water Use General Authorisation

The Competent Authority for the water use GA is the Regional DWS responsible for the Lower Orange WMA. The proposed Fibre Optic Project entails multiple watercourse (rivers and associated wetlands) crossings in the Lower Orange WMA (155 km) and Gouritz WMA (27 km). Since the majority of the proposed Fibre Optic Project is located within the Lower Orange WMA, the regional DWS has accepted responsibility as the Competent Authority and has issued a GA for the Project (see Appendix 19).

5.2 Project team

In accordance with Regulation 12 (1) of the NEMA EIA Regulations, 2014, as amended, the Applicant (SANReN) appointed CSIR EMS to undertake the required BA process. CSIR EMS as the EAP has no vested interest (either business, financial, personal or other) in the proposed Fibre Optic Project proceeding, other than remuneration for the work performed. However, since CSIR is the parent organisation of SANReN (i.e. the Applicant and the EAP are both associated with the CSIR), an independent peer-review EAP was appointed in accordance with Regulation 13 of the NEMA EIA Regulations:

- Regulation 13 (1) (a): An EAP and a specialist, appointed in terms of regulation 12(1) or 12(2), must be independent;
- Regulation 13 (2) In the event where the EAP or specialist does not comply with subregulation (1)(a), the proponent or applicant must, before conducting public participation as contemplated in chapter 6 of these Regulations, appoint another EAP or specialist to externally review all work undertaken by the EAP or specialist, at the applicant's cost.
- Regulation 13 (3) An EAP or specialist appointed to externally review the work of an EAP or specialist as contemplated in subregulation (2), must comply with subregulation (1)(a).

The peer review EAP has reviewed all documents produced in preparation of this draft BAR (see Appendix 12). A peer-review report outlining whether the BA has been conducted in an objective and independent manner, as well as whether the NEMA EIA requirements were satisfactorily met, will be submitted to the Competent Authority together with the Final BAR.

The project team, including specialists and peer-review EAP, is indicated in Table 6. Refer to Appendix 14 for EAP and peer-reviewer curricula vitae, and declaration of interest. Appendix 2, 3, 5 and 6 contains specialist curricula vitae.

Table 6: Basic Assessment project team.

Name	Organisation	Role
Luanita Snyman-van der Walt* SACNASP registered - Pr.Sci.Nat. 400128/16	CSIR EMS	EAP, Project Manager, Lead BAR author
Paul Lochner EAPASA registered - Pr. EAP 2019/745	CSIR EMS	EAP, Project Leader, quality control
Edward Perry* EAPASA registered – Pr. EAP 2019/1210	SLR Consulting SA	Peer-review EAP

Name	Organisation	Role
Dr. Noel van Rooyen SACNASP registered - Pr.Sci.Nat. 401430/83	Ekotrust cc	Terrestrial ecology, biodiversity and species specialist
Prof. Gretel van Rooyen		
Dr. Brian Colloty SACNASP registered - Pr. Sci. Nat. 400268/07	EnviroSci Pty Ltd	Aquatic ecology, biodiversity and species specialist
Jenna Lavin	CTS Heritage	Heritage and archaeology specialist
Dewald Wilken		Palaeontology specialist
Quinton Lawson SACAP registered - 3686	Quinton Lawson Architect (QARC)	Visual Impact Assessment specialist
Bernard Oberholzer SACLAP registered - 87018	Bernard Oberholzer Landscape Architect (BOLA)	
Shawn Johnston PRISA CPRP	Sustainable Futures ZA	Public engagement specialist
EAPASA: Environmental Assessment Practitioners Association of South Africa; SACNASP: South African Council for Natural and Scientific Professions; SACAP: South African Council for the Architectural Profession; SACLAP: South African Council for the Landscape Architectural Profession; PRISA CPRP: Public Relations Institute of Southern Africa Chartered Public Relations Practitioner. ** See Appendix 14 for curricula vitae.*		

5.3 Assumptions and limitations

This BA assumes that correct and relevant project description information was provided by the Applicant to the EAP and specialists to complete the BA process and conduct the assessment.

Further assumptions and limitations specific to each specialist assessment are provided in Appendix 2, 3, 5 and 6.

5.4 Specialist assessments

Nine (09) specialist studies were identified by the Screening Tool as potentially relevant to the BA of the proposed Fibre Optic Project based on the sector classification of "Any activities within or close to a watercourse" (Table 7). The Screening Tool Report notes that it is the responsibility of the EAP to confirm this list and to motivate in the BA Report, the reason for not including any of the identified specialist studies.

Table 7: Specialist assessments recommended by the Screening Tool for the proposed Fibre Optic Project based on the sector classification of "Any activities within or close to a watercourse".

No.	Specialist assessment identified by the Screening Tool	Undertaken as part of the BA	Assessment reporting requirement	BAR reference
1	Landscape/Visual Impact Assessment	Yes	Protocol GN 320 – Part A: Site Sensitivity Verification and Appendix 6 of the NEMA EIA regulations, 2014, as amended.	Appendix 6
2	Archaeological and Cultural Heritage Impact Assessment	Yes	Protocol GN 320 – Part A: Site Sensitivity Verification and Appendix 6 of the NEMA EIA regulations, 2014, as amended.	Appendix 5
3	Palaeontology Impact Assessment	Yes	Protocol GN 320 – Part A: Site Sensitivity Verification and	Appendix 5

No.	Specialist assessment identified by the Screening Tool	Undertaken as part of the BA	Assessment reporting requirement	BAR reference
			Appendix 6 of the NEMA EIA regulations, as amended; S38(8) of the NHRA.	
4	Terrestrial Biodiversity Impact Assessment	Yes	Terrestrial biodiversity protocol (GN 320, 20 March 2020)	Appendix 2
5	Aquatic Biodiversity Impact Assessment	Yes	Aquatic Biodiversity Protocol (GN 320, 20 March 2020)	Appendix 3
6	Hydrology Assessment	Yes, integrated with the Aquatic Ecology, Biodiversity and Species specialist assessment	Aquatic Biodiversity Protocol (GN 320, 20 March 2020)	Appendix 3
7	Socio-Economic Assessment	No	**Motivation for exclusion:** No significant negative socio-economic impacts are expected from the construction and operation of the proposed Fibre Optic Project. Furthermore, direct socio-economic benefits (e.g. job creation) will be short-term and limited. Socio-economics are thus not considered as a critical issue in need of impact assessment. See Box 1, Section 6. Generic relevant socio-economic management actions are include in Part B: EMPr.	
8	Plant Species Assessment	Yes, integrated with the Terrestrial and Aquatic Ecology, Biodiversity and Species specialist assessments	Terrestrial biodiversity protocol (GN 320, 20 March 2020); Aquatic Biodiversity Protocol (GN 320, 20 March 2020). *No species-specific protocols published for implementation at the time of undertaking the terrestrial and aquatic biodiversity and ecology assessments.*	Appendix 2; Appendix 3
9	Animal Species Assessment	Yes, integrated with the Terrestrial and Aquatic Ecology, Biodiversity and Species specialist assessments	Terrestrial biodiversity protocol (GN 320, 20 March 2020); Aquatic Biodiversity Protocol (GN 320, 20 March 2020). *No species-specific protocols published for implementation at the time of undertaking the terrestrial and aquatic biodiversity and ecology assessments.*	Appendix 2; Appendix 3

5.5 Impact assessment methodology

The impact assessment methodology considered the following aspects:

- Nature, significance and consequences of the impact and risk;
- Extent and duration of the impact and risk;
- Probability of the impact occurring;
- Degree to which impacts and risks can be mitigated;
- Degree to which the impacts and risks can be reversed; and
- Degree to which the impacts and risks can cause loss of irreplaceable resources.

The following methodology is applied to the prediction and assessment of impacts and risks (DEAT, 2006). Potential impacts and risks have been rated in terms of direct, indirect and cumulative impacts:

- Direct impacts are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.
- Indirect impacts of an activity are indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.
- Cumulative impacts are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.

The impact assessment methodology includes the following aspects:

- Nature of impact/risk - The type of effect that a proposed activity will have on the environment.
- Status - Whether the impact/risk on the overall environment will be:
    - Positive - environment overall will benefit from the impact/risk;
    - Negative - environment overall will be adversely affected by the impact/risk; or
    - Neutral - environment overall not be affected.
- Spatial extent – The size of the area that will be affected by the impact/risk:
    - Site specific;
    - Local (<10 km from site);
    - Regional (<100 km of site);
    - National; or
    - International (e.g. Greenhouse Gas emissions or migrant birds).
- Duration – The timeframe during which the impact/risk will be experienced:
    - Very short term (instantaneous);
    - Short-term (less than 1 year);
    - Medium term (1 to 10 years);
    - Long-term (the impact will cease after the operational life of the activity (i.e. the impact or risk will occur for the project duration)); or
    - Permanent (mitigation will not occur in such a way or in such a time span that the impact can be considered transient (i.e. the impact will occur beyond the project decommissioning)).
- Reversibility of the Impacts - the extent to which the impacts/risks are reversible assuming that the project has reached the end of its life cycle (decommissioning phase):
    - High reversibility of impacts (impact is highly reversible at end of project life i.e. this is the most favourable assessment for the environment);
    - Moderate reversibility of impacts;
    - Low reversibility of impacts; or
    - Impacts are non-reversible (impact is permanent, i.e. this is the least favourable assessment for the environment).
- Irreplaceability of Receiving Environment/Resource Loss caused by impacts/risks – the degree to which the impact causes irreplaceable loss of resources assuming that the project has reached the end of its life cycle (decommissioning phase):

  - High irreplaceability of resources (project will destroy unique resources that cannot be replaced, i.e. this is the least favourable assessment for the environment);
  - Moderate irreplaceability of resources;
  - Low irreplaceability of resources; or
  - Resources are replaceable (the affected resource is easy to replace/rehabilitate, i.e. this is the most favourable assessment for the environment).

Using the criteria above, the impacts have been further assessed in terms of the following:

- Consequence – The anticipated consequence of the risk/impact:
  - Extreme (extreme alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they permanently cease);
  - Severe (severe alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);
  - Substantial (substantial alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);
  - Moderate (notable alteration of natural systems, patterns or processes, i.e. where the environment continues to function but in a modified manner); or
  - Slight (negligible alteration of natural systems, patterns or processes, i.e. where no natural systems/environmental functions, patterns, or processes are affected).

- Probability – The probability of the impact/risk occurring:
  - Extremely unlikely (little to no chance of occurring);
  - Very unlikely (<30% chance of occurring);
  - Unlikely (30-50% chance of occurring)
  - Likely (51 – 90% chance of occurring); or
  - Very Likely (>90% chance of occurring regardless of prevention measures).

To determine the significance of the identified impact/risk, the consequence is multiplied by probability (Figure 13) (e.g. IPCC, 2014).

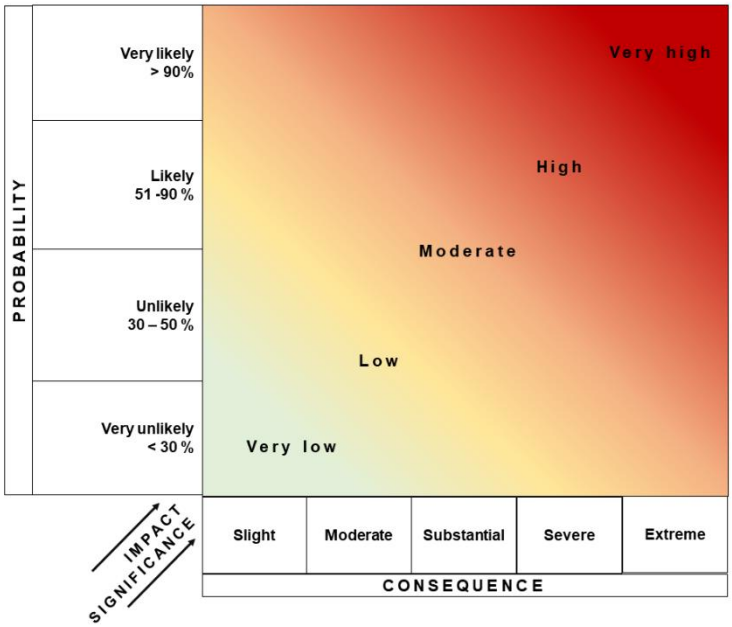


Figure 13: Conceptual guide to qualitatively assessing risk / impact significance as a result of consequence and probability.

- Significance – Will the impact cause a notable alteration of the environment?
    - Very low (the risk/impact may result in very minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);
    - Low (the risk/impact may result in minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);
    - Moderate (the risk/impact will result in moderate alteration of the environment and can be reduced or avoided by implementing the appropriate mitigation measures, and will only have an influence on the decision-making if not mitigated);
    - High (the risk/impact will result in major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making); and
    - Very high (the risk/impact will result in very major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making (i.e. the project cannot be authorised unless major changes to the engineering design are carried out to reduce the significance rating).

With the implementation of mitigation measures, the residual impacts/risks are ranked as follows in terms of significance:

- Very low;
- Low;
- Moderate;
- High; and
- Very high.

Confidence – The degree of confidence in predictions based on available information and specialist knowledge:

- Low;
- Medium; or
- High.

5.6 Public Participation Process

This section provides an overview of the tasks undertaken during the BA, with a particular emphasis on providing a clear record of the Public Participation Process (PPP) followed thus far. The PPP is undertaken in accordance with the PPP requirements set out in Chapter 6 of the NEMA EIA Regulations, 2014, as amended, and the approved public participation plan (see Section 5.6.1 below). Integrated PPP

Proof of the PPP actions taken during the BA process (to date) is included in Appendix 16 of this report.

5.6.1 Public participation plan

On 5 June 2020, the Minister of Forestry, Fisheries and the Environment issued Directions in terms of regulation 4 (10) of the Regulations issued by the Minister of Cooperative Governance and Traditional Affairs in terms of section 27(2) of the Disaster Management Act, 2002 (Act 57 of 2002). These Directions were published in Government Gazette 43412, GN 650 on 5 June 2020, regarding measures to address, prevent and combat the spread of Covid-19 relating to national environmental management permits and licences. Annexure 3 of GN 650 states that an EAP must:

- Prepare a written public participation plan, containing proposals on how the identification of and consultation with all potential Interested and Affected Parties11 (I&APs) will be ensured in accordance with Regulation 41(2)(a) to (d) of the NEMA EIA Regulations, 2014, as amended, or proposed alternative reasonable methods as provided for in regulation 41(2)(e), for purposes of an application and submit such plan to the competent authority. The public participation plan agreed with the competent authority must be annexed to the application form; and
- Request a meeting or pre-application discussion with the competent authority to determine the reasonable measures to be followed to identify potential I&APs and register IA&Ps for purposes of conducting public participation on the application requiring adherence to Chapter 6 of the NEMA EIA Regulations, 2014, as amended as set out in the public participation plan and obtain agreement from the competent authority on the public participation plan.

GN 650 also states that for new applications, the public participation plan agreed with the Competent Authority must be annexed to the EA application form. GN 650 applies to Alert Level 3 and was repealed by GN 970. GN 970, published on 9 September 2020, contains directions regarding measures to address, prevent and combat the spread of COVID-19 relating to national environmental management permits and licences, and it applies for the period of the national state of disaster. However, it is understood that even though GN 650 is repealed, it may be used as a guideline to inform the PPP.

[11] Including the adjacent landowners, Organs of State, stakeholders and the general public.

A public participation plan (Appendix 15) was submitted and accepted by the DFFE (see Appendix 17). PPP was subsequently carried out in accordance with the plan (Figure 14).

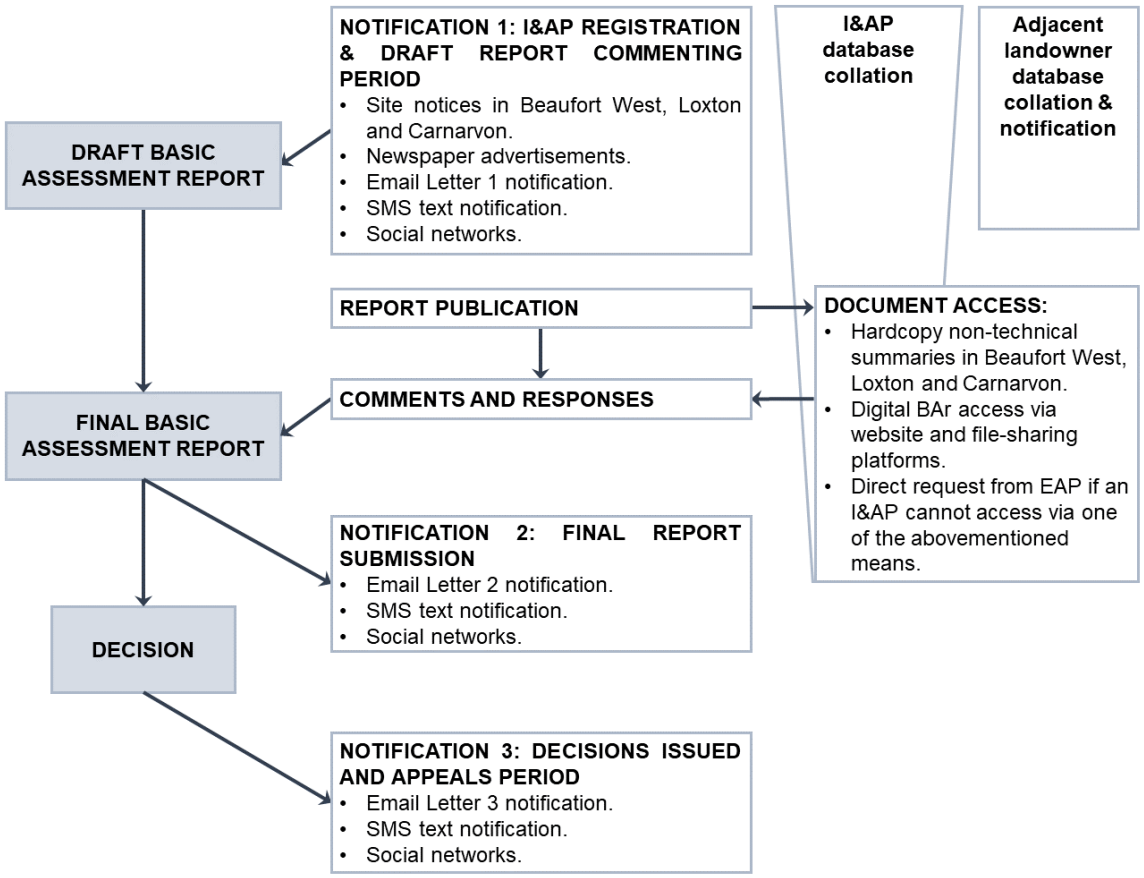


Figure 14: Public Participation Process undertaken for the proposed Fibre Optic Project.

5.6.2 Notification 1: EA application submission, BA process initiation and 30-day commenting period

Notification of all I&APs (including adjacent land owners and authorities) of:

- Submission of the EA application to the Competent Authority (DFFE),
- The BA and GA processes,
- Invitation to register as an I&AP, and / or indicate other relevant I&APs; and
- The opportunity to comment on the draft BAR (incl. GA aspects) during the 30-day commenting period.

This draft BAR is currently published for a 30-day commenting period to allow I&APs to register their interest in the proposed Fibre Optic Project (if not already included in the database) and submit comments on the contents of this report.

The following PPP activities were undertaken to notify I&APs of the EA application submission, BA process initiation and 30-day commenting period:

5.6.2.1 Direct notification

I&APs (including adjacent landowners) included in the I&AP database at the stage of draft BAR publication received a notification letter via email. Where email addresses were not available, letters were sent via post.

Additionally, SMS texts were sent to I&APs on the database, where cell phone numbers were provided / obtainable.

5.6.2.2 Newspaper advertisements

Placement of newspaper advertisements (per Regulation 41 (2) (c) of the 2014 NEMA EIA Regulations (as amended)) in one local and one national newspaper (in English and Afrikaans). Tear sheets will be included as proof in the final BAR.

5.6.2.3 Site notices

Notice boards placed at key roads along which the fibre optic cable will be installed in the towns of Beaufort West, Loxton and Carnarvon, as well as at well-known retail facilities / public spaces within these towns. Photos of site notice board placements will be included in the final BAR.

5.6.2.4 Document Access

In **digital** format, the full Draft BAR with all appendices are available via websites and file-sharing platforms at the following URLs:

- https://www.csir.co.za/environmental-impact-assessment
- https://bit.ly/SKAfibre-PPP

Additionally, **hardcopy non-technical summaries** of the draft BAR were be placed at key locations in the towns of Beaufort West, Loxton and Carnarvon during the 30-day public commenting period.

5.6.2.5 Social networks

Communication with key I&APs such as farmer's associations, and ward councillors / municipal managers to request that they send notifications of the project and report availability and executive summaries via their local social networks (such as WhatsApp groups, Neighbourhood Watch groups, other social media mechanisms etc.). This mechanism relies on the willingness of people to 'spread the word' of the project, and cannot be monitored in detail by the EAP.

5.6.2.6 Comments and responses forms

Comments and responses forms (also to be used by new I&APs to register to the project) were included in direct notification letter, and is also available as an online form:

- https://bit.ly/SKAfibre-IAP

5.6.3 Comments and responses

Comments from I&APs during the 30-day draft BAR public commenting period and associated responses by the EAP, specialists and / or Applicant will be captured here in the Final BAR.

5.6.4 Notification 2: Final report submission to the Competent Authority

Following the 30-day commenting period of the BAR and incorporation of the comments received into the reports, the Final BAR will be submitted to the Competent Authority in line with Regulation 19 (1) (a) NEMA EIA Regulations, 2014, amended).

The reports will be submitted electronically to the DFFE via the Novell S-Filer system, as recommended by the DFFE since June 2020.

In line with best practice, I&APs on the project database will be notified via direct notification mechanisms (i.e. letter email and SMS text) of the submission of the final BAR to the DFFE for decision-making. The final BA Reports will be made available on the project website (https://www.csir.co.za/environmental-impact-assessment) and file-sharing platform (https://bit.ly/SKAfibre-PPP).

The Final BAR that will be submitted for decision-making to the DFFE will include a complete record and proof of the PPP in Appendix 16 of this report.

5.6.5 Notification 3: Decision-making and Appeal Period

Subsequent to the decision-making phase all registered I&APs will receive notification of the decision issued by the Competent Authority and the associated appeal period. The notification will be issued to I&APs within fourteen days of the decision date (as per Regulation 4 (1) of the NEMA EIA Regulations. 2014, as amended) via direct notification (email letter, text SMS, hardcopy letter where email is not available).

If the EA is granted, a copy will be attached to the email notifications and made available on the project website (https://www.csir.co.za/environmental-impact-assessment) and file-sharing platform (https://bit.ly/SKAfibre-PPP).

5.7 Authority consultation to date

Consultation with the DFFE, Regional DWS for the Lower Orange WMA, SANParks (Karoo National Park management) and HWC was undertaken before the publication of the draft BAR (Appendix 17).

5.7.1 DFFE pre-application meetings

Two pre-application meetings with the DFFE were undertaken on 14 October 2020 and 22 April 2021, respectively (Reference number: 2020-10-0001) (Appendix 17). During first pre-application meeting, the peer-review EAP (SLR Consulting SA) was not in attendance. Subsequently, the DFFE required that a second meeting be held with the peer-review EAP present.

Key discussion points during the pre-application meetings included:

- Project description overview;
- Strategic importance of the proposed Fibre Optic Project;
- Applicable Listed Activities and other permits / approvals;
- Specialist assessments;
- Public Participation Process plan; and
- Micro-siting during construction / spatial extent of EA.

5.7.2 Regional DWS for the Lower Orange WMA

The Applicant, EAP and a representative from SKA / SARAO conducted a site visit with a representative of the Competent Authority for the water use GA (Regional DWS for the Lower

Orange WMA) on 17 November 2020. The purpose of the site visit was to drive the entirety of the proposed fibre optic cable route. Nine (09) points of interest (recommended by the aquatic ecology specialist) along the route were inspected. The construction methods at watercourse crossings, as well as the outcomes of NWA Section 21 (c) and (i) water use Risk Assessment matrix undertaken by the aquatic ecology specialist, were discussed with the DWS representative. The site visit acted as a pre-application meeting for the water use authorisation process. The water use licensing approach for the proposed Fibre Optic Project was discussed and confirmed as a GA approach, and subsequently registered as such on the electronic Water Use Licence Application and Authorisation System (e-WULAAS) (Appendix 17). GA for the Project was issued on 26 July 2021 (see Appendix 19)

5.7.3 SANParks

The Karoo National Park Management were consulted at early stages and throughout the BA process. The Applicant and EAP conducted a site visit with representatives of the Karoo National Park management on 18 November 2021. The purpose of the site visit was to drive the proposed Molteno Pass section of the fibre optic cabling on the eastern side of the Karoo National Park and ascertain where the cabling would need to be constructed on Park property. Furthermore, the Karoo National Park Management were provided an opportunity to consider and approve this draft BAR (per Section 19 (2) of the NEM:PAA regulations for the proper administration of national parks (South Africa, 2005), and subsequently provided the proposed Fibre Optic Project with approval in terms of Section 50 (5) of the NEM:PAA (Appendix 13).

5.7.4 Heritage resources authorities

5.7.4.1 Heritage Western Cape

A Notice of the Intent to Develop (NID) and heritage screener report (Appendix 18) was submitted by CTS Heritage to HWC on 07 October 2020, subsequently acknowledged by HWC (17 October 2020) and assigned a case number (20200206SB1006E) (Appendix 17).

HWC requires that applications made in terms of Section 38(3) of the NHRA require consultation with registered conservation bodies. No registered conservation bodies exist in the proposed Fibre Optic Project study area (HWC, 2020). The Beaufort West Municipality was provided with the opportunity to comment on the draft HIA for 30 days (26 January – 28 February 2021) (Appendix 17). No comments on the draft HIA were received from the Beaufort West Municipality during the commenting time.

5.7.4.2 South African Heritage Resources Agency

A case was opened on the online South African Heritage Resources Information System (SAHRIS) and the heritage screener report (Appendix 18) uploaded by CTS Heritage on 02 October 2020 (Case ID 15577). SAHRA acknowledged the application and provided interim comment on 23 October 2020 (Appendix 17).

CHAPTER 6 BASELINE ENVIRONMENTAL DESCRIPTION

6.1 Climate

The proposed Fibre Optic Project study area is situated within the arid Great Karoo region. The climate is relatively consistent throughout the study area, characterised by summer rainfall (less than 250 mm mean annual precipitation) and average maximum temperatures reaching 30°C (Figure 15). The predominant wind direction in Beaufort West alters from the South-East and North-West, and is more variable in the towns of Loxton and Carnarvon, predominantly blowing from South-Easterly and Westerly directions. Wind speeds rarely exceed 28 km/h (Meteoblue, 2021).

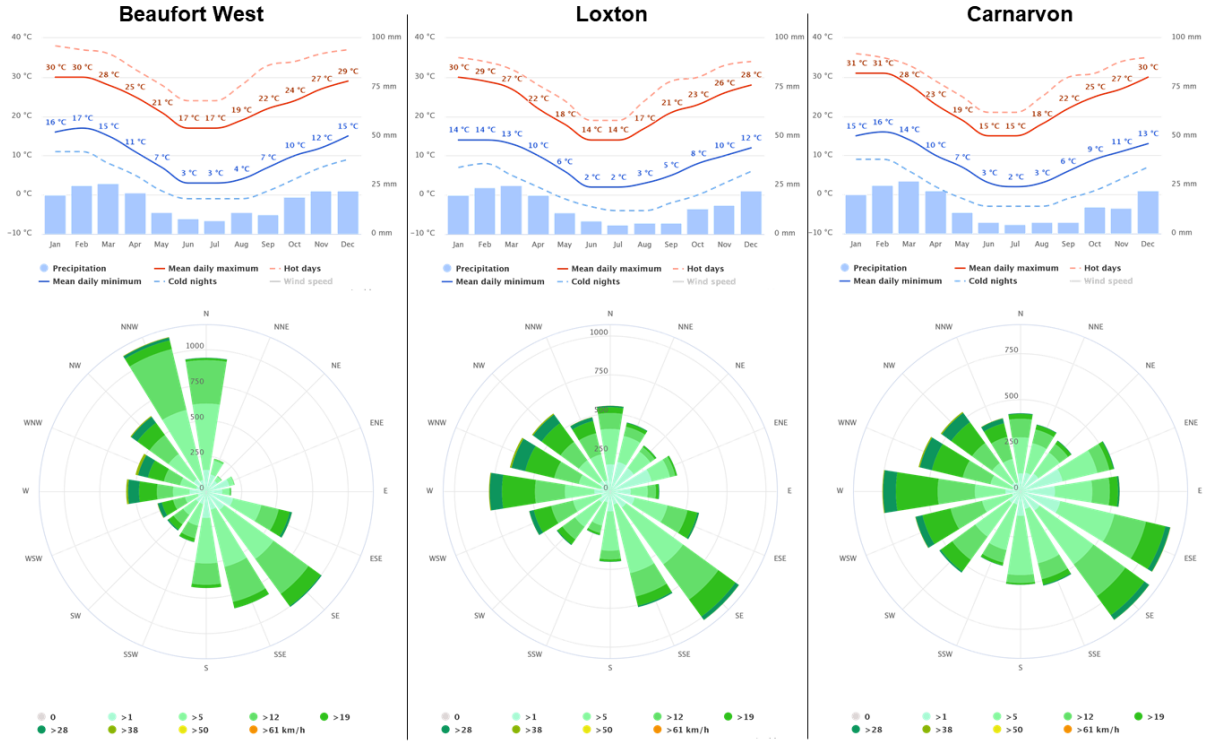


Figure 15: Average monthly temperatures and precipitation (top) and wind (hours per year and direction – "wind roses") (bottom) for the towns of Beaufort West, Loxton and Carnarvon (Meteoblue, 2021).

6.2 Geology, topography and landscape[12]

The proposed Fibre Optic Project study area is predominantly underlain by geological strata from the Beaufort and Ecca groups (CGS, 1979; 1989) (Figure 16, Table 8). The topography of the Great Karoo region is predominantly determined by the geology.

[12] Extracted and / or summarised from CTS Heritage (2020) (see Appendix 5) and Lawson & Oberholzer (2021). (see Appendix 6).

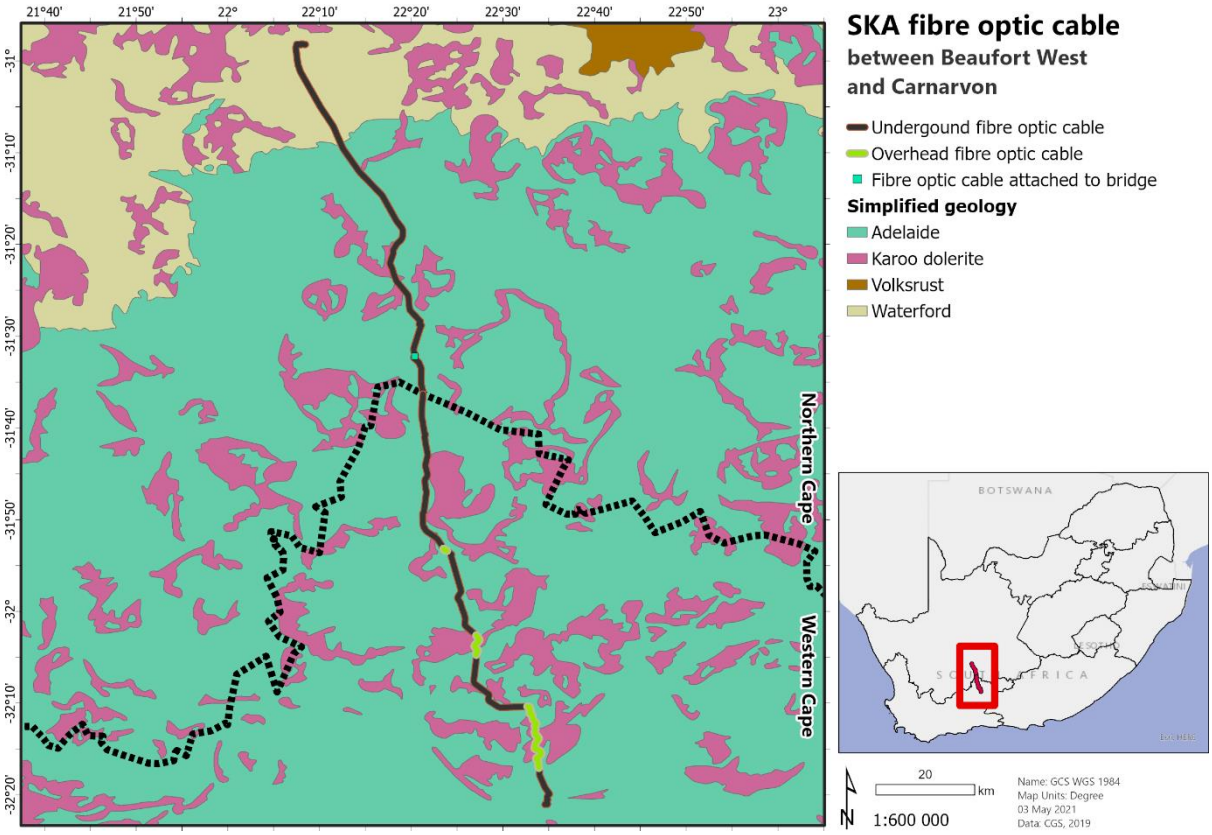


Figure 16: Simplified geology of the proposed Fibre Optic Project study area.

Table 8: Geological strata underlying the proposed Fibre Optic Project study area.

Symbol	Group	Formation	Lithology
Pth	Beaufort, Adelaide Subgroup	Teekloof, Hoedemaker member	Arenaceous sandstone
Ptp	Beaufort, Adelaide Subgroup	Teekloof, Poortjie member	Red Mudstone
Pa	Beaufort, Adelaide Subgroup	Abrahamskraal	Green to blue-grey mudstones
Pc	Ecca	Water Ford (Previously Carnarvon)	Fine grained sandstones and mudrock or clastic rhythmite units
Pt	Ecca	Tierberg	Dark shales, yellow tuffs.
Jd	Jurassic Dolerites	Dolerite	-
Qs	Quaternary Sediment	Sand/Clay/ silt	-

The Great Karoo landscape in the proposed Fibre Optic Project study area has been eroded over time to expose the once deeply buried Beaufort Group mudstones and sandstones and the dolerite intrusions to form the present-day Karoo landscape. The Nuweveld escarpment is characterised by horizontal sills of erosion-resistant dolerite forming steep cliffs, boulder-strewn slopes, and flat-topped *koppies*, as well as the Nuweveld mountain range. The plateau areas consist of more even topography with easily weathered mudstone, and occasional narrow ledges of harder sandstone.

Figure 17 indicates the elevation profile of the fibre optic cable route, following the R381 and R63 roads. The more complex terrain associated with the Molteno, Blounek and Rosenberg passes, thus requiring overhead cabling installation, are indicated.

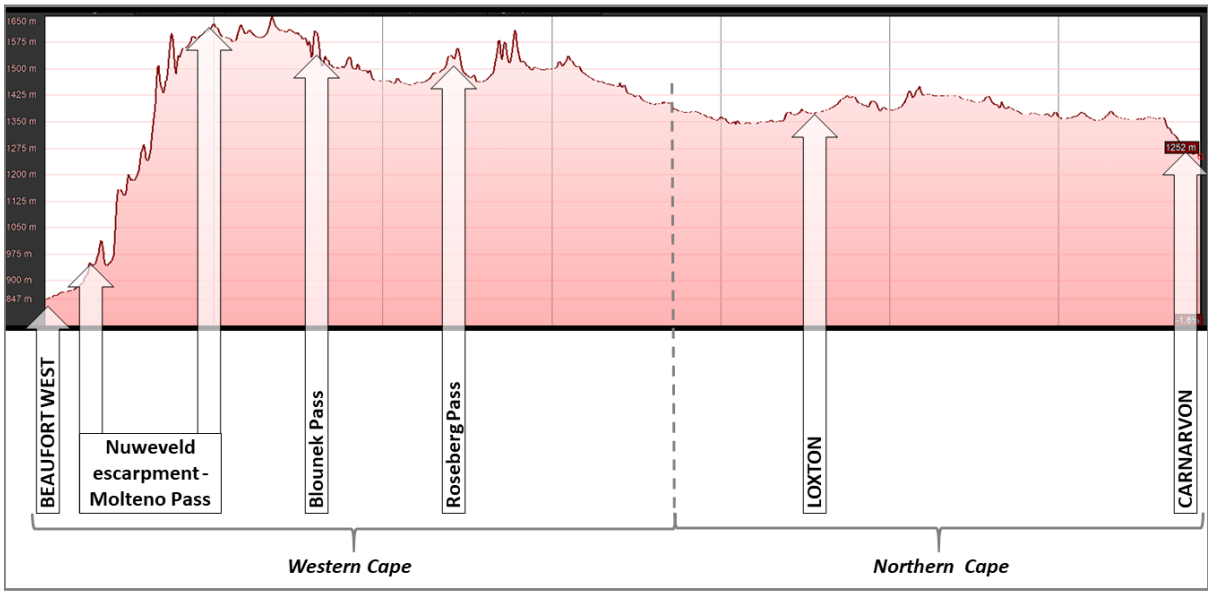


Figure 17: Elevation profile of the proposed Fibre Optic Project study area, indicating the location of Beaufort West, Loxton and Carnarvon, as well as passes where the cabling will be installed overhead, along the route (created with Google Earth Pro™).

6.3 Socio-economic context

The proposed Fibre Optic Project is located in the Western Cape and Northern Cape provinces, encompassing two district and three local municipalities (LMs) (Figure 18). The main towns along the proposed fibre optic cable route is Beaufort West, Loxton and Carnarvon.

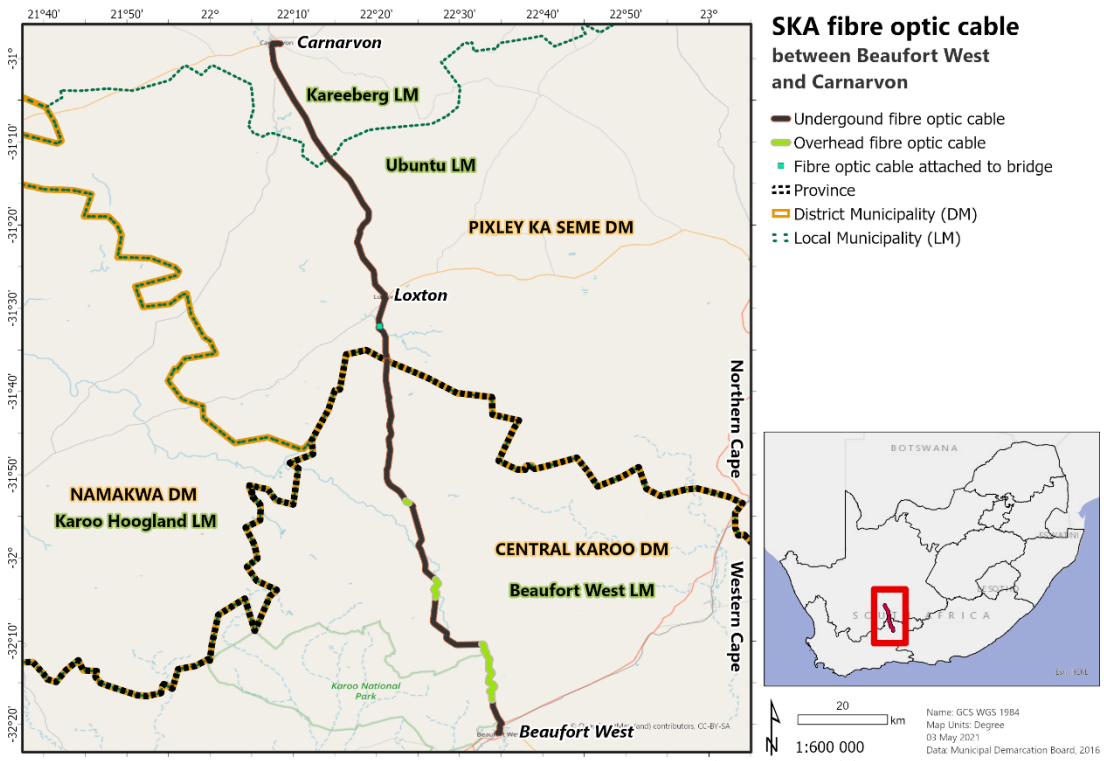


Figure 18: The Fibre Optic Project is located within the Beaufort West Local Municipality (Central Karoo District, Western Cape) and the Ubuntu and Kareeberg Local Municipalities (Pixley ka Seme District, Northern Cape).

Table 9: Socio-economic profile of the Beaufort West, Kareeberg and Ubuntu Local Municipalities in the which Fibre Optic Project is proposed (StatsSA, 2011)

Key statistic	Beaufort West (WC053)	Ubuntu (NC071)	Kareeberg (NC074)
Total population	49 586	18 601	11 673
Young (0-14)	31.5 %	33.3 %	29.4 %
Working Age (15-64)	62.6 %	61.1 %	62.5 %
Elderly (65+)	5.9 %	5.6 %	8.1 %
Dependency ratio	59.7	63.5	59.9
Sex ratio	94.8	98.4	97.2
Growth rate (2001 – 2011)	1.36 %	1.27 %	2.07 %
Population density	2 persons/km^2	1 person/km^2	1 person/km^2
Unemployment rate	25.5 %	29.1 %	25 %
Youth unemployment rate	34.5 %	34.8 %	32.1 %
No schooling aged 20+	10.1 %	16.4 %	18 %
Higher education aged 20+	6.5 %	6 %	5.7 %
Matric aged 20+	23.6 %	18.7 %	17.5 %
Number of households	13 089	5 129	3 222
Number of Agricultural households	1 593	1 490	685
Average household size	3.6	3.5	3.4
Female headed households	37.7 %	34.6 %	33.6 %
Formal dwellings	97.9 %	87.6 %	89.6 %
Housing owned/paying off	60.7 %	54.7 %	51.7 %
Flush toilet connected to sewerage	83.2 %	64.3 %	55.6 %
Weekly refuse removal	83.7 %	66.6 %	70.9 %
Piped water inside dwelling	81.3 %	49.2 %	41.5 %
Electricity for lighting	92 %	84.8 %	73.6 %

Beaufort West is known as a service town and regional economic anchor for the Karoo region, whilst Loxton is classified as a local town / settlement node and Carnarvon as a small service Town and rural service centre (CSIR, 2018). The economy of the proposed Fibre Optic Project study area, at mesozone[13] scale is predominantly reliant on agriculture (especially sheep and game), with economic diversification evident in the towns of Beaufort West, Carnarvon and, to a lesser degree, Loxton (CSIR, 2018) (Figure 19).

Reported socio-economic challenges in the proposed Fibre Optic Project study area include:

- Beaufort West LM (BWLM, 2019):
  - Increasing demand for and costs of electricity;
  - Maintenance of public services and infrastructure, e.g. water and sanitation services and waste management;
  - Road maintenance; and
  - Availability of land and services for expanding human settlement.
- Ubuntu LM (ULM, 2016):
  - Overall reduction in poverty levels;
  - Access to basic services such as water, sanitation, electricity and housing;
  - Access to education, health and social services.
  - Stabilising and decreasing the rate of HIV and AIDS infection, tuberculosis, foetal alcohol syndrome and other diseases;
  - Reduction in the rate of crime;
  - Critical skills shortage of the labour force;

[13] Finer scale spatial unit of socio-economic data for South Africa.

- Targeting special groups, e.g. women, disabled and youth; and
- Sustainable job creation.

- Kareeberg LM (KLM, 2018):
  - Water scarcity;
  - Unemployment, poverty and social ills due to lack of job opportunities and sustainable economic initiatives;
  - Maintenance of public services and infrastructure, e.g. sewerage networks and landfill sites; and
  - Road maintenance.

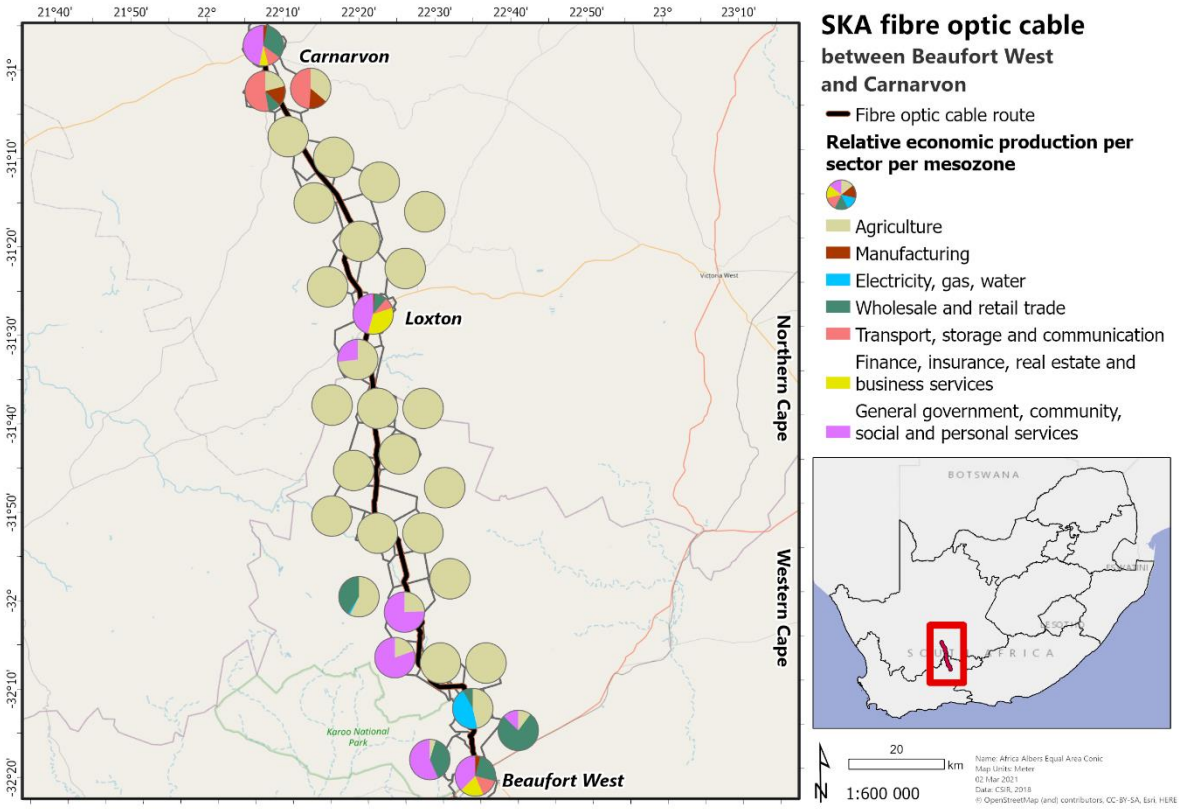


Figure 19: Relative distribution and productivity of the main economic sectors in the proposed Fibre Optic Project Study Area at mesozone scale.

The broader SKA project is recognised as a key large-scale project in the Karoo (DALRRD & SALGA, 2020), an important contribution to the international scientific community (DRDLR & DPME, 2019), promoting education and training in science, engineering and technology (PKSDM, 2014), a geographic hub for investment (PKSDM, 2017; KLM, 2018), and an opportunity for sub-regional tourism linked to the SKA (BWLM, 2013).

Box 1: Socio-economic impact of the proposed Fibre Optic Project

Due to the insignificant direct impact of the proposed Fibre Optic Project on the socio-economics of the study area, a full impact assessment was not included in this BAR. Potential, albeit insignificant / negligible, effects include:

Employment

It is anticipated that approximately 180 part-time job opportunities will be created during the construction phase. The majority will require skilled (construction) workers and contractors, whilst some opportunities may be available for unskilled workers to dig trenches by hand where required (e.g. within towns and at dry watercourse crossings).

Local economies

During the construction phase and, to a lesser extent the operations phase, contractors will require lodging, meals, fuel etc. This will likely increase local expenditure in the towns of Beaufort West, Loxton and Carnarvon, and thus result in a small positive impact on the towns' local economies.

Competing land uses – agriculture

The main land use and economic sector in the proposed Fibre Optic Project study area is agriculture. The fibre optic cable will predominantly be constructed within the road reserve (i.e. between the road surface and the fence line of any adjacent property) where no agriculture is actively practiced or likely to be practiced in the future. Where cabling is installed overhead at between 7.5 and 9 m height, agricultural practices will be able to continue undeterred. As such, the proposed fibre optic cable poses negligible risk to agricultural resources, and thus the agricultural economy of the region. However, aspects such as the control of erosion and invasive alien plants, which could have secondary and farther reaching consequences for agricultural resources, are addressed in the EMPr.

Competing land uses – conservation and tourism

The section traversing the Molteno pass in the Karoo National Park will be installed overhead so as to traverse the difficult and complex terrain of this area. The cabling will follow the existing linear infrastructure in the area (Eskom 22 kV distribution powerline and abandoned telephone lines) and will not be visible from the Karoo National Park hospitality accommodation, and is therefore not expected to deter visitors and result in economic decline of the hospitality function of the Park. The overhead cabling will be visible to people driving the scenic Molteno pass, but is not expected to actively deter any tourists driving the pass for its scenic value (refer to the VIA, Appendix 6, for more information).

6.4 Terrestrial ecology, biodiversity and species [14]

6.4.1 Vegetation and habitat types

The proposed Fibre Optic Project is located in the Nama Karoo Biome and more specifically in the Upper Karoo Bioregion (NKu) from north of Beaufort West to Carnarvon. The plains around Beaufort West in the south lie in the Lower Karoo Bioregion (NKl). Six broad-scale vegetation types occur along the route (Figure 20): Gamka Karoo (NKl 1); Western Upper Karoo (NKu 1); Upper Karoo Hardeveld (NKu 2); Northern Upper Karoo (NKu 3); Eastern Upper Karoo (NKu 4); and Southern Karoo Riviere (AZi 6), all of which are listed as Least Threatened (LT) (South Africa, 2011; SANBI, 2018).

[14] Extracted and / or summarised from Ekotrust (2020) (see Appendix 2).

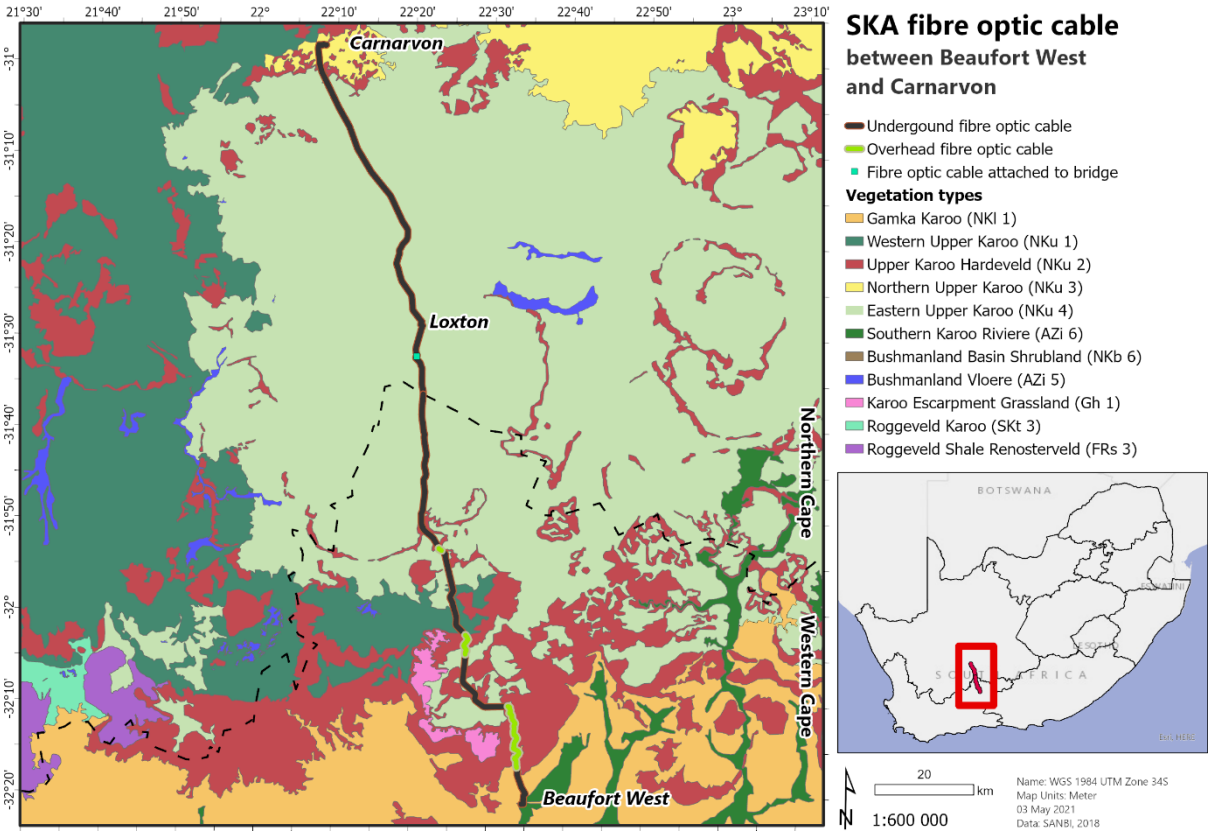


Figure 20: Vegetation types found in the proposed Fibre Optic Project study area.

Based on the topography of the area, the following habitat types can be distinguished along the route (Figure 21):

- Drainage lines (watercourses: channels, streams, rivers) and their associated banks[15]
- Bottomlands on the plains (broad floodplains, leegtes, vloere)[10];
- Plains;
- Valleys in the mountains (bottomlands or valley floors);
- Low hills;
- Footslopes of koppies and mountains;
- Midslopes of mountains, usually steep;
- Plateaux in the mountains; and
- Mountains often comprising a mixture of upper slopes, scarps and crests.

[15] Also see Section 6.5 and Appendix 3.

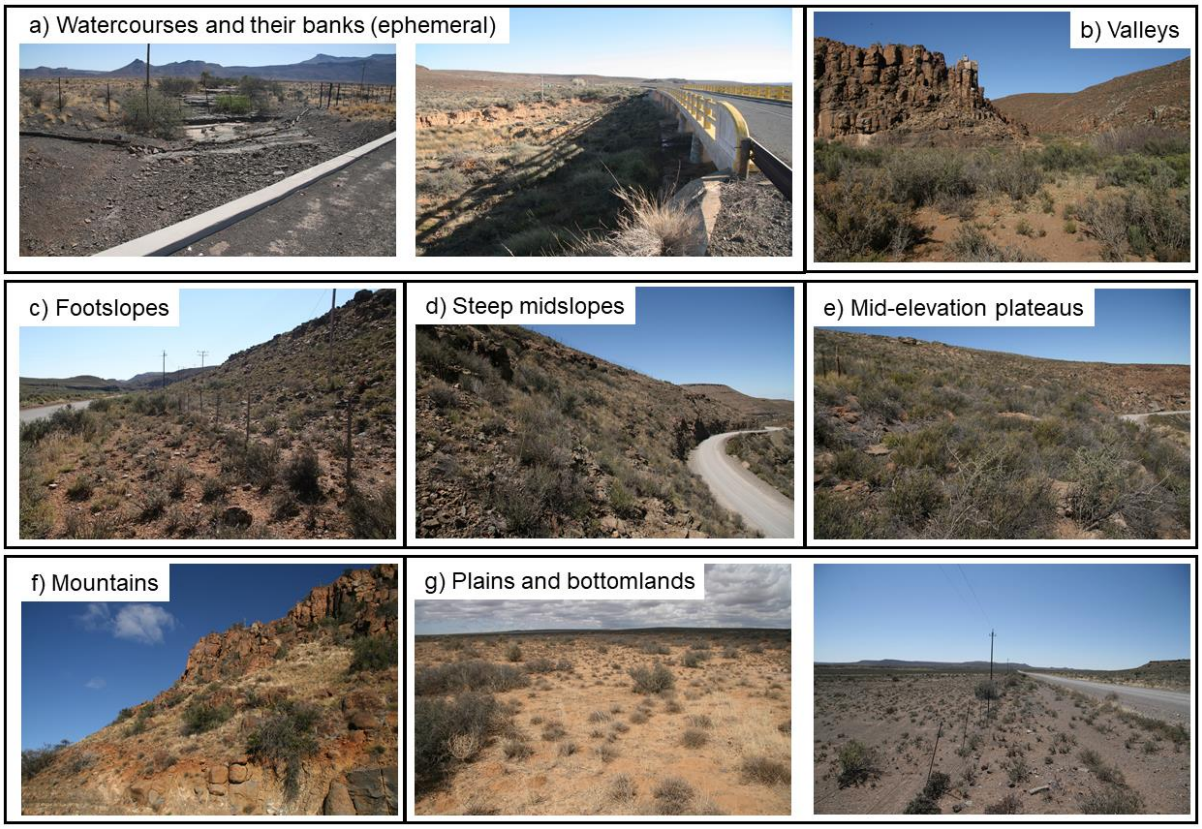


Figure 21: Main terrestrial habitat types of the proposed Fibre Optic Project study area: a) watercourses and their banks (ephemeral); b) valleys; c) footslopes; d) steep midslopes; e) mid-elevation plateaus; f) mountains; and g) plains and bottomlands. Photo: Ekotrust, 2020.

6.4.2 Ecological drivers, processes and function

Ecological processes in the Karoo region operate at extensive spatial scales. It is unlikely that the construction and operation of the fibre optic cable will contribute to the disruption of these broad-scale ecological processes such as dispersal, migration or the ability of fauna to respond to fluctuations in climate or other conditions.

Road reserves often act as conduits for AIS and the disturbance caused by the construction of the fibre optic cable will inevitably create conditions favourable for further invasion by AIS. Although the level of infestation along the route was observed during the field surveys to be fairly low, an alien invasive plant species monitoring and control programme, nevertheless, needs to be initiated to control AIS (see Part B: EMPr).

Fire in this arid part of the Nama-Karoo is rare as a result of the high grazing pressure and variable rainfall and not considered as an important driver of vegetation dynamics.

6.4.3 Flora

During the field surveys Ekotrust (2020) recorded 356 plant species. Combined, the New Plants of Southern Africa (NewPosa) list and the list for the current study yielded 854 species, which could potentially occur in the environments of the fibre-optic route. None of the red list threatened species which could occur in the study area were recorded during the site survey.

Box 2: Terrestrial plant species overview

- Number of plant species known to occur – **854** (**356 recorded)**
- Western Cape Schedule 4 protected species recorded – **58 species** (mostly Aizonaceae)
- Northern Cape Schedule 1 specially protected species recorded – **5 species**
- Northern Cape Schedule 2 protected species recorded – **90 species** (mostly Aizoaceae or Crassulaceae)
- ToPS recorded – **none**
- CITES listed species recorded - **13 species**
- CITES Appendix II species recorded – **21 species** (mostly *Anacmpseros, Aloe* and *Euphorbia* species)
- AIS recorded – **10 species**
  1. *Atriplex lindleyi* subsp*. inflata*
  2. *Atriplex nummularia*
  3. *Salsola kali*
  4. *Cirsium vulgare*
  5. *Opuntia ficus-indica*
  6. *Prosopis glandulosa*
  7. *Argemone ochroleuca*
  8. *Pinus* sp
  9. *Pennisetum setaceum*
  10. *Populus alba*
- Identified plant Species of Conservation Concern (SCCs) – **15** (Note: none are IUCN red-listed)
  11. *Aloe* spp*.*
  12. *Anacampseros albidiflora*
  13. *Anacampseros cf. lanceolata*
  14. *Anacampseros ustulata*
  15. *Aristaloe aristata*
  16. *Euphorbia clavarioides*
  17. *Gonialoe variegate*
  18. *Huernia barbata*
  19. *Lessertia frutescens*
  20. *Mesembryanthemum emarcidum*
  21. *Pachypodium succulentum*
  22. *Stapelia grandiflora*
  23. *Stomatium difforme*
  24. *Stomatium suaveolens* (endemic)
  25. *Stomatium villetii*

Note: rare plant species usually occur in specialised and localised habitats which are often destroyed by road building. Sightings of rare plant species were therefore unlikely during the site survey.

Appendix 2 contains full species lists.

6.4.4 Fauna

Very few animal species were observed during the site survey, however, various databases and other literature sources were consulted to determine the diversity, conservation status and distribution of mammal, reptile, avifauna, frog, arachnid and insect species that are known to occur in the proposed Fibre Optic Project study area.

Notably, the CR riverine rabbit is known to occur in the region, specifically in the area south of Loxton around the Sak and Brak Rivers. The riverine rabbit is associated with dense, discontinuous vegetation fringing the seasonal rivers of the central Karoo. In general, the habitat in the road reserve and at stream crossings in the proposed Fibre Optic Project study area has been found to not be suitable habitat for the riverine rabbit due to previous disturbance during road building[16]. Additionally, traffic and other activities would deter them from making burrows in the road reserve.

Box 3: Terrestrial animal species overview

- Number of mammal species known to occur – **82 species (9 observed)**
  - Mammal SCCs:
    1. Riverine rabbit — *Bunolagus monticularis* — CR
    2. Mountain reedbuck — *Redunca fulvorufula fulvorufula* — EN
    3. Black-footed cat — *Felis nigripes* — VU
- Number of reptile species known to occur – **57 species (3 observed)**
  - Reptile SCCs:
    1. Karoo dwarf tortoise (endemic) — *Chersobius boulengeri* — EN
- Number of frog species known to occur – **14 species (none observed)**
  - Frog SCCs:
    1. Giant bull frog (protected) — *Pyxicephalus adspersus* — NT
- Number of avifauna species known to occur – **626 species (7 observed)**
  - Avifauna SCCs:
    1. Black harrier — *Circus maurus* — EN
    2. Yellow-billed stork — *Mycteria ibis* — EN
    3. Ludwig's bustard — *Neotis ludwigii* — EN
    4. Martial eagle — *Polemaetus bellicosus* — EN
    5. Southern black korhaan — *Afrotis afra* — VU
    6. Verreaux's eagle — *Aquila verreauxii* — VU
    7. Black stork — *Ciconia nigra* — VU
    8. Burchell's courser — *Cursorius rufus* — VU
    9. Lanner falcon — *Falco biarmicus* — VU
    10. Secretarybird — *Sagittarius serpentarius* — VU
- Number of butterfly and moth species known to occur – **139 species (none observed)**
  - Butterfly SCCs:
    1. Speckled orange — *Acanthovalva focularia* — NT
    2. - — *Anthemoctena textilis* — NT
    3. - — *Drepanogynis bifasciata* — NT
    4. - — *Drepanogynis tripartita* — NT
    5. - — *Eulycia grisea grisea* — NT
    6. - — *Isturgia deerraria* — NT
    7. - — *Rhodometra participata* — NT
    8. - — *Rhodometra sacraria* — NT
- Number of dragonfly and damselfly species known to occur - **22 species (none observed)**

Appendix 2 contains full species lists.

[16] Note that no trapping (either camera trapping or by way of Sherman traps) was conducted for fauna during the terrestrial ecology field survey. These methods generally provide an underrepresentation of the full faunal diversity within the limited timeframes available to conduct the survey (Ekotrust, 2020). Furthermore, additional camera trap data would not change the outcomes and recommended mitigation and management actions of the Terrestrial Ecology, Biodiversity and Species specialist assessment and BAR.

6.4.5 Conservation

6.4.5.1 Protected Areas and National Protected Areas Expansion Strategy

In order to traverse the topographically and geologically difficult terrain of the Molteno Pass at the eastern side of the Karoo National Park (Figure 22), it is proposed that the fibre optic cabling (overhead) be installed in the Park in a corridor where Eskom and Telkom infrastructure has already been established and currently still exists. NEM:PAA Section 50(5) approval is being sought from the Karoo National Park in this regard.

The route of the fibre optic cable traverses areas earmarked by National Protected Areas Expansion Strategy (NPAES) for future expansion of the Karoo National Park (Figure 22), but is not expected to interfere with the Park's expansion strategy, due to the nature of the overhead cabling infrastructure (i.e. predominantly timber poles at 7.5 – 9 m high), and due to the cabling following existing linear infrastructure corridors (e.g. Eskom and Telkom infrastructure) and being confined to the road reserves of existing roads.

6.4.5.2 Critical Biodiversity Areas

CBAs are regarded as areas of high biodiversity and ecological value and need to be kept in a natural or near-natural state, with no further loss of habitat or species (Figure 22). The proposed construction of the fibre-optic cable will predominantly take place in the road reserve, a highly transformed habitat found during the site survey to not be representative of the adjacent land spatial data on which the CBA identification was based. Consequently, the CBA1 classification of the road reserve sections of the proposed Fibre Optic Project study area cannot be upheld.

Land uses considered to be undesirable in CBAs, according to Pool-Stanvliet et al. (2017), include mining and prospecting, complete-barrier fencing, conversion of natural habitat to agriculture or forestry, extensive / intensive grazing, and linear infrastructure that disrupts CBA corridor connectivity. Although the SKA fibre optic cable constitutes linear infrastructure, it is proposed within the disturbance corridors of existing roads and will not result in additional landscape fragmentation.

Although the classification of the road reserve as CBA is questionable from a vegetation standpoint, the associated habitat may still at least be marginal riverine rabbit habitat. CBA1 are defined as areas that are irreplaceable for meeting biodiversity targets – no other options for conserving the ecosystems, species or ecological processes in these areas[17] (SANBI, 2017). A road reserve does not fully comply with these conditions. CBA2 are defined as areas that are the best option for meeting biodiversity targets, in the smallest area, while avoiding conflict with other land uses[18] (SANBI, 2017). Road reserves may not necessarily be the best option to meet biodiversity targets due to ongoing disturbance due to road maintenance and traffic.

Regardless of the fact that the road reserve areas where the Fibre Optic Project is proposed were found to not necessarily meet the requirements of CBAs, the potential impacts to CBAs and ESAs were assessed (CHAPTER 8) and the Listed Activity relating to clearance of vegetation in CBAs (refer to Section 4.2.1) is included in the EA application.

[17] In the Western Cape: "Areas in a natural condition that are required to meet biodiversity targets, for species, ecosystems or ecological processes and infrastructure" (Pool-Stanvliet et al. (2017).
[18] In the Western Cape: "Areas in a degraded or secondary condition that are required to meet biodiversity targets, for species, ecosystems or ecological processes and infrastructure" (Pool-Stanvliet et al. (2017).

6.4.5.3 Ecological Support Areas (ESAs):

ESAs need to be maintained in at least a functional and often natural state, but some limited habitat loss may be acceptable (Figure 22). Ecological processes and functioning of ESAs are not expected to be altered by the proposed Fibre Optic Project (also refer to Section 6.4.2). Furthermore, the proposed fibre optic cable installation will not sever ecological corridors or introduce additional permanent barriers that impede migration and movement of flora and fauna. Thus, loss of ecological connectivity in relation to the broader landscape is unlikely.

6.4.5.4 Conservancies

Four riverine rabbit conservancies exist in the Nama Karoo between Beaufort West and Loxton (The Sakriver, Brakriver, Kromriver and Wagenaarskraal conservancies) (Figure 22) (EWT, 2015). These conservancies were established by private landowners and farmers in the region together with the Endangered Wildlife Trust (EWT). Landowners in these conservancies contribute to the conservation of riverine rabbit (CR) through managing the key threats to Riverine rabbits through action that include allowing buffers between agricultural activities and riverine areas, and managing dogs and the use of traps to control damage-causing animals (Little & Theron, 2014).

These conservancies are also recognised in the Beaufort West LM's SDF (BWLM, 2013), adopted in 2017 for the period 2017-2022 (BWLM, 2018).

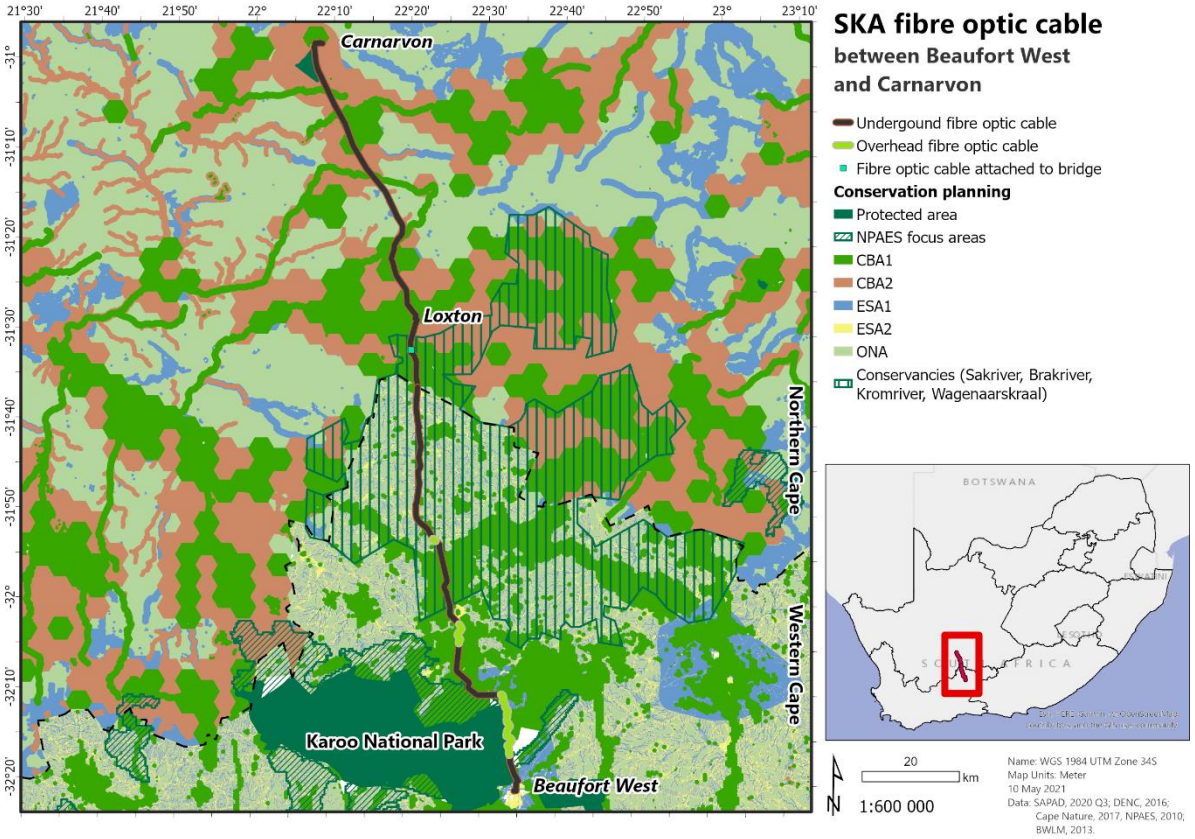


Figure 22: Protected areas, conservancies and conservation planning of the proposed Fibre Optic Project study area.

6.5 Aquatic ecology, biodiversity and species [19]

6.5.1 Aquatic ecosystems

Spatial data – e.g. NBA (SANBI, 2018) and National Freshwater Ecosystem Priority Areas (NFEPA) (Net et al. 2011) – indicates that several important as well as Threatened riverine systems are traversed by the proposed cable alignment. These include portions of the Slangfontein, Sak, Brak, Alarmleegte, Soutpoort, and Gansvlei rivers that are listed as EN (Figure 23 – based on existing spatial data, for delineated aquatic systems refer to Figure 25). Although these spatial databases indicate that some of these aquatic systems are perennial, all of the systems can be considered non-perennial or ephemeral based on numerous site surveys across several years and seasons for various other project proposals by the aquatic specialist (Dr. Brian Colloty). The systems with larger valley bottom wetlands, are known to sometimes contain pools with moderate flows, but this is only within short river reaches along systems such as the Sak, Brak and Soutpoort Rivers.

Box 4: Water Management Areas and catchments

The proposed Fibre Optic Project is located predominantly in the Lower Orange WMA (156 km) with a smaller section in the Gouritz WMA (27 km), and traverses the following catchments:

- Kuils / Gamka (J21A);
- Sak (D55A);
- Slangfontein se Leegte / Brak (D55C);
- Brak / Soutpoort (D55D);
- Gansvlei (D55G);
- Alarmleegte (D55F); and
- Carnarvonleegte (D54B).

[19] Extracted and / or summarised from EnviroSci (2020) (see Appendix 3).

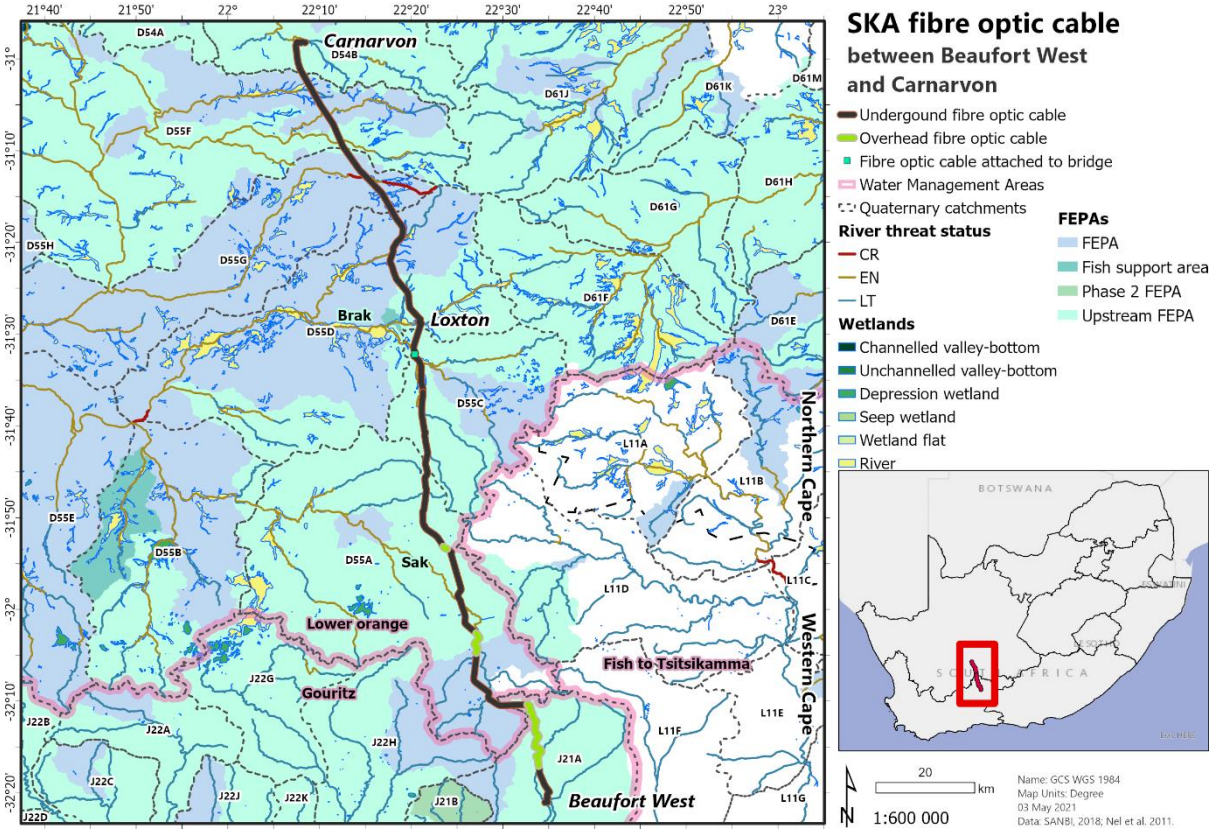


Figure 23: Rivers (and threat status), wetlands and Freshwater Ecosystem Priority Areas for the proposed Fibre Optic Project study area.

The proposed Fibre Optic Project study area is thus dominated by various aquatic features associated with catchments and rivers which have been characterised as follows (Figure 24):

- Riverine with distinct riparian zone: Alluvial Floodplain and tree riparian dominated systems, characterised by *Vachellia karroo* and or *Sersia* species;
- Riverine with limited riparian vegetation: Incised channels with limited riparian vegetation or part of an alluvial valley. These are mostly associated with the central and northern portions of the fibre optic cable alignment from Rosedene (just north of the Molteno Pass), northwards onto Carnarvon;
- Wetland: Valley bottom wetlands (mostly channelled);
- Pan (wetland): Endorheic Pan/Depressions (none present within the proximity of the proposed fibre optic cabling route); and
- Artificial: Dams, reservoirs and shallow borrowpits that were filled with surface water runoff.

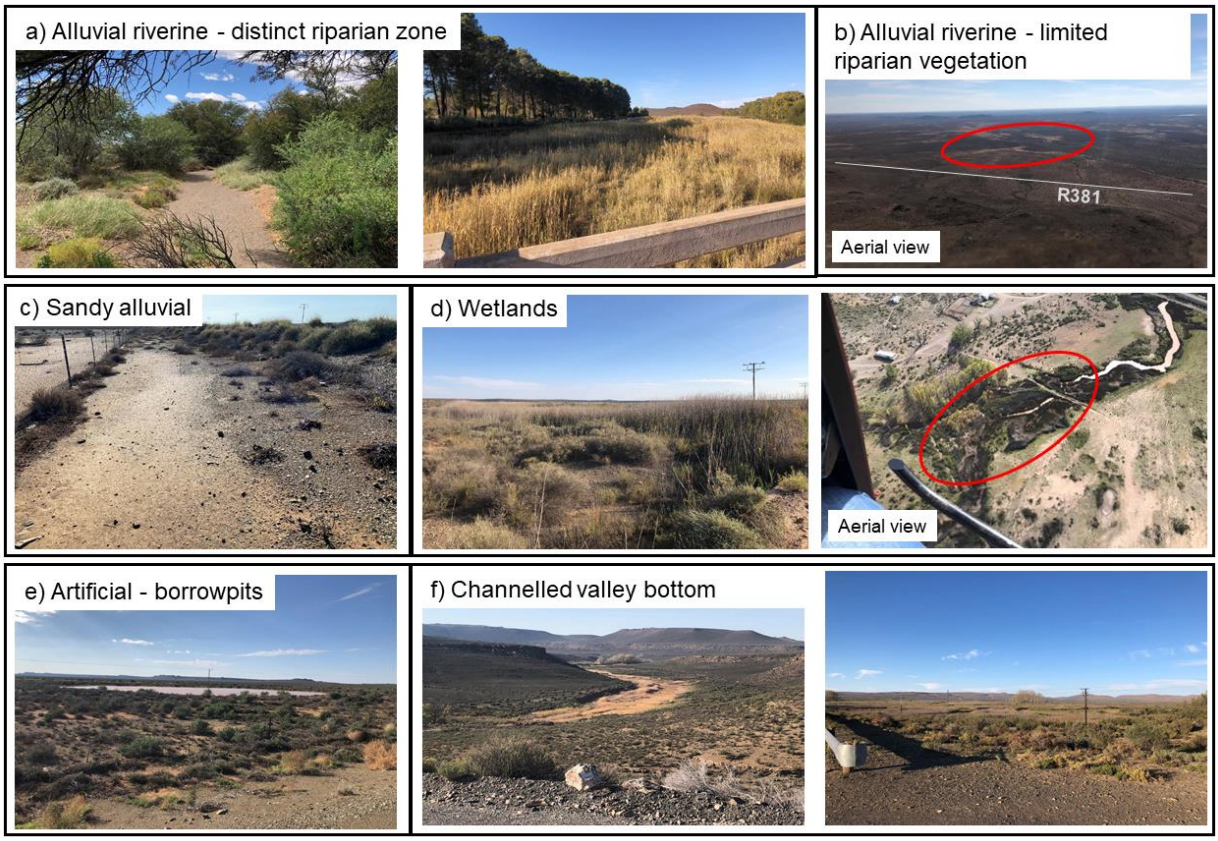


Figure 24: Main aquatic systems of the proposed Fibre Optic Project study area: a) alluvial riverine with distinct riparian zone; b) alluvial riverine with limited riparian vegetation; c) sandy alluvial systems; d) wetlands; e) artificial systems, e.g. borrowpits; f) channelled valley bottoms. Photo: EnviroSci, 2018 - 2020.

6.5.2 Delineated systems and ecological state

All of the observed systems within the proposed Fibre Optic Project study area were rated, at the Subquaternary (quinary) level, as Present Ecological State (PES) Largely natural (B) to Moderately Modified (C). While these were also rated as High to Moderate / Medium in terms of Ecological Sensitivity (ES) and Ecological Importance (EI) (DWS, 2014).

Based on the information collected during the field investigations, these ratings are verified and upheld for the riverine / alluvial systems. The natural wetlands were, however, rated independently and achieved PES scores of B & B/C, while the EIS was rated as High. This high rating is attributed to these systems retaining water during dry periods, with small pools still evident in downstream areas even after a low rainfall year (2020). These pools also create refugia for important fish and amphibians known to occur within the region, as well as provide drinking water to small mammals and livestock within the area.

The Moderate and High EIS rating for both natural watercourses and wetlands, is further substantiated by the fact that the affected catchments are included in both the NFEPA and provincial CBA spatial data (refer to Figure 22). These areas are highlighted as support areas for downstream rivers (i.e. Upstream FEPAs) and important corridors along the various river systems.

Figure 25 indicates delineated watercourses for the proposed Fibre Optic Project study area.

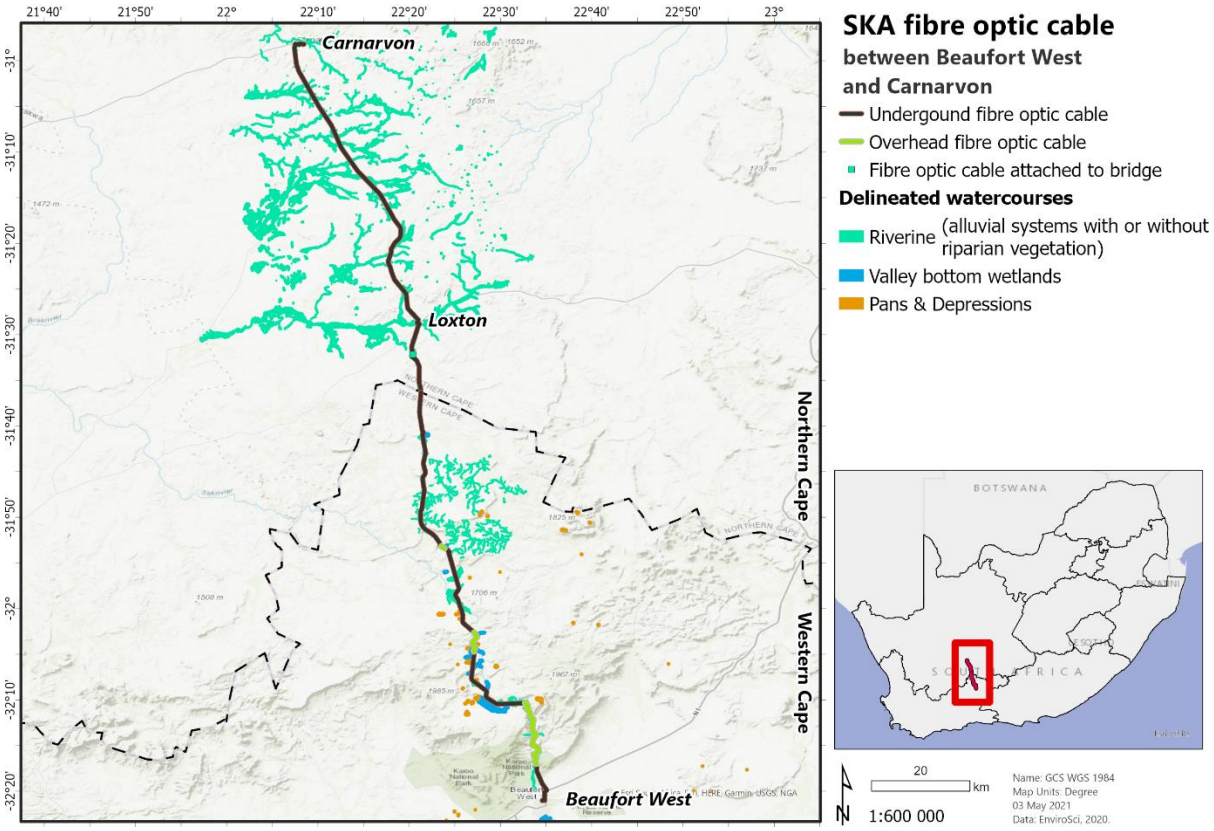


Figure 25: Delineated natural watercourses in the proposed Fibre Optic Project study area.

Overall, the catchment areas and subsequent rivers / watercourses are largely in a natural state with localised impacts in some areas, which include the following:

- Erosion and sedimentation associated with road crossings;
- Impeded water flow due to several in channel farm dams; and
- Sedimentation and scour of channels due to undersized culverts within present-day road crossings.

6.5.3 Flora

Coupled to the aquatic system delineations, information was collected on potential species that could occur within the wetlands and watercourses, especially any areas that would contain open water for long periods and or conservation worthy species (Listed or Protected). None of the dominant riparian / wetland associated plant species observed are listed or protected under any form of legislation.

Box 5: Riparian / wetland plant species overview

- Riparian / wetland associated plant species observed during the site survey:
  - *Seersia lanceolata*
  - *Vachellia karroo*
  - *Ficinia nodusa*
  - *Juncus effusus*
  - *Carex* spp
  - *Centella asiatica*
  - *Erianthus capensis*
  - *Sporobolus fimbriatus*
  - *Cynodon incompletus*
  - *Prosopis* spp (exotic)
  - *Eragrostis curvula*
  - *Erharta calcynia*
  - *Merxmuellera disticha*
  - *Phragmites australis*
  - *Cynodon dactylon*

6.5.4 Fauna

Amphibian species are known to occur within the region based on collection data for Beaufort West and the Karoo National Park, but little is known of the actual distribution of frogs within the proposed Fibre Optic Project study area. Various databases and other literature sources were consulted to determine the frog and fish species that are known to occur in the proposed Fibre Optic Project study area. None of these species are IUCN red-listed.

Box 6: Aquatic animal species overview

- Number of frog species known to occur – **7 species (3 observed*)**

Karoo toad *	*Vandijkophrynus gariepensis gariepensis*	LC
Common caco	*Cacosternum boettgeri*	LC
Karoo dainty frog	*Cacosternum karooicum*	LC
Clicking stream frog	*Strongylopus grayii*	LC
Cape river frog *	*Amietia fuscigula*	LC
African clawed toad *	*Xenopus laevis*	LC
Cape sand frog	*Tomopterna delanandii*	LC

- Fish species known to occur – **4 species (none observed)**

Chubbyhead Barb	*Enteromius anoplus*
Vaal-orange Smallmouth Yellowfish	*Labeobarbus aeneus*
Common carp	*Cyprinus carpio* (exotic)
Orange River Mudfish	*Labeo capensis*

Note: fish are mainly associated with downstream areas of the Sak River, for example, beyond the proposed Fibre Optic Project study are (ca. 25km).

6.6 Heritage, archaeology and palaeontology[20]

Eight heritage resources (archaeology and palaeontology) were recorded in the proposed Fibre Optic Project study area (Figure 26).

[20] Extracted and / or summarised from CTS Heritage (2020) (see Appendix 5).

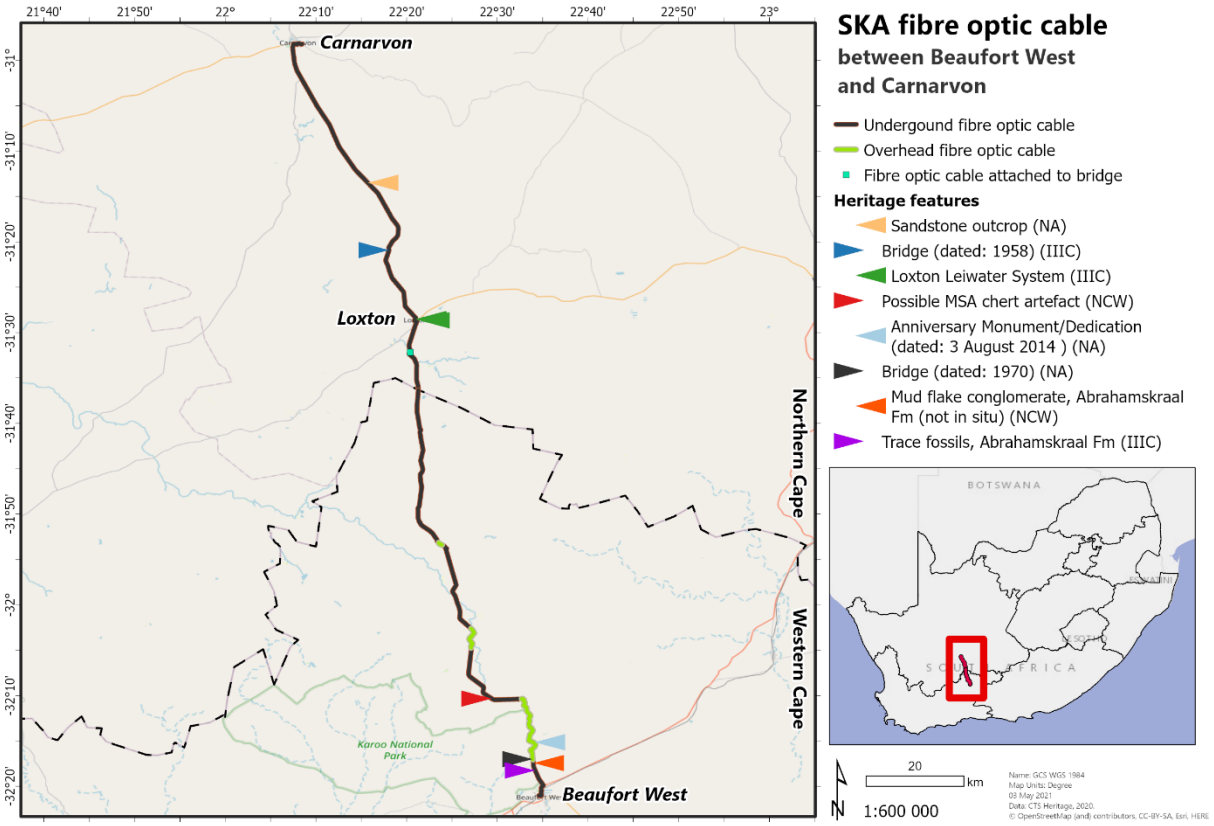


Figure 26: Heritage resources recorded in the proposed Fibre Optic Project study area.

6.6.1 History and context

Carnarvon was established in 1853 on a route between Cape Town and Botswana that was followed by early explorers and traders. It was originally established as a mission station of the Rhenish Missionary Society and named Harmsfontein.

Loxton's first church building and schoolhouse was built in 1900. Tree-lined streets and flood irrigation channels that run alongside the town's main roads were completed in the same year. The town became a municipality in 1905 as it developed to serve the region's sheep-farming community. The church that stands in the town's centre was constructed in 1924.

Beaufort West was the first town to be established in the central Karoo. The town was founded in 1818 and became the first municipality in South Africa on 3 February 1837 and had the country's first town hall. When the railroad reached the town in 1880 it became a marshalling yard and locomotive depot and today it is the largest town in the Karoo.

All of the towns in the proposed Fibre Optic Project study have significant historic town centres with a unique sense of place. It is not anticipated that trenching for the fibre optic cabling will negatively impact on any historic fabric or on this unique sense of place. However, care must be taken to ensure that historic features such as leiwater systems[21] are not negatively impacted by the proposed trenches.

[21] Leiwater systems are open channels along the streets water-scarce towns to provide water for the trees and gardens, also allowing residents to cultivate orchards and vegetables (Karoo - South Africa, n.d.)

6.6.2 Archaeology

According to Tusenius (2012:4), "the rich archaeological heritage of the Karoo has not been systematically studied… Sites and scatters of Early, Middle and Late Stone Age (ESA, MSA and LSA) material have been recorded, as well as pastoralist occurrences, historical sites, rock paintings and engravings." A concise summary of the heritage of the area is provided by Rossouw (2019:1): Rock engravings located to the southeast of Loxton, suggest the possibility that a giant long-horned buffalo (*Syncerus antiquus*), which became extinct more than 10 000 years ago, previously occurred in the area. Furthermore, "multiple rock engraving sites have been recorded in the region and are mainly attributed to San hunter-gatherers who inhabited the area and had done so for thousands of years while the pastoralist Khoekhoe had been present in the Karoo for at least 2 000 years. The historical footprint is largely represented by the vernacular architecture of the well-known corbelled houses in the region, which is related to 19th century trekboers who occupied these buildings, and whose cultural history dates back to their 18th century movement onto the VOC ("Verenigde Oostindische Compagnie" / United East India Company) Cape frontier that resulted in ongoing interaction with indigenous people in the Karoo."

Box 7: Recorded built heritage and archaeological resources

- Built heritage – **3 resources observed**
  - Bridge over the Soutpoort river north of Loxton, dated 1958 (Grade IIIC)
  - Bridge over stream north of Beaufort West, dated 1970 (N/A in terms of grading)
  - Loxton leiwater system, lined with old trees (Grade IIIC)
  - Anniversary dedication monument, dated 2014 (Grading N/A)
- Archaeology – **4 species (none observed)**
  - Possible MSA chert artefact (Not Conservation Worthy)
  - Sandstone outcrop (Grading N/A)

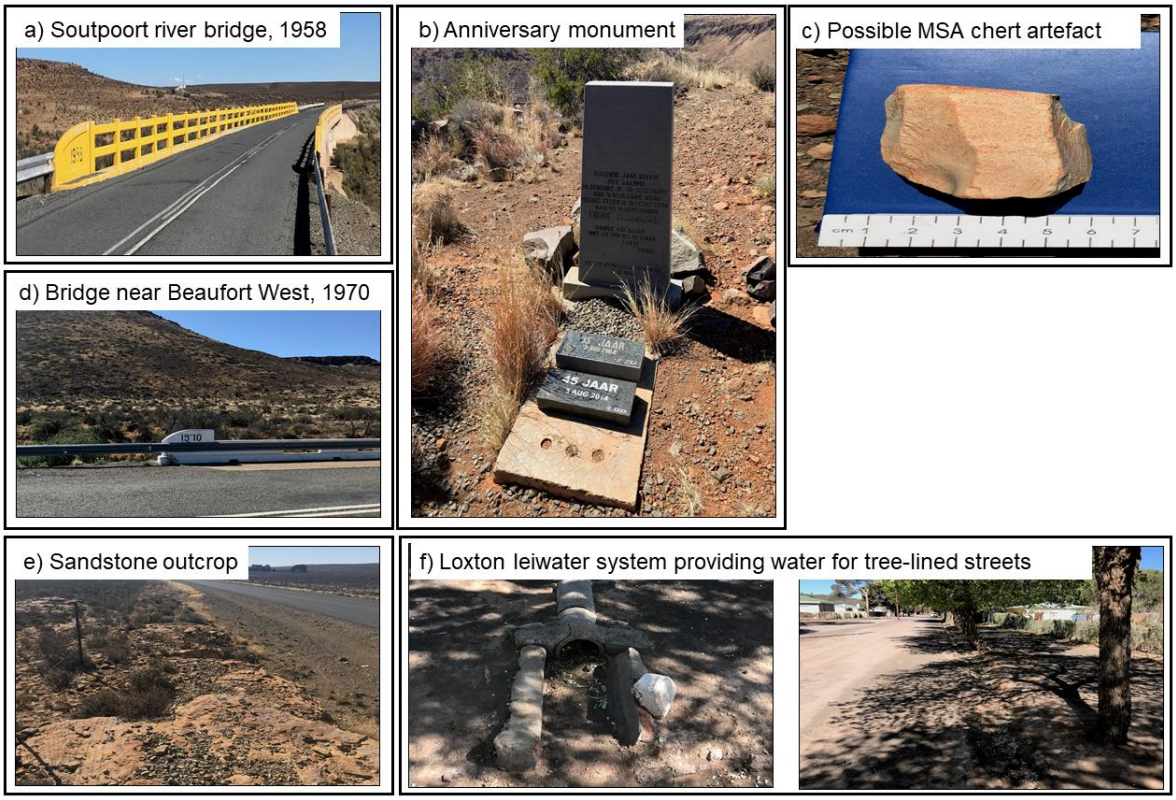


Figure 27: Built heritage and archaeological resources recorded in the proposed Fibre Optic Project study area.

6.6.3 Palaeontology

The proposed Fibre Optic Project study area is located within “early Permian Abrahamskraal Formation rocks of the Adelaide Subgroup (Karoo Supergroup) that is capped by severely degraded, superficial sheet wash and channel related (Quaternary) deposits bounded by Jurassic age dolerite intrusions to the north. The Loxton area lies within the outcrop area of the Tapinocephalus Assemblage Zone (AZ) which spans the middle part of the Abrahamskraal Formation. Vertebrate fossils of the Tapinocephalus AZ are not as common as in succeeding biozones and are usually found as individual specimens in the mudrock sequences in association with, and often enveloped by, brown-weathering calcareous nodular material. This faunal assemblage is mainly represented by small dicynodonts, large dinocephalians, pareiasaurs and pristerognathid therocephalians” Rossouw (2019:1).

Palaeontology associated with the geology of the study area is presented in Table 10.

Table 10: Palaeontology associated with the geology of the proposed Fibre Optic Project study area.

Group	Formation	Palaeontology
Beaufort, Adelaide Subgroup	Teekloof, Hoedemaker member	Raindrop imprints, desiccation cracks, Tropidostoma Assemblage Zone
Beaufort, Adelaide Subgroup	Teekloof, Poortjie member	Raindrop imprints, desiccation cracks, Pristerognathus Assemblage Zone
Beaufort, Adelaide Subgroup	Abrahamskraal	Bioturbation, Trance fossils, Tapinocephalus Assemblage Zone
Ecca	Water Ford (Previously Carnarvon)	Trace Fossils
Ecca	Tierberg	Trace fossils, fish scales, and sponge spicules

Box 8: Recorded palaeontological resources

- Only 2 palaeontological resources were recorded:
  - Trace fossils (Grade IIIC);
  - Mud flake conglomerate (Not Conservation Worthy).

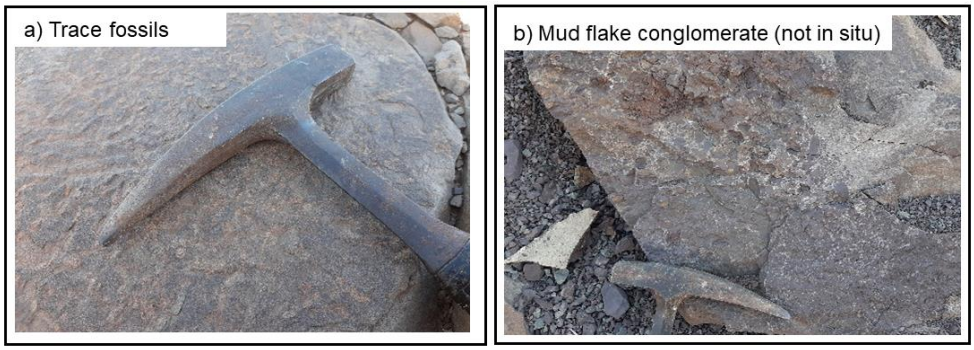


Figure 28: Palaeontological resources recorded in the proposed Fibre Optic Project study area.

6.7 Visual, aesthetic and scenic resources[22]

The main visual, aesthetic and scenic resources associated with the proposed overhead fibre optic cable section are the Molteno Pass, Nuweveld mountains, Karoo National Park and smaller passes and *poorts*.

The Molteno Pass, completed in 1881 by the renowned pass builder, Thomas Bain, is one of South Africa's first mountain passes, and forms an important gateway to the plateau and Great Karoo to the north. The Molteno pass consists of a mix of tar and gravel sections of the R381 and ascends 647m to the plateau at 1574m.

The flat-topped dolerite hills and Nuweveld mountains, forming the escarpment, are characteristic features of the Great Karoo in an otherwise fairly featureless, parched landscape, an area noted mainly for its empty, uncluttered landscapes.

The Karoo National Park adjoins the southern section of the proposed grid route in the vicinity of the Molteno Pass. Much of the proposed SKA cable would lie within the 'Viewshed Protection Area' of the National Park.

There are several farmsteads along the route, as well as tourist facilities, such as Ko-Ka Tsara Bush Camp in the Molteno Pass area. The farms in the area have mainly merino sheep, as well as dorper sheep and game. Isolated farmsteads form green oases in the semi-arid landscape, sheltered from the heat by poplars and other exotic trees.

Figure 29: Picturesque Molteno pass R381 route winding between dolerite formations. Powerline pylons visible on the far skyline.

Existing intrusions along the route of the proposed SKA overhead cable include the R381 road, which required a number of cut and fill embankments in the steeper sections. The only other significant visual intrusion is that of the 22kV Eskom powerline and a smaller telephone line which thread their way through the passes and *poorts*, sometimes crossing small ridges on the skyline, but generally following the R381 in the flatter areas. Little effort was made to avoid visual intrusion on scenic resources in the original routing of the powerline and telephone line.

[22] Extracted and / or summarised from Lawson & Oberholzer (2021) (see Appendix 6).

CHAPTER 7 ENVIRONMENTAL SENSITIVITY

7.1 Screening Tool sensitivity verification

The sensitivity of the receiving environment under the various relevant Screening Tool themes are largely upheld (e.g. for animal and plant species), but disputed for some attributes / features as it relates to the nature of the proposed Fibre Optic Project and / or specifically where the cabling is proposed underground in road reserves (e.g. terrestrial biodiversity, archaeology, palaeontology). For aquatic ecology and visual / cultural features, the binary sensitivity assignment (Very High or Low) were refined into more sensitivity classes.

Table 11 summarises the screening sensitivity verification undertaken for the various Screening Tool themes. Full sensitivity verifications may be found in:

- Plant Species, Animal Species, and Terrestrial Biodiversity – Appendix 2;
- Aquatic Biodiversity – Appendix 3;
- Archaeology[23] – Appendix 5 ;
- Cultural Heritage[19] – Appendix 5 and Appendix 6;
- Palaeontology – Appendix 5; and
- Agriculture, Civil Aviation, and Defence[24] - Box 9.

Box 10: Sensitivity verification for Agriculture, Civil Aviation, and Defence Themes

Agriculture:

The overall Screening Tool sensitivity rating for Agriculture in relation to the proposed Fibre Optic Project study area is **High**. The sensitivities are further detailed as:

• Annual Crop Cultivation / Planted Pastures Rotation; Land capability;01. Very low/02. Very low/03. Low-Very low/04. Low-Very low/05. Low • Annual Crop Cultivation / Planted Pastures Rotation; Land capability;06. Low-Moderate/07. Low-Moderate/08. Moderate	High
• Land capability;06. Low-Moderate/07. Low-Moderate/08. Moderate	Medium
• Land capability;01. Very low/02. Very low/03. Low-Very low/04. Low-Very low/05. Low	Low

The sensitivity ratings are disputed from the perspective of the proposed Fibre Optic Project due to the nature of the Fibre Optic Project. The cabling will predominantly be installed underground in the road reserve (~162 km). No agriculture was observed to be practiced or likely to be practiced in the future (Figure 30).

Where the fibre optic cabling is proposed overhead on poles at a maximum height of 9 m (~21 km), potentially outside the road reserve, agricultural activities (mainly grazing within the study area) can continue unaffected once the cabling has been installed.

The suggested sensitivity of Agriculture to the proposed Fibre Optic Project is thus Low.

[23] Included in the Screening Tool's overarching "Archaeological and Cultural Heritage Theme"
[24] The Screening Tool did not identify Agriculture, Civil Aviation, and Defence as specialist assessments for inclusion in the assessment report.

Figure 30: Typical characteristics of the road reserve in the proposed Fibre Optic Project study area. The road reserve varies in width, and can be very narrow some places. Photo: L. Snyman-van der Walt, site visit, 17 November 2021.

Civil aviation:

The overall Screening Tool sensitivity rating for Civil Aviation in relation to the proposed Fibre Optic Project study area is **High**. The sensitivities are further detailed as:

• Within 8 km of other civil aviation aerodrome • Dangerous and restricted airspace as demarcated	High
• Within 5 km of an air traffic control or navigation site • Between 8 and 15 km of other civil aviation aerodrome	Medium

The potential presence of the aerodromes, air traffic control sites and air space is not contested; however, the sensitivity ratings are disputed from the perspective of the proposed Fibre Optic Project due to the nature of the fibre optic cable infrastructure. The cabling will predominantly be installed underground (~162 km), and overhead sections on poles at a maximum height of 9 m (~21 km), alongside taller existing infrastructure (e.g. Eskom power lines). Additionally, the fibre optic cabling itself does not broadcast signals or emit electromagnetic radiation and as such poses no risk to interference with aviation radar.

The suggested sensitivity of Civil Aviation to the proposed Fibre Optic Project is thus Low.

Defence:

The overall Screening Tool sensitivity rating for Defence in relation to the proposed Fibre Optic Project study area is **Low. This sensitivity is confirmed,** as it is unlikely that any sensitive defence sites, installations, infrastructure or activities exist within close proximity to the roads (R381 and R 83) where the fibre optic cabling in proposed. None were observed during the site visit (17-18 Nov. 2020). It is not anticipated that the proposed Fibre Optic Project would pose any risk to defence sites, installations, infrastructure or activities, and vice versa.

Table 11: Screening Tool Sensitivity verification summary.

Theme / feature	Screening Tool Sensitivity	Specialist sensitivity verification	
ANIMAL SPECIES THEME			
Aves - *Aquila verreauxii* (Verreaux's eagle)	**High**	**High**	Confirmed High. Note: an additional eight (08) red-listed avifauna species are known to occur in the region.
Aves - *Circus maurus* (Black harrier)	**High**	**High**	
Mammalia - *Redunca fulvorufula fulvorufula* (Mountain reedbuck)	**High**	**High**	Confirmed High, although unlikely to be free-roaming within the road reserve.
Mammalia - *Bunolagus monticularis* (Riverine rabbit)	**High**	**High**	Confirmed High.
Mammalia - *Bunolagus monticularis* (Riverine rabbit)	**Medium**	**High**	It is unclear what the reason is for both high and medium sensitivity ratings for Riverine rabbit is.
Reptilia - *Chersobius boulengeri* (Karoo dwarf tortoise)	**Medium**	**Medium**	Confirmed Medium.
PLANT SPECIES THEME			
Note: No red-listed species recorded along the route. Many provincially protected / specially protected and CITES II listed species were recorded.			
Cliffortia arborea	**Medium**	**Medium**	Confirmed Medium. Note: not recorded during site survey.
Sensitive species 704	**Medium**	**Medium**	Confirmed Medium. Note: not recorded during site survey.
TERRESTRIAL BIODIVERSITY THEME			
Ecological Support Area	**Very high**	**Low**	Disputed **within the road reserve**. Suggested sensitivity Low. Recorded sensitive habitats have been assigned sensitivities ranging from Low to Medium.
Ecological Support Area 1	**Very high**	**Low**	
Ecological Support Area 2	**Very high**	**Low**	
Critical Biodiversity Area 1	**Very high**	**Low**	
Critical Biodiversity Area 2	**Very high**	**Low**	
Focus Areas for land-based protected areas expansion	**Very high**	**Low**	
Freshwater ecosystem priority area quinary catchments	**Very high**	**Low**	
Karoo National Park	**Very high**	**Very high**	Confirmed Very high.
Dr Appie van Heerden Nature Reserve	**Very high**	**Very high**	Confirmed Very high. Note: not affected by the proposed Fibre Optic Project in the road reserve.

Theme / feature	Screening Tool Sensitivity	Specialist sensitivity verification	
AQUATIC BIODIVERSITY THEME			
Aquatic CBAs Rivers Wetlands and Estuaries Freshwater ecosystem priority area quinary catchments	**Very high**	**High**	Valley bottom wetlands
		Medium	All riverine systems, with or without riparian vegetation or that formed part of an alluvial system.
		Low	Artificial systems and minor 1:50 000 watercourses of low sensitivity or constraint.
ARCHAEOLOGICAL AND CULTURAL HERITAGE THEME			
Within 500 m of an important river Within 500 m of an important wetland Within 500 m of a heritage site Within 500 m of a provincial heritage site	**High**	**Low**	Disputed **within the road reserve** for archaeological resources associated with rivers, wetlands and / or heritage sites. Suggested sensitivity Low.
Within protected area	**High**	**Very high**	Karoo National Park.
Within 1 km of a protected area	**High**	**High**	Within 100 m.
		Medium	Within 150 m.
Important mountain pass	**High**	**High**	Within 50 m.
		Medium	Within 100 m.
Mountain or ridge	**Medium**	**Very high**	Feature.
		High	Within 50 m.
		Medium	Within 100 m.
PALAEONTOLOGY THEME			
Rock units with a high paleontological sensitivity	**High**	**Low**	Disputed **within the road reserve** for palaeontology. Suggested sensitivity Low.
Rock units with a medium paleontological sensitivity	**Medium**		
AGRICULTURE THEME*	**High**	**Low**	Disputed **within the road reserve and based on the nature of the Fibre Optic Project.** Suggested sensitivity Low.
CIVIL AVIATION THEME*	**High**	**Low**	Disputed **based on the nature of the Fibre Optic Project.** The fibre optic cabling will predominantly be installed underground and aboveground sections on poles at a maximum height of only 9 m. Suggested sensitivity Low.
DEFENCE THEME*	**Low**	**Low**	Confirmed Low.
**Verified by the EAP.*			

7.2 Sensitivity analysis

7.2.1 Terrestrial ecology, biodiversity and species [25]

The sensitivity of terrestrial ecosystems, biodiversity and species, based on the field trip, were analysed at a habitat level, taking into consideration the vegetation type threat status, presence of red data, provincially protected, and endemic species, species richness, habitat conservation value, connectivity, erosion and resilience. Potential riverine rabbit habitat and rocky areas, where the existing roads are cut into hills and the SCCs may occur, are rated High sensitivity (Table 12).

Table 12: Sensitivity classification for terrestrial ecology, biodiversity and species within the proposed Fibre Optic Project.

Feature/s	Sensitivity rating
▪ Riverine rabbit habitat. ▪ Rocky areas with SCC (where the road is cut into hills).	**High**
▪ Western Upper Karoo (low hills). ▪ Upper Karoo Hardeveld (mountains, midslopes, plateaus, valley). ▪ Eastern Upper Karoo (hills). ▪ Gamka Karoo (hills, plateaus).	**Moderate**
▪ Western Upper Karoo (footslopes, plains). ▪ Upper Karoo Hardeveld (footslopes, low hills, plains). ▪ Northern Upper Karoo (plains). ▪ Eastern Upper Karoo (bottomlands, footslopes, plains). ▪ Gamka Karoo (footslopes, plains).	**Low**

7.2.2 Aquatic ecology, biodiversity and species[26]

The two main delineated aquatic systems within the proposed Fibre Optic Project study area, valley bottom wetlands and riverine / alluvial systems, were assigned sensitivity classes based on their characteristics and current level of disturbances (Table 13).

Table 13: Sensitivity classification for aquatic ecology, biodiversity and species within the proposed Fibre Optic Project.

Feature/s	Sensitivity rating
▪ All delineated valley bottom wetland systems.	**High**
▪ All delineated riverine systems, with or without riparian vegetation or that formed part of an alluvial system.	**Moderate**

7.2.3 Heritage, archaeology and palaeontology[27]

The proposed Fibre Optic Project study area has a Low heritage, archaeological and palaeontological sensitivity (Table 14). Recorded heritage resources are either non-graded, Not Conservation Worthy (NCW) or grade IIIC[28]. No evidence of in situ archaeological material, rock engraving sites, or graves along the proposed routing were recorded. No historical buildings or structures older than 60 years observed within the direct footprint of the proposed fibre optic cable

[25] Extracted and / or summarised from Ekotrust (2020) (see Appendix 2)
[26] Extracted and / or summarised from EnviroSci (2020) (see Appendix 3)
[27] Extracted and / or summarised from CTS Heritage (2020) (see Appendix 5)
[28] Grade IIIC. "This grading is applied to buildings and/or sites whose significance is, in large part, a significance that contributes to the character or significance of the environs" (HWC, 2012:7); "High local heritage significance. Administered by local municipal authorities that have successfully applied for devolution of powers to the local level" (SAHRIS, n.d);

route, apart from the bridge crossing the Soutpoort river (BTC07, dated 1958) north of Loxton, were observed.

Table 14: Sensitivity classification for heritage features (archaeology and palaeontology) within the proposed Fibre Optic Project.

Feature/s	Sensitivity rating
▪ All recorded heritage features (archaeology and palaeontology) non-graded, Not Conservation Worthy and grade IIIC.	**Low**

7.2.4 Visual, aesthetic and scenic resources[29]

Sensitive topographic features include the Nuweveld Mountains, which form part of the escarpment, a major scenic feature of this part of the Karoo.

The Gamka River, flowing through the Nuweveld Mountain, adjacent to the Molteno Pass (R381 route), is the main water feature, forming scenic gorges. The Sak River, which also rises in the Nuweveld Mountains, flows north, and is crossed by the R381 road and thus the proposed overhead sections of the Fibre Optic Project in places.

The Karoo National Park, adjacent to the R381 Route, which includes a 'Viewshed Protection Area' (SANParks, 2017), has wilderness and scenic value in addition to its biological conservation role, serving as an important visitor / tourist destination. Visual significance is increased by its protection status.

Private nature reserves and guest farms in the area, which include the Ko-Ka Tsara Bush Camp, are important for the local tourism economy, and tend to be sensitive to loss or degradation of scenic quality. However, these are some distance from the proposed overhead fibre optic cable, and would not be affected.

Farmsteads bordering on the proposed overhead sections of the Fibre Optic Project are also generally some distance from the proposed cable route, and are mostly screened by trees.

The R381 Route, particularly the Molteno Pass, and a number of smaller passes and poorts, have high scenic value in places and are therefore visually sensitive for users of the roads.

The key scenic resources in the areas where the fibre optic cabling is proposed overhead on timber (predominantly) and concrete poles at heights of 7.5 – 9 m have been classified into three sensitivity classes (Table 15).

[29] Extracted and / or summarised from Oberholzer & Lawson (2021) (see Appendix 6)

Table 15: Sensitivity classification for scenic resources within the proposed overhead sections of the Fibre Optic Project study area.

Feature/s	Sensitivity rating
▪ Topographic features, ridges, peaks, scarps (feature). ▪ Geological features / outcrops (feature). ▪ Scenic water features (rivers, large dams) (50 m). ▪ National Parks (Karoo National Park) (feature). ▪ Nature Reserves (feature). ▪ Guest farms (feature). ▪ Farmsteads (50 m).	**Very high**
▪ Topographic features, ridges, peaks, scarps (50 m). ▪ Geological features / outcrops (25 m). ▪ Steep slopes (> 1:4) ▪ Scenic water features (rivers, large dams) (100 m). ▪ National Parks (Karoo National Park) (100 m). ▪ Nature Reserves (100 m). ▪ Guest farms (100 m). ▪ Farmsteads (100 m). ▪ Scenic poorts / passes R381 (50 m)* ▪ Arterial route R381 (25 m)* ▪ Main district road (25 m)*	**High**
▪ Topographic features, ridges, peaks, scarps (100 m). ▪ Geological features / outcrops (50 m). ▪ Steep slopes (> 1:10) ▪ Scenic water features (rivers, large dams) (150 m). ▪ National Parks (Karoo National Park) (150 m). ▪ Nature Reserves (150 m). ▪ Guest farms (150 m). ▪ Farmsteads (150 m). ▪ Scenic poorts / passes R381 (100 m)* ▪ Arterial route R381 (50 m)* ▪ Main district road (50 m)*	**Moderate**
** Except where road crossings are required.*	

7.2.5 Combined sensitivity maps

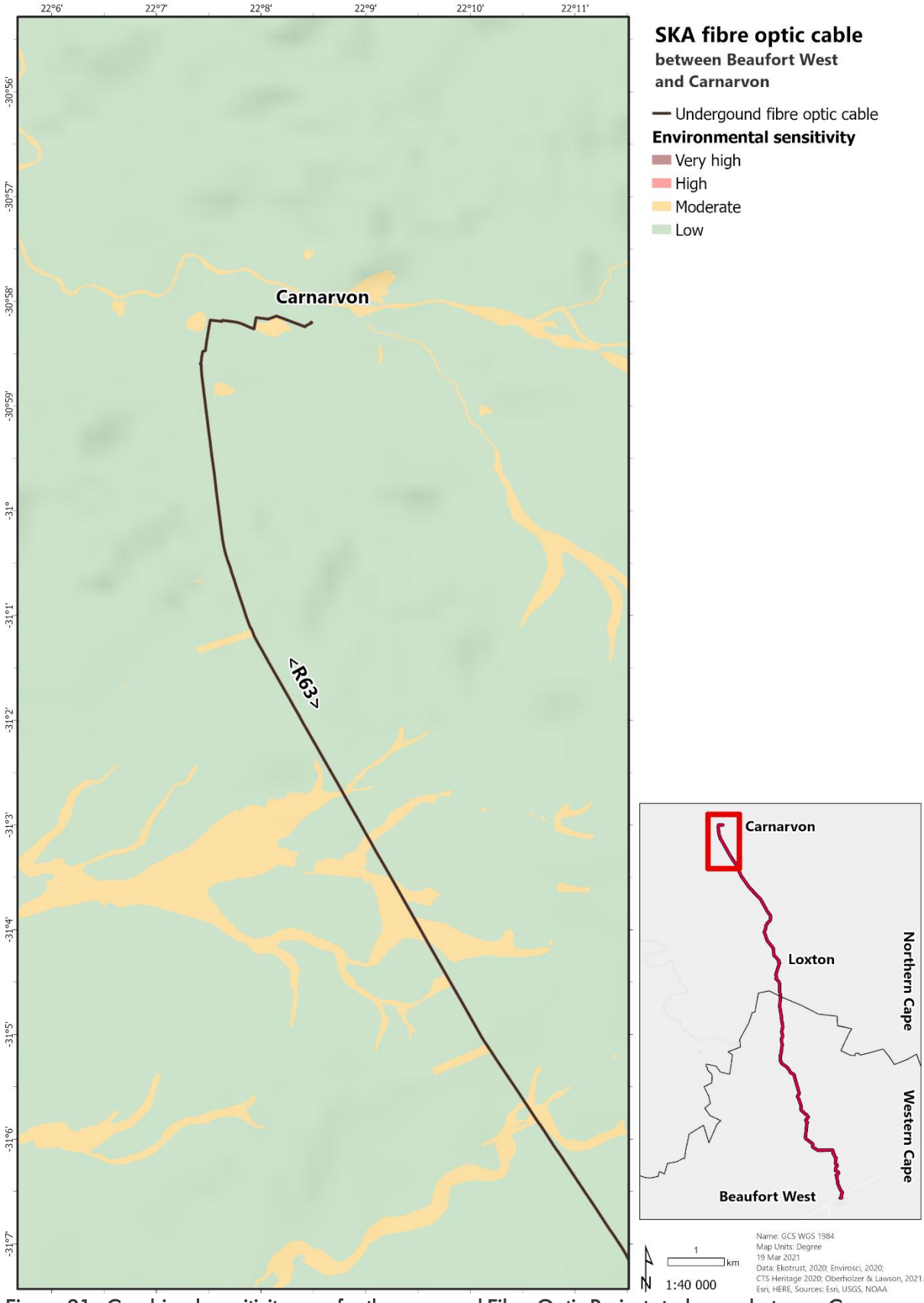


Figure 31: Combined sensitivity map for the proposed Fibre Optic Project study area between Carnarvon and 31°05'24.8"S 22°10'21.2"E, following the R63 road.

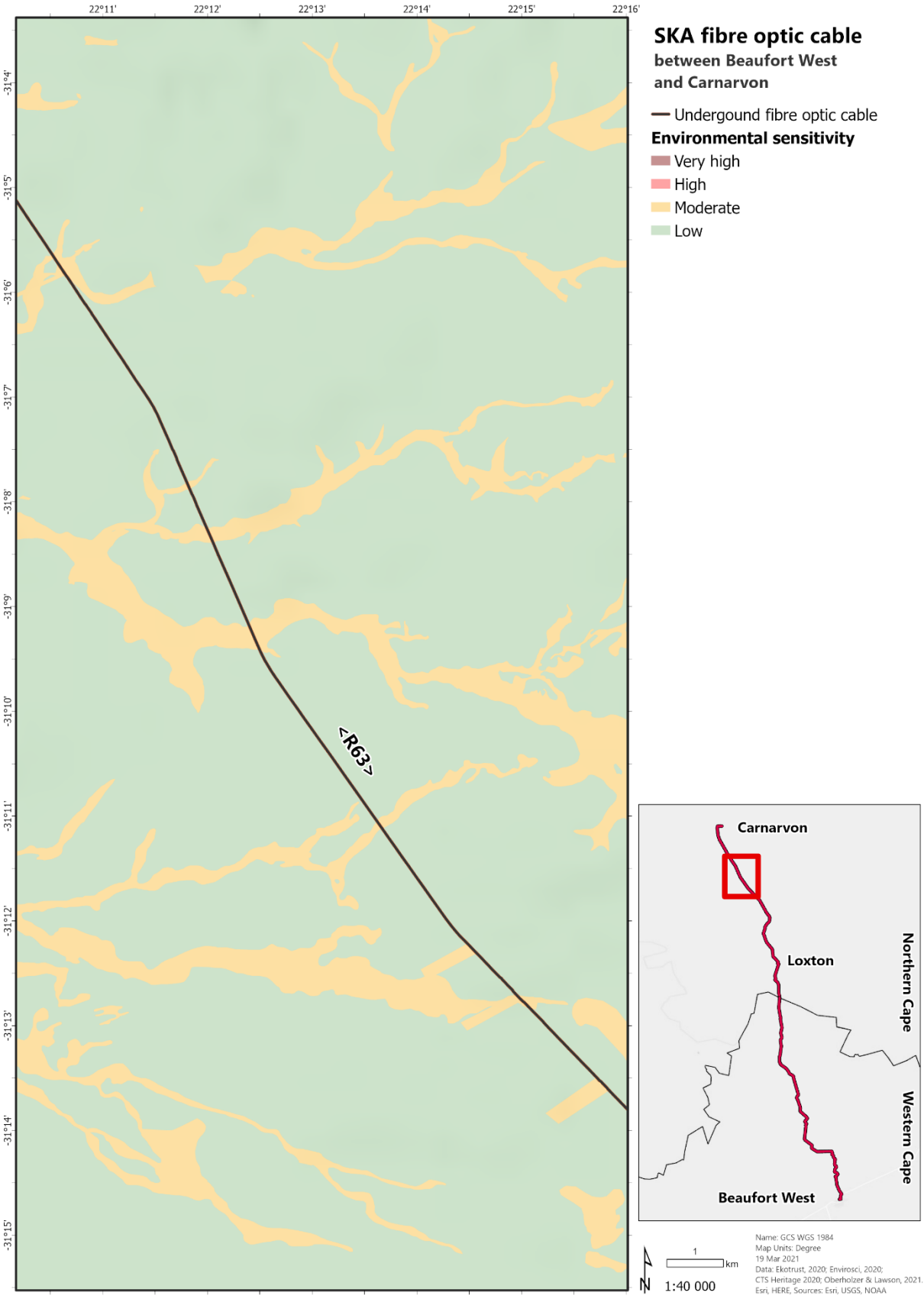


Figure 32: Combined sensitivity map for the proposed Fibre Optic Project study area between 31°05'24.8"S 22°10'21.2"E and 31°13'21.7"S 22°15'34.2"E, following the R63 road.

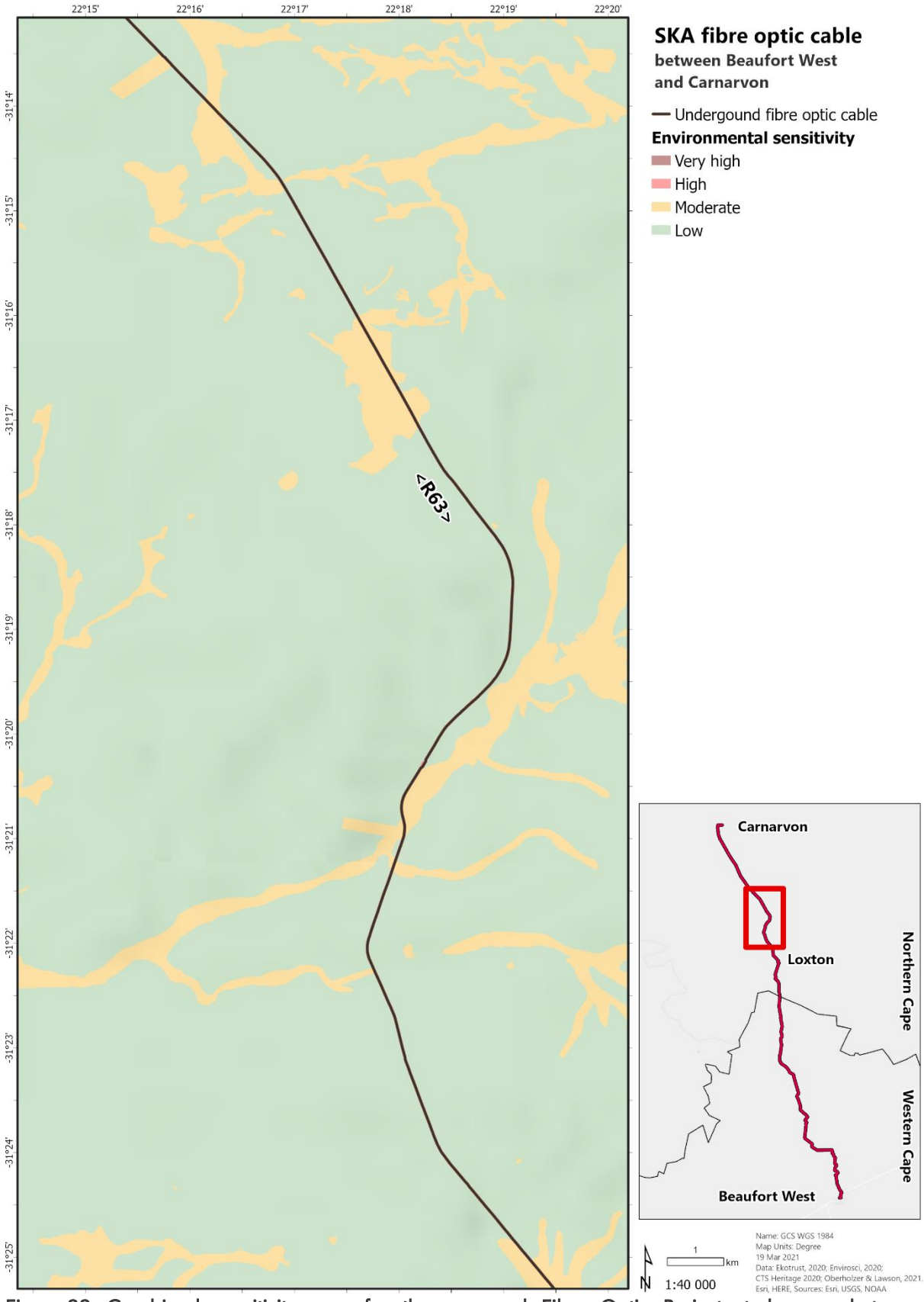


Figure 33: Combined sensitivity map for the proposed Fibre Optic Project study area between 31°13'21.7"S 22°15'34.2"E and 31°24'52.3"S 22°19'08.1"E, following the R63 road.

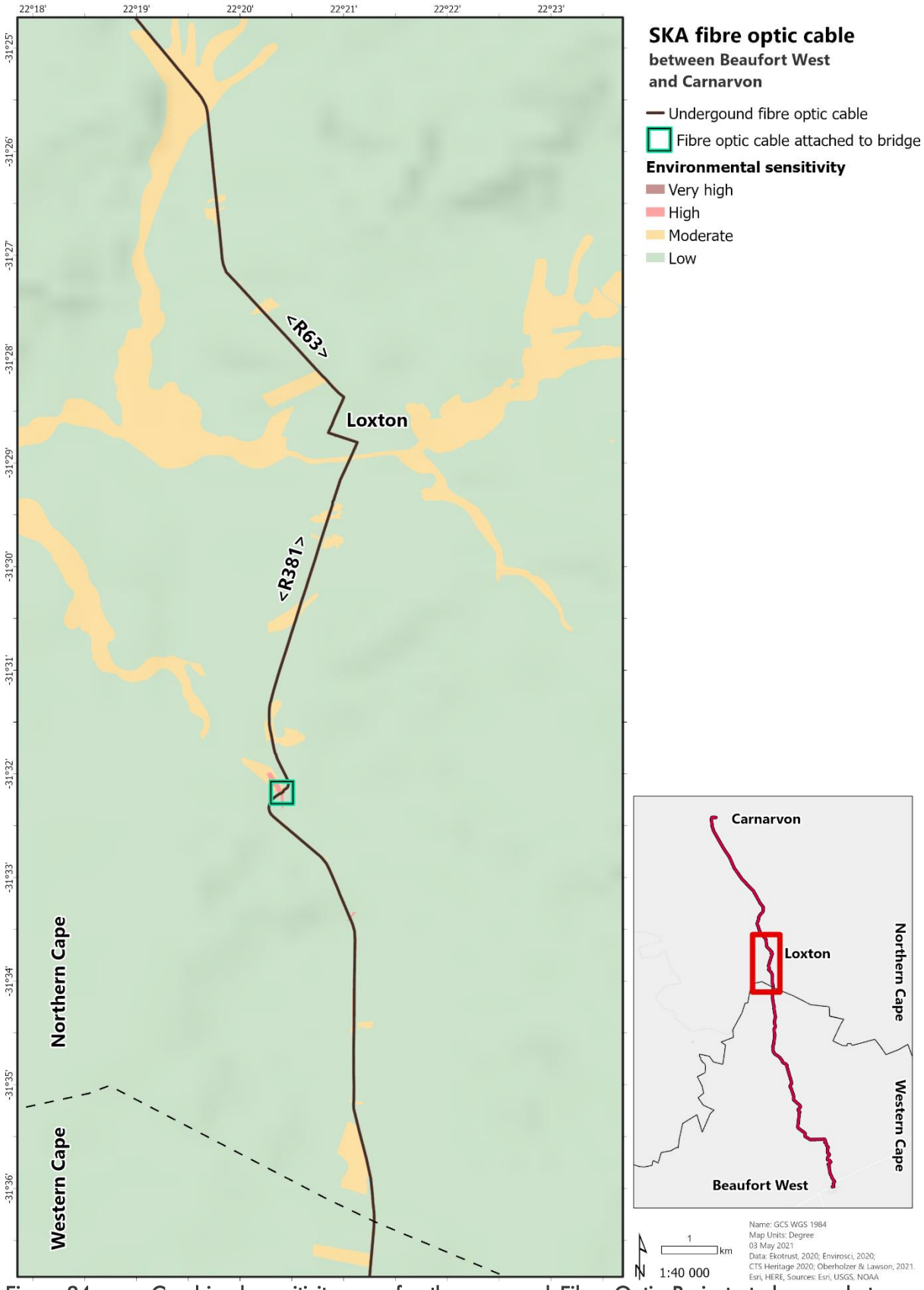


Figure 34: Combined sensitivity map for the proposed Fibre Optic Project study area between 31°24'52.3"S 22°19'08.1"E and 31°37'34.1"S 22°21'10.7"E, following the R381 and R63 roads.

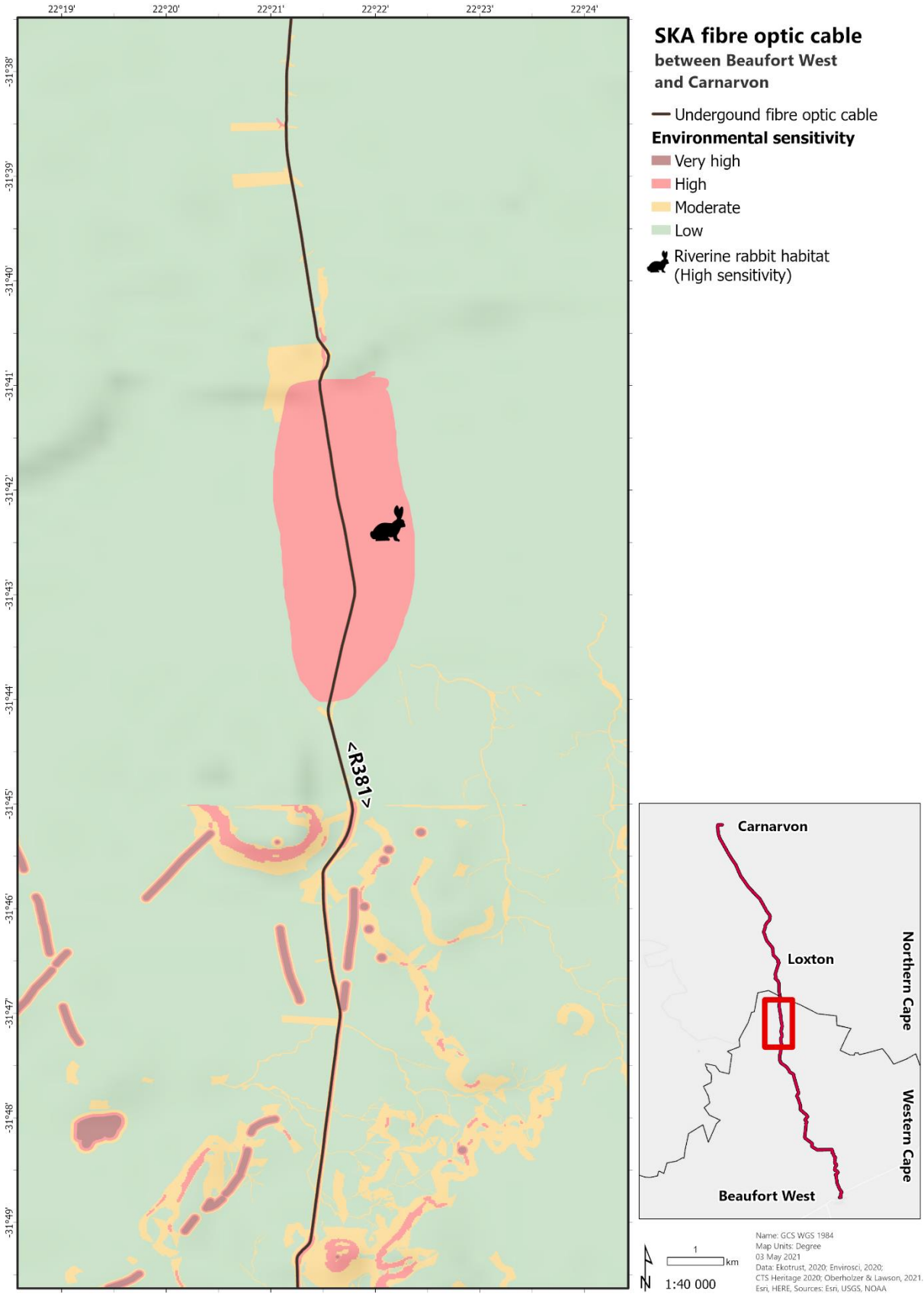


Figure 35: Combined sensitivity map for the proposed Fibre Optic Project study area between 31°37'34.1"S 22°21'10.7"E and 31°48'35.7"S 22°21'27.3"E, following the R381 road.

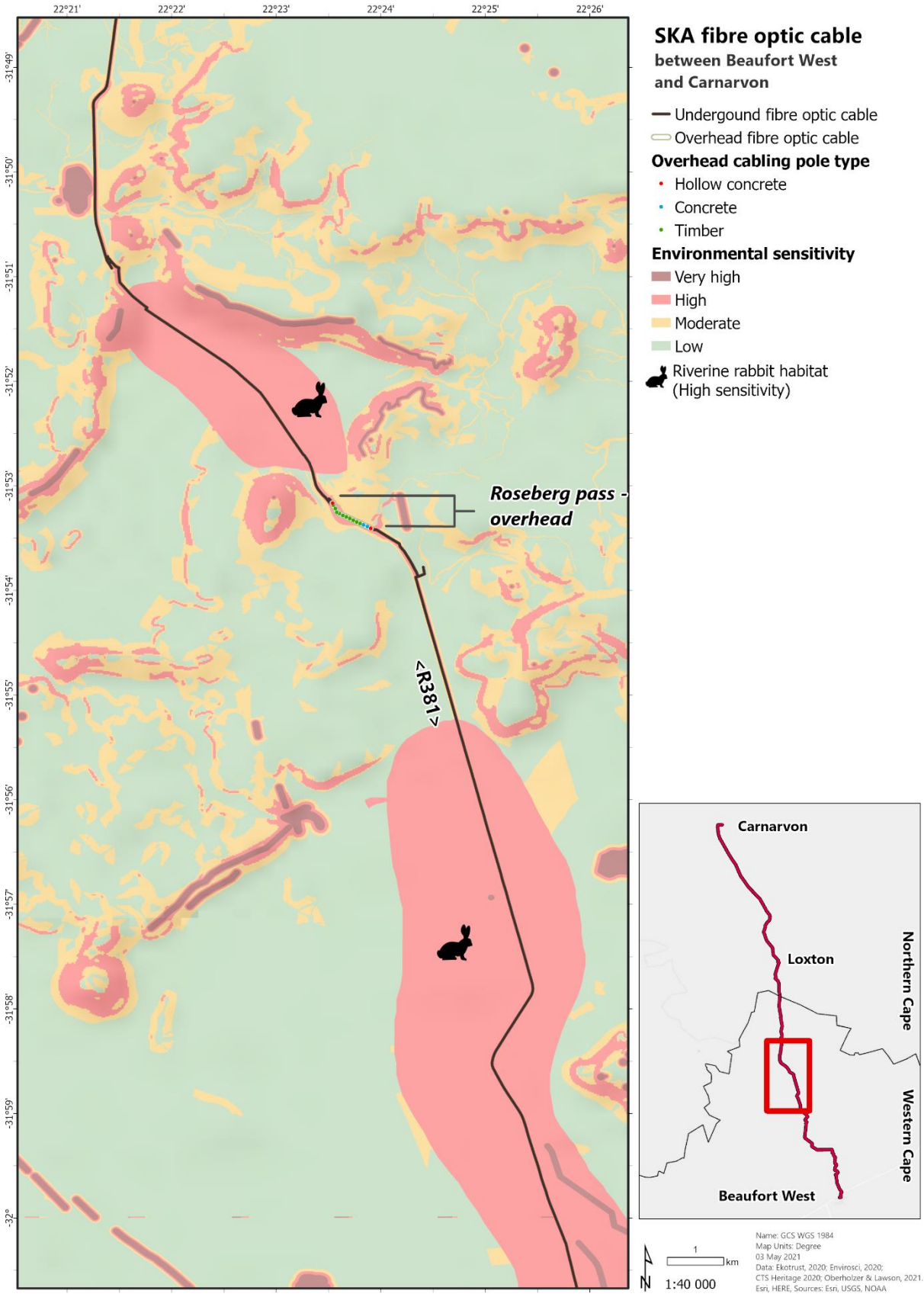


Figure 36: Combined sensitivity map for the proposed Fibre Optic Project study area between 31°48'35.7"S 22°21'27.3"E and 31°59'48.9"S 22°25'35.7"E, following the R381 road.

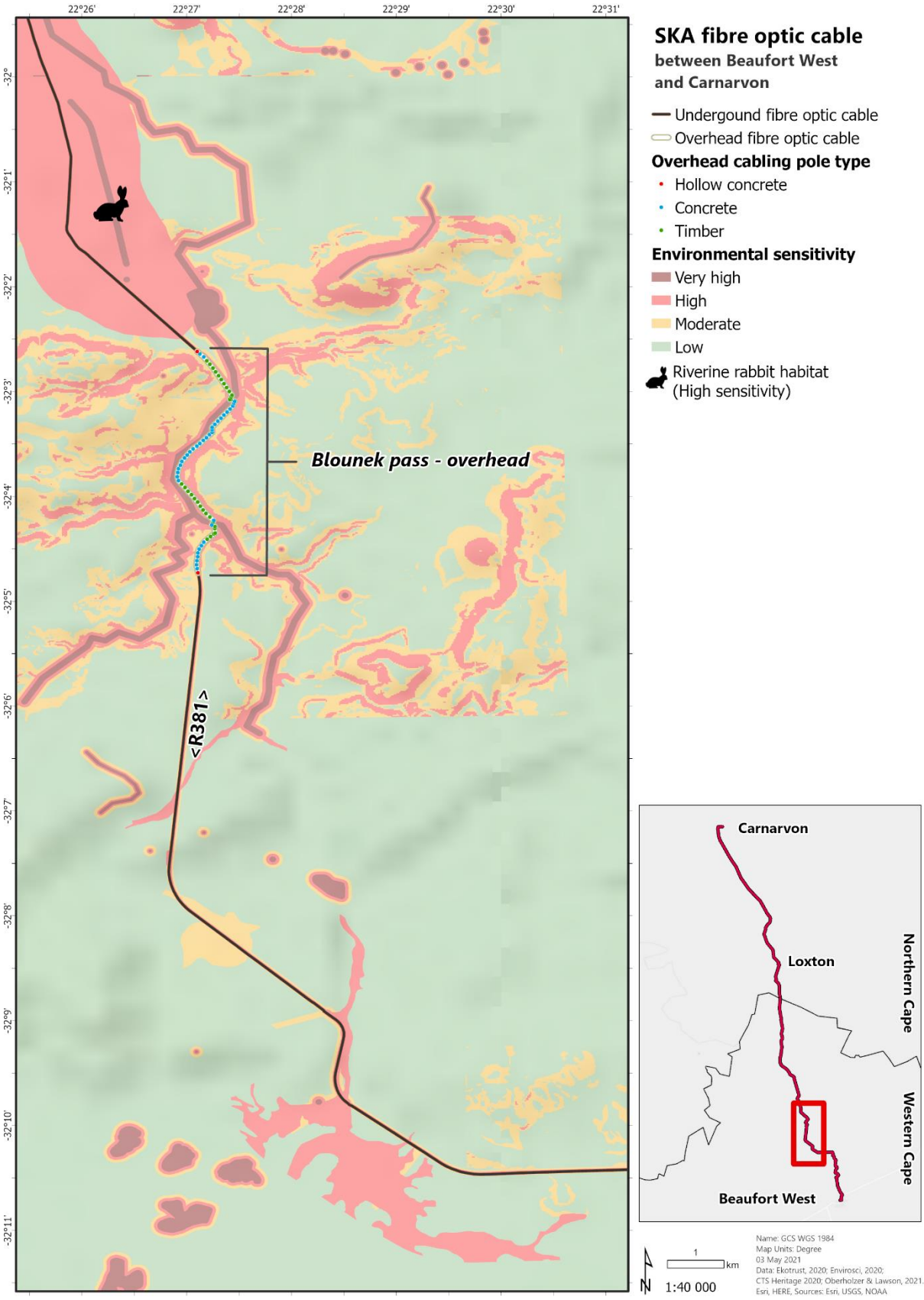


Figure 37: Combined sensitivity map for the proposed Fibre Optic Project study area between 31°59'48.9"S 22°25'35.7"E and 32°09'57.0"S 22°31'02.6"E, following the R381 road.

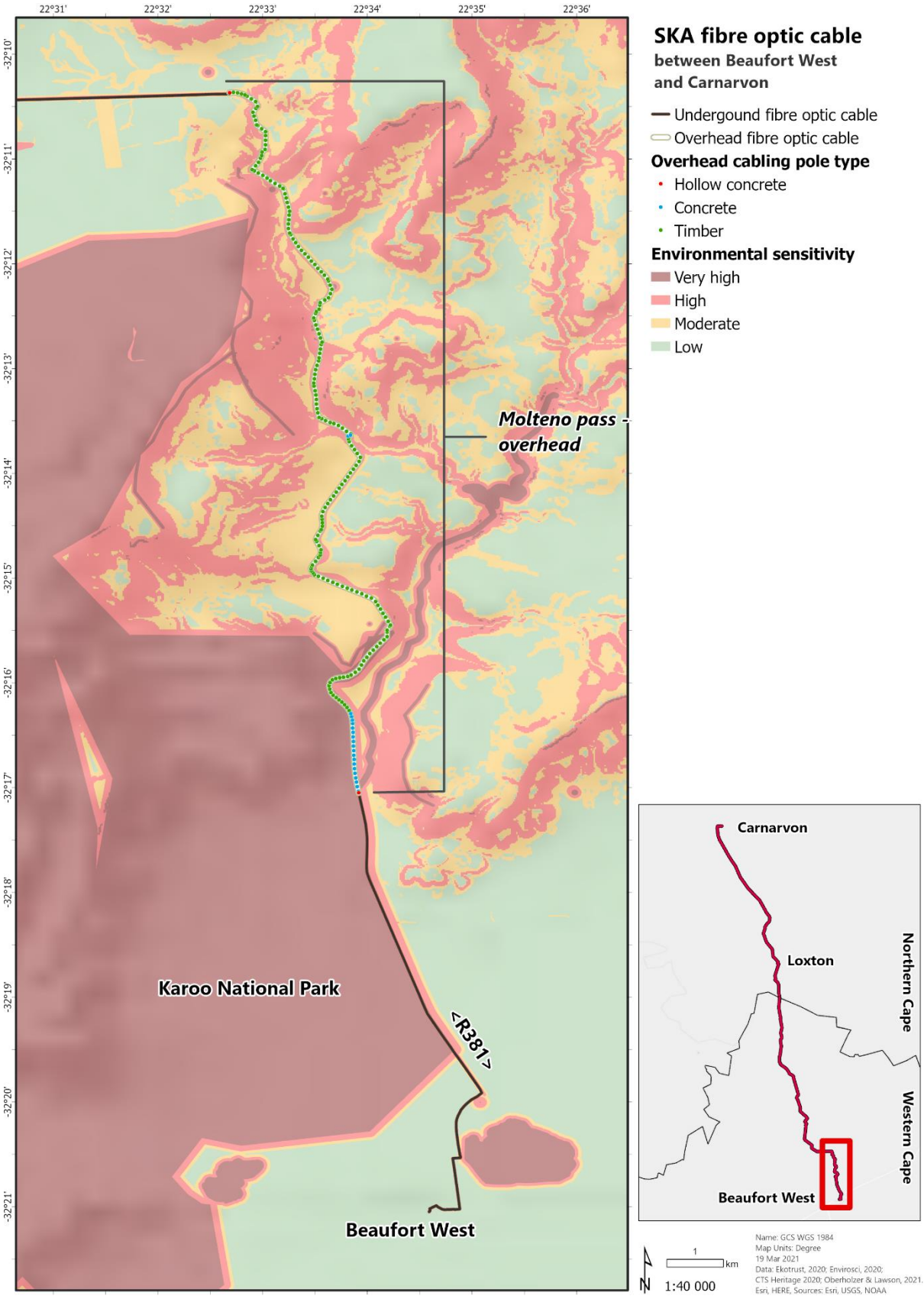


Figure 38: Combined sensitivity map for the proposed Fibre Optic Project study area between 32°09'57.0"S 22°31'02.6"E and Beaufort West, following the R381 road.

CHAPTER 8 IMPACT ASSESSMENT

8.1 Construction phase

Box 9: Construction phase impacts overview

Construction phase		Impact significance	
Theme	**Impact**	**Pre-mitigation**	**Post-mitigation**
Terrestrial ecology, biodiversity and species	Clearance of natural vegetation and resultant loss of faunal habitat.	**Low**	**Low**
	Loss of threatened, protected and endemic plants / animals.	**Low**	**Low**
	Faunal mortalities due to construction, trench digging and increased traffic.	**Low**	**Low**
	Increased dust generation and deposition.	**Very low**	**Very low**
	Increased human activity and noise levels.	**Very low**	**Very low**
	Establishment and spread of alien invasive vegetation.	**Low**	**Very low**
	Increased erosion and water runoff.	**Low**	**Very low**
Aquatic ecology, biodiversity and species	Clearance of vegetation within wetland crossings.	**Low**	**Very low**
	Clearance of vegetation within riverine (with riparian and or alluvial systems) crossings.	**Low**	**Very low**
	Loss of aquatic Species of Conservation Concern.	**Low**	**Very low**
	Compromised localised surface water quality through spills and leaks.	**Low**	**Very low**
	Erosion and sedimentation.	**Low**	**Very low**
Heritage, archaeology & palaeontology	Damage to or destruction of significant heritage resources.	**Very low**	**Very low**
Visual, aesthetic and scenic resources	Visual effect of spoil heaps from underground cable trenches, dust and noise.	**Very low**	**Very low**

8.1.1 Terrestrial ecology, biodiversity and species [30]

8.1.1.1 Clearance of natural vegetation and resultant loss of faunal habitat – direct impact

Natural vegetation will be cleared for the trench to bury the cable and for planting the overhead poles. The removal of indigenous vegetation may cause a loss of individuals of threatened, protected and endemic species and associated loss of faunal habitat. Overall, this may result in impoverished biodiversity at those sites. Vegetation loss is generally also associated with increased water runoff and erosion.

Some destruction of the vegetation adjacent to the footprint will also inevitably occur due to the use of heavy machinery to dig the trench and holes for the overhead poles. However, it is

[30] Extracted and / or summarised from Ekotrust (2020) (see Appendix 2)

anticipated that unnecessary clearance of vegetation beyond the footprint of the development can largely be avoided.

Proposed mitigation measures:

- Construction crews, in particular the drivers and operators of heavy machinery, should undergo environmental training (induction) to increase their awareness of environmental concerns.
- Vegetation clearance should be confined to the footprint of the development and unnecessary clearance should be avoided.
- The cliffs and rocky sheets should be avoided, as far as possible.

Table 16: Impact assessment – clearance of natural vegetation and resultant loss of faunal habitat during the construction phase.

Impact: Clearance of natural vegetation and resultant loss of faunal habitat during the construction phase.	
Status	Negative
Spatial extent	Site-specific
Duration	Short to medium term
Consequence (Severity)	Moderate
Probability	Very likely
Reversibility	Moderate
Irreplaceability	Low
Confidence level of assessment	High

Impact significance	
Without mitigation	**With mitigation**
Low	**Low**

8.1.1.2 Loss of threatened, protected and endemic plants / animals – direct impact

The loss of the vegetation for trench digging and pole planting may cause a loss of individuals of SCC. The site visit did not however reveal the presence of any species with an IUCN threatened status. Many provincially protected plant species were recorded, most of them are quite common and some are even weedy. The rare protected species are often habitat specialists (e.g. found on rocky sheets) – these areas should be avoided as far as possible. Where protected species cannot be avoided, permits need to be obtained for the destruction of provincially protected or specially protected species. Only one species endemic plant species was recorded during the site survey.

Proposed mitigation measures:

- The construction crews, in particular the drivers and operators of heavy machinery, should undergo environmental training (induction) to make them aware of the importance of protected species.
- Placement of the trench or poles should be done in such a way as to minimise the impact on protected species.
- Where the road is cut into hillsides / koppies, the trench should follow the bottom of the cutting and not go over the top.
- The trench and poles must be micro-sited within the approved corridor, under the advice of appointed ecological specialist/s, to avoid protected species and other key environmental sensitivities that may be identified at a fine-scale in the field.

Table 17: Impact assessment - loss of threatened, protected and endemic plants / animals during the construction phase.

Impact: Loss of threatened, protected and endemic plants / animals during the construction phase.	
Status	Negative
Spatial extent	Site-specific
Duration	Long-term
Consequence (Severity)	Moderate
Probability	Likely
Reversibility	Low
Irreplaceability	Moderate
Confidence level of assessment	Medium

Impact significance	
Without mitigation	**With mitigation**
Low	**Low**

8.1.1.3 Faunal mortalities due to construction, trench digging and increased traffic – direct impact

Faunal mortalities may be caused by groundworks during construction activities, construction vehicles and waste material. Slow-moving species such as tortoises are particularly prone to these mortalities. Animals could fall into the trench and be unable to get out unassisted. Fatalities might arise when animals ingest waste material or become ensnared in wires.

Proposed mitigation measures:

- Construction crews, in particular the drivers and operators of heavy machinery, should undergo environmental training (induction) to increase their awareness of environmental concerns. Although all road kills cannot be avoided, the increased awareness of drivers should be able to reduce the number of fatalities.
- Before trenches are dug in those areas that have been indicated as prime habitat for the riverine rabbit, the route should be walked on foot by the Environmental Control Officer (ECO) to ensure that no riverine rabbit burrows are present in the path of the trench.
- If any riverine rabbit burrows are found, the routing must be adapted (micro-sited) to avoid the burrows and any other key environmental sensitivities.
- Construction of the trench in favoured riverine rabbit habitat (see Figure 35 to Figure 37) should preferably not be conducted during the breeding season (August to May).
- Trenches should not be left open for long periods of time. Trenches should also be inspected regularly for the presence of trapped animals and immediately before they are filled.
- Proper waste management procedures should be in place to avoid waste lying around and to remove all waste material from the site.
- Speed limits should be strictly adhered to.

Table 18: Impact assessment – direct faunal mortalities due to construction, trench digging and increased traffic during the construction phase.

Impact: Direct faunal mortalities due to construction, trench digging and increased traffic during the construction phase.	
Status	Negative
Spatial extent	Site-specific
Duration	Short-term
Consequence (Severity)	Moderate
Probability	Likely
Reversibility	Low
Irreplaceability	Moderate
Confidence level of assessment	Medium

Impact significance	
Without mitigation	**With mitigation**
Low	**Low**

8.1.1.4 Increased dust generation and deposition – direct impact

The cable follows long stretches of gravel road between Beaufort West and Loxton and dust caused by vehicles may remain in the air for a long time. Increased dust deposition can harm physiological processes of plants and results in reduced photosynthetic capacity. The dust layer on the vegetation may also deter herbivores. The increased dust levels will be temporary.

Proposed mitigation measures:

- Reduce driving speeds and adhere to speed limits.
- In the event that excessive dust is generated, water may be sprayed onto the soil to control dust generation. However, due to prolonged drought and water scarcity in the region (e.g. Felix, 2020), this is the last resort option, and in which case water must be sourced from water-secure areas, with the necessary approvals in place.

Table 19: Impact assessment – increased dust generation and deposition during the construction phase.

Impact: Increased dust generation and deposition during the construction phase.	
Status	Negative
Spatial extent	Site-specific
Duration	Short-term
Consequence (Severity)	Slight
Probability	Likely
Reversibility	High
Irreplaceability	-
Confidence level of assessment	High

Impact significance	
Without mitigation	**With mitigation**
Very low	**Very low**

8.1.1.5 Increased human activity and noise levels – direct impact

Construction activities will increase human presence and noise levels at the site. These activities may adversely affect animal behaviour.

Proposed mitigation measures:

- No construction should be done at night.
- Ensure all equipment is of good quality, good condition and maintained regularly;
- Ensure that all operators of construction equipment receive proper training in the use of the equipment and that the equipment is serviced regularly off-site.

Table 20: Impact assessment – increased human activity and noise levels during the construction phase.

Impact: Increased human activity and noise levels during the construction phase	
Status	Negative
Spatial extent	Site-specific
Duration	Very short-term
Consequence (Severity)	Slight
Probability	Likely
Reversibility	High
Irreplaceability	-
Confidence level of assessment	High

Impact significance	
Without mitigation	**With mitigation**
Very low	**Very low**

8.1.1.6 Establishment and spread of alien invasive vegetation – indirect impact

As a result of the clearance of indigenous vegetation and resulting degradation, alien species might invade the area. AIS are generally more common in road reserves than the adjacent undisturbed farm land. Ten declared invasive species were recorded during the site survey. Furthermore, increased vehicle traffic may facilitate the introduction of seeds of alien species. Infestation by invasive alien species may result in changes to the structure and functioning of the ecosystem, which often exacerbates the further loss of indigenous vegetation.

Proposed mitigation measures:

- Implement a monitoring program for the early detection of alien invasive plant species.
- Employ a control program to combat declared alien invasive plant species, where they have established within the disturbance footprint (e.g. the 0.3 m wide trench and adjacent temporary spoil heap areas). Monitoring for alien invasive plant species must be undertaken every three months during all project phases.

Table 21: Impact assessment – establishment and spread of alien invasive vegetation during the construction phase.

Impact: Establishment and spread of alien invasive vegetation during the construction phase.	
Status	Negative
Spatial extent	Local
Duration	Long-term
Consequence (Severity)	Moderate
Probability	Very likely
Reversibility	Moderate
Irreplaceability	Low
Confidence level of assessment	Medium

Impact significance	
Without mitigation	**With mitigation**
Low	**Very low**

8.1.1.7 Increased erosion and water runoff – indirect impact

Increased water runoff and erosion may be caused by the clearing of the vegetation, especially against slopes and going over cuttings. It is improbable that the increased runoff and erosion will affect hydrological processes in the area and change water and silt discharge into the streams.

Proposed mitigation measures:

- Clearing of vegetation should be restricted to the footprint of the proposed development.
- Avoid trenching over road cuttings in hillsides and koppies as far as possible – rather place the trench next to the road shoulder.

Table 22: Impact assessment – increased erosion and water runoff during the construction phase.

Impact: Increased erosion and water runoff during the construction phase.	
Status	Negative
Spatial extent	Local
Duration	Medium-term
Consequence (Severity)	Moderate
Probability	Likely
Reversibility	Low
Irreplaceability	Moderate
Confidence level of assessment	Medium

Impact significance	
Without mitigation	**With mitigation**
Low	**Very low**

8.1.2 Aquatic ecology, biodiversity and species [31]

8.1.2.1 Clearance of vegetation within wetland crossings – direct impact

Several wetlands were identified along the proposed Fibre Optic Project study area, especially in the southern portion of the cable alignment. There exists the potential for clearing of valley bottom wetland vegetation within the delineated systems, whilst Pans / Depressions will be avoided.

Clearing of wetland vegetation would be limited as presently the R381 / R63 crosses these systems, while the larger systems south of Rosedene towards Beaufort West will be spanned by overhead cable installation and thus avoided.

Regardless, both means of crossing these systems would thus limit the impact on flow regime through avoidance (spanned or buried), thus limiting the potential impact on water quality, habitat and biota in the long term or operational phases of the project once the vegetation has re-established.

Proposed mitigation measures:

- Where wetland areas are not spanned by overhead cabling, the underground cables should be tied into the existing bridges. Should this not be an option, and the crossing distance is deemed suitable, then HDD is recommended.
- Failing the options above, it is suggested that hand-dug trenching occur in these areas (i.e. no mechanical trenching in delineated watercourses).
- The trench and poles must be micro-sited, under the advice of appointed ecological specialist/s, to avoid any sensitive species and / or environmental features identified at a fine-scale in the field.
- All construction activities, should be monitored by the ECO, especially during periods of river flow.
- Any points of erosion should be stabilised immediately (sand bags in the short term) using gabions, reno mattress, or similar erosion control measures, as required.
- No activities should take place outside of the demarcated site (i.e. trench width plus adjacent temporary spoil heap areas), to prevent additional cumulative impacts on these systems.

[31] Extracted and / or summarised from EnviroSci (2020) (see Appendix 3)

Table 23: Impact assessment – clearance of vegetation within wetland crossings during the construction phase.

Impact: Clearance of vegetation within wetland crossings during the construction phase.	
Status	Negative
Spatial extent	Site-specific
Duration	Short-term
Consequence (Severity)	Moderate
Probability	Likely
Reversibility	Moderate
Irreplaceability	Low
Confidence level of assessment	High

Impact significance	
Without mitigation	**With mitigation**
Low	**Very low**

8.1.2.2 Clearance of vegetation within riverine (with riparian or alluvial systems) crossings – direct impact

Clearing of any riparian vegetation or disturbance of any bed or banks of alluvial systems would be limited as the R381 / R63 roads presently cross these systems. This would limit the impact on flow regime through avoidance, and thus reduce the potential impact on water quality, habitat and biota. Coupled with the fact that the existing habitat where the cabling is proposed is accustomed to disturbance – i.e. alluvial dominated systems that transport large volumes of sediment during high flow conditions.

Proposed mitigation measures:

- Where wetland areas are not spanned by overhead cabling, the underground cables should be tied into the existing bridges. Should this not be an option, and the crossing distance is deemed suitable, then HDD is recommended.
- Failing options above, it is suggested that hand-dug trenching occur in these areas (i.e. no mechanical trenching in delineated watercourses).
- The trench and poles must be micro-sited, under the advice of appointed ecological specialist/s, so as to avoid any sensitive species and / or environmental features identified at a fine-scale in the field.
- All construction activities should be monitored by the ECO, especially during periods of river flow.
- Any points of erosion should be stabilised immediately (sand bags in the short term) using gabions, reno mattress, or similar erosion control measures, as required.
- No activities should take place outside of the demarcated site (i.e. trench width plus adjacent temporary spoil heap areas), to prevent additional cumulative impacts on these systems.

Table 24: Impact assessment – clearance of vegetation within riverine crossings during the construction phase.

Impact: Clearance of vegetation within riverine crossings during the construction phase.	
Status	Negative
Spatial extent	Site specific
Duration	Short-term
Consequence (Severity)	Moderate
Probability	Likely
Reversibility	Moderate
Irreplaceability	Low
Confidence level of assessment	High

Impact significance	
Without mitigation	**With mitigation**
Low	**Very low**

8.1.2.3 Loss of aquatic Species of Conservation Concern – direct impact

Several plant SCCs within the region are conservation worthy or are protected by the respective Provincial bodies of legislation, but no listed aquatic species were observed or recorded within any of the systems during the site survey.

Proposed mitigation measures:

- Search and Rescue should be initiated by appointed aquatic ecological specialist before construction.

Table 25: Impact assessment – loss of aquatic Species of Conservation Concern during the construction phase.

Impact: Loss of aquatic Species of Conservation Concern during the construction phase.	
Status	Negative
Spatial extent	Regional
Duration	Long-term
Consequence (Severity)	Moderate
Probability	Unlikely
Reversibility	Moderate
Irreplaceability	Low
Confidence level of assessment	High

Impact significance	
Without mitigation	**With mitigation**
Low	**Very low**

8.1.2.4 Compromised localised surface water quality through spills and leaks from construction vehicles / machinery when working in or near the delineated systems – direct impact

Oil and fuel leaks from machinery, vehicles or certain construction materials such as cement / concrete used during the construction phase have the potential to result in localised pollution, should any spill / leak occur within the watercourse / wetlands observed. These are likely to occur, but on a small scale, with quick remediation.

Proposed mitigation measures:

- No parking, refuelling or servicing of machinery and vehicles should occur within the delineated systems.
- Daily monitoring must be undertaken by the ECO.

Table 26: Impact assessment – compromised surface water quality through fuel spills / leaks during the construction phase.

Impact: Compromised surface water quality through fuel spills / leaks during the construction phase.	
Status	Negative
Spatial extent	Site-specific
Duration	Short-term
Consequence (Severity)	Moderate
Probability	Likely
Reversibility	Moderate
Irreplaceability	Low
Confidence level of assessment	High

Impact significance	
Without mitigation	**With mitigation**
Low	**Very low**

8.1.2.5 Erosion and sedimentation – direct impact

Erosion of unstable soils may result in downstream sedimentation and thus impact on localised surface water quality and lead to habitat degradation. This impact would have a limited effect on the natural watercourse / alluvial systems, as these already carry natural sediment loads when flowing, but may pose negative consequences to the wetland areas. Any disturbances within these areas, could impact on the flow and dynamics within the wetland areas in particular, although on a limited scale.

Proposed mitigation measures:

- Monitoring of potential erosion by the ECO;
- Where any unstable soils occur, these must be protected with temporary stabilisation (sand bags or hay bales dependent on the scale of the operation) until areas become revegetated.
- In areas that have been identified after construction as requiring permanent erosion protection, active revegetation is encouraged. I.e. once construction has been completed, the disturbed areas are demarcated as exclusion areas from additional disturbance, thus preventing compaction / disturbance of area.

Table 27: Impact assessment – erosion and sedimentation of watercourses during the construction phase.

Impact: Erosion and sedimentation of watercourses during the construction phase.	
Status	Negative
Spatial extent	Site-specific
Duration	Short-term
Consequence (Severity)	Moderate
Probability	Likely
Reversibility	Moderate
Irreplaceability	Low
Confidence level of assessment	High

Impact significance	
Without mitigation	**With mitigation**
Low	**Very low**

8.1.3 Heritage, archaeology and palaeontology[32]

8.1.3.1 Damage to or destruction of significant heritage resources – direct impact

The primary impact to heritage resources is likely to occur during the construction phase with excavation activities associated with trenching and digging of holes to plant poles. The activities are likely to destroy any heritage resources that are located within the proposed fibre cable route. However, based on the assessment completed, the area proposed for development has a low archaeological sensitivity. No evidence of in situ archaeological material, rock engraving sites, or graves along the proposed trench or overhead alignments were recorded.

Additionally, no historical buildings or structures older than 60 years observed within the footprint of the proposed fibre line, apart from the bridge crossing the Soutpoort river (dated 1958) north of Loxton. The cabling will be installed under the Soutpoort river via HDD – no damage / negative impact to the bridge is anticipated.

[32] Extracted and / or summarised from CTS Heritage (2020) (see Appendix 5)

Some cultural remains along the roadside are likely covered in gravel from road construction. Therefore, the possibility exists that some artefacts may only be uncovered during the digging of the trenches or holes during the installation of the fibre optic cable.

The road reserves where the fibre line will be installed in trenches are highly degraded, with large amounts of external material brought in during road construction. The mudstones in the area are also extremely fractured, decreasing the chance of fossil preservation. Only one site was identified to contain trace fossils during the site survey. For these reasons it is unlikely that the trenching to lay the fibre line will have a significant effect on the palaeontology of the area, provided that the chance fossil find procedure is followed in the possible case of a fossil being found during excavation activities during the construction phase.

No additional impacts are anticipated during the operations and maintenance, and decommissioning phases.

Proposed mitigation measures:

- A 10 m buffer must be applied around the recorded Anniversary Monument (BTC02) – i.e. no temporary structures or laydown areas, or permanent poles for overhead cabling may be placed within 10 m of this feature.
- During the construction phase excavations should be monitored for fossil remains, archaeological resources and burial sites / graves by the responsible ECO by implementing a Chance Fossils Finds Procedure.
- Should substantial heritage resources be exposed during construction, the responsible ECO should safeguard these, preferably in situ, and alert the relevant heritage authority (SAHRA in the Northern Cape; HWC in the Western Cape) so that appropriate action can be taken by a professional palaeontologist or archaeologist, as required.

Table 28: Impact assessment – damage to or destruction of significant heritage resources during the construction phase.

Impact: Damage to or destruction of significant heritage resources during the construction phase.	
Status	Negative
Spatial extent	Site specific
Duration	Short-term
Consequence (Severity)	Extreme
Probability	Extremely unlikely
Reversibility	Non-reversible
Irreplaceability	High
Confidence level of assessment	High

Impact significance	
Without mitigation	**With mitigation**
Very low	**Very low**

8.1.4 Visual, aesthetic and scenic resources[33]

Visual effect of spoil heaps from underground cable trenches, and potential dust and noise caused by excavation works – direct impact

Where the proposed cable is located underground, or where holes are excavated for poles, there could be potential visual impacts relating to spoil heaps from trenches, mainly along the road reserves. There would also be potential dust and noise caused by excavation works. These impacts would however only affect users of the roads, be fairly localised and of short term duration.

[33] Extracted and / or summarised from Oberholzer & Lawson (2021) (see Appendix 6)

Proposed mitigation measures:

- Adherence to construction methods and best practice (e.g. trench backfilling in 1 – 2 days).

Table 29: Impact assessment – visual effect of spoil heaps, dust and noise during the construction phase.

Impact: Visual effect of spoil heaps, dust and noise during the construction phase.	
Status	Negative
Spatial extent	Site specific
Duration	Short-term
Consequence (Severity)	Slight
Probability	Likely
Reversibility	High
Irreplaceability	Low
Confidence level of assessment	High

Impact significance	
Without mitigation	**With mitigation**
Very low	**Very low**

8.2 Operations and maintenance phase

Box 10: Operations and maintenance phase impacts overview

Operations and maintenance phase		**Impact significance**	
Theme	**Impact**	**Pre-mitigation**	**Post-mitigation**
Terrestrial ecology, biodiversity and species	Faunal mortalities.	**Low**	**Very low**
	Establishment and spread of alien invasive vegetation.	**Low**	**Very low**
Aquatic ecology, biodiversity and species	Creation of hard surfaces, resulting in runoff, erosion and sedimentation.	**Low**	**Very low**
Visual, aesthetic and scenic resources	Visual intrusion of overhead cables in the landscape, and visual clutter of poles where cable is routed close to the road.	**Moderate**	**Moderate**

8.2.1 Terrestrial ecology, biodiversity and species [34]

8.2.1.1 Faunal mortalities – direct impact

Faunal mortalities may be caused by maintenance vehicles or other maintenance activities and waste material. Slow-moving species such as tortoises are particularly prone to road mortalities. Fatalities might also arise when animals ingest waste material or become ensnared in wires. Bird collisions might occur with the overhead cable.

Proposed mitigation measures:

- The maintenance crew should undergo environmental training to increase their awareness of environmental concerns.
- All excess cables and waste material should be removed from the site and properly disposed of.

[34] Extracted and / or summarised from Ekotrust (2020) (see Appendix 2)

- A monitoring programme[35] should be initiated to determine the extent of bird collisions with the overhead cable. If recorded annual collision rates of Red Data species exceed the mortality threshold of the directly affected populations of those species (thresholds and species as determined by an avifaunal specialist after consultation with other avifaunal specialists and BirdLife South Africa), bird flight diverters should be attached to the sections demarcated by the avifaunal specialist
- Speed limits should be strictly adhered to.

Table 30: Impact assessment – direct faunal mortalities during the operations and maintenance phase.

Impact: Direct faunal mortalities during the operations and maintenance phase.	
Status	Negative
Spatial extent	Site-specific
Duration	Short-term (possibly long-term)
Consequence (Severity)	Moderate
Probability	Unlikely
Reversibility	Moderate
Irreplaceability	Low
Confidence level of assessment	Medium

Impact significance	
Without mitigation	**With mitigation**
Low	**Very low**

8.2.1.2 Establishment and spread of alien invasive vegetation – indirect impact

As a result of the loss of indigenous vegetation and resulting degradation, alien species might invade the area. Alien invasive species are generally more common in road reserves than the adjacent undisturbed farmland. The invasion by alien species will continue unless controlled. Increased vehicle traffic may further facilitate the introduction of seeds of alien species. Infestation by invasive alien species may cause changes to the structure and functioning of the ecosystem which often exacerbates the further loss of indigenous vegetation.

Proposed mitigation measures:

- Implement a monitoring program for the early detection of alien invasive plant species.
- Employ a control program to combat declared alien invasive plant species, where they have established within the disturbance footprint (e.g. the 0.3 m wide trench and adjacent temporary spoil heap areas). Monitoring for alien invasive plant species must be undertaken every three months during all project phases.

Table 31: Impact assessment: establishment of alien invasive vegetation during the operations and maintenance phase.

Impact: Establishment and spread of alien vegetation during the operations and maintenance phase.	
Status	Negative
Spatial extent	Local
Duration	Long-term
Consequence (Severity)	Moderate
Probability	Likely
Reversibility	Moderate
Irreplaceability	Low
Confidence level of assessment	Medium

Impact significance	
Without mitigation	**With mitigation**
Low	**Very low**

[35] This study need not be done in accordance to Appendix 6 of the NEMA EIA Regulations, but is only is only needed to determine areas of known flight paths and collisions so that bird flappers can be installed on identified sections.

8.2.2 Aquatic ecology, biodiversity and species [36]

8.2.2.1 Creation of hard surfaces, resulting in runoff, erosion and sedimentation – direct impact

This impact would be limited to any additional hard surface areas, although limited to manhole structures and any supporting infrastructure. These structures may generate surface water runoff, which in turn may cause erosion and downstream sedimentation. Noting the alluvial nature of the receiving environment and the size and position of the structures, this impact is unlikely to occur.

Proposed mitigation measures:

- Monitoring should occur monthly for 6 months post-construction.
- Any unstable soils must be protected with temporary stabilisation dependent on the scale of the impact (i.e. sand bags, hay bales, or similar) until areas become revegetated.
- In areas that have been identified after construction as requiring permanent erosion protection, active revegetation is encouraged. I.e. once construction has been completed, the disturbed areas are demarcated as exclusion areas from additional disturbance, thus preventing compaction / disturbance of area.

Table 32: Impact assessment – runoff, erosion and sedimentation from hard surfaces during the operations and maintenance phase.

Impact: Runoff, erosion and sedimentation from hard surfaces during the operations and maintenance phase.	
Status	Negative
Spatial extent	Site-specific
Duration	Short-term
Consequence (Severity)	Moderate
Probability	Unlikely
Reversibility	Moderate
Irreplaceability	Low
Confidence level of assessment	High

Impact significance	
Without mitigation	**With mitigation**
Low	**Very low**

8.2.3 Visual, aesthetic and scenic resources[37]

8.2.3.1 Visual intrusion of overhead cables in the landscape, and visual clutter of poles where cable is routed close to the road – direct impact

The overhead cabling sections could create potential visual intrusion in the scenic landscape, particularly when visible on the skyline, on the scenic Molteno Pass, as well as other smaller passes and *poorts.* In addition, there would be potential visual clutter of poles where the cable is routed close to the R381 Road.

[36] Extracted and / or summarised from EnviroSci (2020) (see Appendix 3)
[37] Extracted and / or summarised from Oberholzer & Lawson (2021) (see Appendix 6)

Proposed mitigation measures[38]:

- Locate new poles for the fibre optic cabling in the same corridor as the existing Eskom powerline, where possible.
- Install cabling underground, where feasible.
- Locate poles in low-lying areas or valleys and avoid ridgelines, where possible.

Table 33: Impact assessment – visual intrusion and clutter of overhead cabling during the operations and maintenance phase.

Impact: Visual intrusion and clutter of overhead cabling during the operations and maintenance phase.	
Status	Negative
Spatial extent	Local
Duration	Long-term
Consequence (Severity)	Substantial
Probability	Likely
Reversibility	High
Irreplaceability	Low
Confidence level of assessment	High

Impact significance	
Without mitigation	**With mitigation**
Moderate	**Moderate**

8.3 Decommissioning phase

Box 11: Decommissioning phase impacts overview

Decommissioning phase		**Impact significance**	
Theme	**Impact**	**Pre-mitigation**	**Post-mitigation**
Terrestrial ecology, biodiversity and species	Clearance of natural vegetation.	**Very low**	**Very low**
	Faunal mortalities.	**Low**	**Very low**
	Establishment and spread of alien invasive vegetation.	**Very low**	**Very low**
Aquatic ecology, biodiversity and species	Clearance of vegetation within wetland crossings.	**Low**	**Very low**
	Clearance of vegetation within riverine (with riparian and or alluvial systems) crossings.	**Low**	**Very low**
	Loss of species of Conservation Concern.	**Low**	**Very low**
	Compromised localised surface water quality through spills and leaks.	**Low**	**Very low**
	Erosion and sedimentation of watercourses.	**Low**	**Very low**
Visual, aesthetic and scenic resources	Visual impact of abandoned poles and overhead cabling.	**Moderate**	**Very low**

[38] The options to mitigate potential visual impacts are constrained by the practical and technical feasibility of installing the overhead cabling in the difficult terrain associated with the Molteno, Blounek and Roseberg passes.

8.3.1 Terrestrial ecology, biodiversity and species [39]

8.3.1.1 Clearance of natural vegetation – direct impact

Clearing of natural vegetation will be limited to the small sites where the infrastructure will be removed. Due to the small area that will be impacted, it is unlikely that individuals of threatened, protected and endemic species will be lost or that any appreciable loss of faunal habitat will occur.

Proposed mitigation measures:

- Unnecessary clearance of natural vegetation should be avoided.

Table 34: Impact assessment – clearance of natural vegetation during the decommissioning phase.

Impact: Clearance of natural vegetation during the decommissioning phase.	
Status	Negative
Spatial extent	Site-specific
Duration	Short-term
Consequence (Severity)	Slight
Probability	Very unlikely
Reversibility	Moderate
Irreplaceability	Low
Confidence level of assessment	Medium

Impact significance	
Without mitigation	**With mitigation**
Very low	**Very low**

8.3.1.2 Faunal mortalities – direct impact

Faunal mortalities may be caused by vehicles or other decommissioning activities and waste. Slow-moving species such as tortoises are particularly prone to road mortalities. Fatalities might also arise when animals ingest waste material or become ensnared in it.

Proposed mitigation measures:

- Decommissioning crew should undergo environmental training to increase their awareness of environmental concerns.
- Speed limits should be adhered to.
- Proper waste management procedures should be in place and no material should be left on site to prevent instances of ensnarement or ingestion of foreign material by fauna.

Table 35: Impact assessment: direct faunal mortalities during the decommissioning phase.

Impact: Direct faunal mortalities during the decommissioning phase.	
Status	Negative
Spatial extent	Site-specific
Duration	Short-term
Consequence (Severity)	Moderate
Probability	Likely
Reversibility	Moderate
Irreplaceability	Low
Confidence level of assessment	Medium

Impact significance	
Without mitigation	**With mitigation**
Low	**Very low**

[39] Extracted and / or summarised from Ekotrust (2020) (see Appendix 2)

8.3.1.3 Establishment and spread of alien invasive vegetation – indirect impact

Invasion by alien invasive species is an ongoing process and will usually follow after any soil disturbance and loss of vegetation. Alien invasive species are generally more common in road reserves than the adjacent undisturbed farmland. Disturbance during the decommissioning phase is, however, expected to be minimal.

Proposed mitigation measures:

- Implement a monitoring program for the early detection of alien invasive plant species.
- Employ a control program to combat declared alien invasive plant species, where they have established within the disturbance footprint (e.g. the 0.3 m wide trench and adjacent temporary spoil heap areas).

Table 36: Impact assessment - Establishment and spread of alien invasive vegetation during the decommissioning phase.

Impact: Establishment and spread of alien invasive vegetation during the decommissioning phase.	
Status	Negative
Spatial extent	Local
Duration	Long-term
Consequence (Severity)	Slight
Probability	Likely
Reversibility	Moderate
Irreplaceability	Low
Confidence level of assessment	Medium

Impact significance	
Without mitigation	**With mitigation**
Very low	**Very low**

8.3.2 Aquatic ecology, biodiversity and species [40]

8.3.2.1 Clearance of vegetation within wetland crossings – direct impact

Any wetland vegetation that had re-established would need would be cleared at small sites as required. As in the construction phase this would be limited to the road reserves where the R381 / R63 cross the watercourse systems, while the larger systems south of Rosedene towards Beaufort West will have overhead lines, i.e. spanned and thus avoided.

Proposed mitigation measures:

- Any decommissioning activities should be monitored by the appointed ECO on a daily basis, especially during periods of river flow.
- Any points of erosion should be stabilised immediately (sand bags in the short term) using gabions and reno mattress, or similar erosion control measures, as required.
- No activities should take place outside of the demarcated site (i.e. trench width plus adjacent temporary spoil heap areas), to prevent additional cumulative impacts on these systems.

[40] Extracted and / or summarised from EnviroSci (2020) (see Appendix 3)

Table 37: Impact assessment – clearance of vegetation within wetland crossings during the decommissioning phase.

Impact: Clearance of vegetation within wetland crossings during the decommissioning phase.	
Status	Negative
Spatial extent	Site-specific
Duration	Short-term
Consequence (Severity)	Moderate
Probability	Likely
Reversibility	Moderate
Irreplaceability	Low
Confidence level of assessment	High

Impact significance	
Without mitigation	**With mitigation**
Low	**Very low**

8.3.2.2 *Clearance of vegetation within riverine (with riparian and or alluvial systems) crossings – direct impact*

Clearing of any riparian vegetation that re-established post construction or disturbance of any bed or banks of alluvial systems would be limited to the road reserves of the R381 / R63 currently crossing these systems. This would limit the impact on flow regime through avoidance, and thus reduce the potential impact on water quality, habitat and biota. Coupled with the fact that the existing habitat where the cabling is proposed is accustomed to disturbance – i.e. alluvial dominated systems that transport large volumes of sediment during high flow conditions.

Recommended mitigation measures:

- Any decommissioning activities, should also be monitored by the appointed ECO daily, especially during periods of river flow.
- Any points of erosion should be stabilised immediately (sandbags in the short term) using gabions and reno mattress, or similar erosion control measures, as required.
- No activities should take place outside of the demarcated site (i.e. trench width plus adjacent temporary spoil heap areas), to prevent additional cumulative impacts on these systems.

Table 38: Impact assessment – clearance of vegetation within riverine crossings during the decommissioning phase.

Impact: Clearance of vegetation within riverine crossings during the decommissioning phase.	
Status	Negative
Spatial extent	Site-specific
Duration	Short-term
Consequence (Severity)	Moderate
Probability	Likely
Reversibility	Moderate
Irreplaceability	Low
Confidence level of assessment	High

Impact significance	
Without mitigation	**With mitigation**
Low	**Very low**

8.3.2.3 Loss of species of Conservation Concern – direct Impact

Several plant SCCs within the region are conservation worthy or are protected by the respective Provincial bodies of legislation, but no listed species were observed or recorded within any of the systems during the site survey. However, SCCs may establish between the construction and decommissioning phases.

Proposed mitigation measures:

- Search and Rescue of SCCs that may have established should be initiated, by an appointed aquatic ecological specialist, before decommissioning.

Table 39: Impact assessment – loss of aquatic Species of Conservation Concern during the decommissioning phase.

Impact: Loss of aquatic Species of Conservation Concern during the decommissioning phase.	
Status	Negative
Spatial extent	Regional
Duration	Long-term
Consequence (Severity)	Moderate
Probability	Unlikely
Reversibility	Moderate
Irreplaceability	Low
Confidence level of assessment	High

Impact significance	
Without mitigation	**With mitigation**
Low	**Very low**

8.3.2.4 Compromised localised surface water quality through spills and leaks from vehicles / machinery when working in or near the delineated systems – direct impact

Oil and fuel leaks from machinery, vehicles or certain materials such as cement / concrete used during the decommissioning phase have the potential to result in localised pollution, should any spill / leaks occur within the watercourse / wetlands observed. These are likely to occur, but on a small scale, with quick remediation.

Proposed mitigation measures:

- No parking, refuelling or servicing of machinery and vehicles should occur within the delineated systems.
- Monitoring of potential spills and leaks must be undertaken by the ECO.

Table 40: Impact assessment – compromised surface water quality through fuel spills / leaks during the decommissioning phase.

Impact: Compromised surface water quality through fuel spills / leaks during the decommissioning phase.	
Status	Negative
Spatial extent	Site specific
Duration	Short-term
Consequence (Severity)	Moderate
Probability	Likely
Reversibility	Moderate
Irreplaceability	Low
Confidence level of assessment	High

Impact significance	
Without mitigation	**With mitigation**
Low	**Very low**

8.3.2.5 Erosion and sedimentation of watercourses – direct impact

Erosion of unstable soils may result in downstream sedimentation and thus impact localised surface water quality and lead to habitat degradation. This impact would have a limited effect on the natural watercourse / alluvial systems, as these already carry natural sediment loads when flowing, but may pose negative consequences to the wetland areas. Any disturbances within these areas, could impact on the flow and dynamics within the wetland areas in particular, although on a limited scale.

Proposed mitigation measures:

- Monitoring of potential erosion by the ECO;
- Where any unstable soils occur, these must be protected with temporary stabilisation (sandbags or hay bales dependent on the scale of the operation) until areas become revegetated.
- In areas that have been identified after construction as requiring permanent erosion protection, active revegetation is encouraged. I.e. once construction has been completed, the disturbed areas are demarcated as exclusion areas from additional disturbance, thus preventing compaction / disturbance of area.

Table 41: Impact assessment – erosion and sedimentation of watercourses during the decommissioning phase.

Impact: Erosion and sedimentation of watercourses during the decommissioning phase.	
Status	Negative
Spatial extent	Site-specific
Duration	Short-term
Consequence (Severity)	Moderate
Probability	Likely
Reversibility	Moderate
Irreplaceability	Low
Confidence level of assessment	High

Impact significance	
Without mitigation	**With mitigation**
Low	**Very low**

8.3.3 Visual, aesthetic and scenic resources[41]

8.3.3.1 Visual impact of abandoned poles and overhead cabling – direct impact

Ongoing potential visual impact of abandoned poles and overhead cabling may occur, if these are not removed after decommissioning. However, mitigation is feasible if the infrastructure is removed and the site rehabilitated, in which case scenic resources would be restored.

Proposed mitigation measures:

- Overhead poles and cabling to be removed after decommissioning.
- Affected area to be rehabilitated as per terrestrial and aquatic specialist specifications.

[41] Extracted and / or summarised from Oberholzer & Lawson (2021) (see Appendix 6)

Table 42: Impact assessment – visual impact of abandoned overhead cabling during the decommissioning phase.

Impact: Visual impact of abandoned overhead cabling during the decommissioning phase.	
Status	Negative
Spatial extent	Local
Duration	Long-term
Consequence (Severity)	Substantial
Probability	Likely
Reversibility	High
Irreplaceability	Low
Confidence level of assessment	High

Impact significance	
Without mitigation	**With mitigation**
Moderate	**Very low**

8.4 Cumulative impacts

Box 12: Cumulative impacts overview

The larger region, especially the Gamka Karoo areas are experiencing developmental pressures from renewable energy development, prospective mining and hydrocarbons exploration, and urban expansion in the Beaufort West area.

It is important to note that the contribution of the fibre optic cable, predominantly installed in previously disturbed road reserve, to these impacts are relatively small to negligible, resulting in overall low to very low cumulative impact.

Cumulative impacts		**Impact significance**	
Theme	**Impact**	**Pre-mitigation**	**Post-mitigation**
Terrestrial ecology, biodiversity and species	Vegetation loss, habitat destruction, loss of SCCs, compromised CBAs, soil erosion.	**Very low**	**Very low**
	Vegetation loss and habitat destruction due to main developments in the **Gamka Karoo*** (e.g. renewable energy, minerals and hydrocarbons exploration and exploitation and urban expansion).	**Low**	**Very low**
	Loss of SCCs due to all developments in the **Gamka Karoo***.	**Low**	**Low**
	Compromised integrity of CBAs, Ecological Support Areas (ESAs) and National Protected Areas Expansion Strategy (NPAES) focus areas due to all developments in the **Gamka Karoo***.	**Low**	**Low**
	Increased erosion and water runoff due to all developments in the **Gamka Karoo***.	**Low**	**Low**
Aquatic ecology, biodiversity and species	Disturbance to watercourse flow regimes and aquatic habitats.	**Low**	**Very low**
Heritage, archaeology & palaeontology	Disturbance to or destruction of heritage resources.	**Very low**	**Very low**
Visual, aesthetic and scenic resources	Cumulative visual impacts during the construction phase.	**Very low**	**Very low**
	Cumulative visual impacts during the operations and maintenance phase.	**Moderate**	**Moderate**
	Cumulative visual impacts during the decommissioning phase.	**Moderate**	**Very low**
***** *Approximately 9.5 km (~ 5 %) of the fibre optic cabling is proposed in the Gamka Karoo vegetation type.*			

The following existing and potential future developments in the broader region in which the Fibre Optic Project is proposed were considered in determining cumulative impacts:

- Existing road/s and other linear infrastructure currently in the road reserve as observed in the field (powerlines, telephone lines);
- Renewable energy projects around Beaufort West[42];
- Housing developments near Beaufort West; and
- Proposed uranium mining and shale gas extraction.

8.4.1 Terrestrial ecology, biodiversity and species [43]

The majority of larger developments (e.g. renewable energy, uranium mining) within the proposed Fibre Optic Project study area are located close to Beaufort West, predominantly in the Gamka Karoo vegetation type with some sections in the Southern Karoo Riviere. Only about 4 % of the route of the fibre-optic cable passes through the Gamka Karoo and this section is highly degraded due to its close proximity to Beaufort West.

Developments in the Eastern Upper Karoo include the proposed shale gas exploration, mining for an unspecific mineral and the powerline in the Karoo National Park. The powerline follows the R381 for part of its course and is thus in the same proximity as the proposed fibre-optic route. However, powerlines on the smaller roads generally do not occur in the road reserve. The project with the greatest negative impact would be the proposed shale gas extraction, since it coincides with the habitat of the riverine rabbit.

The assessment of cumulative impacts to terrestrial ecology, biodiversity and species is thus focused on the Gamka Karoo vegetation type which faces the most pressures from other types of development that would require large-scale vegetation clearing. In the other vegetation types cumulative impacts will be low.

It is important to note that the contribution of the fibre optic cable, predominantly installed in the previously disturbed road reserve, to these impacts in the Gamka Karoo is negligible.

8.4.1.1 Vegetation loss and habitat destruction due to all developments in the Gamka Karoo

Vegetation loss and habitat destruction will occur due to larger-scale developments in the region. The habitat destruction will lead to changes in the physical features of the habitat, with concomitant changes in ecological processes. Secondary vegetation will develop at sites where the vegetation was cleared or the soil compacted. The species composition may change and alien species might invade. Vegetation loss will also constitute the loss of animal habitat. Considering all the developments in the region, the most severe impact will be on the Gamka Karoo's fauna and flora.

[42] 12/12/20/2133: 19MW Photovoltaic Solar Facility Proposed By Lurama 214 Pty Ltd On Portion 1 Of The Farm Steenrotsfontein 168, Beaufort West, Western Cape; 12/12/20/2286: Beaufort West Photovoltaic Park On Portion 9 Of The Farm 161 Kuilspoort in The Western Cape Province; 14/12/16/3/3/2/406: Wind and solar facility on Farm Lombaardskraal, Farm 330, Beaufort West, Western Cape; 14/12/16/3/3/2/772: Establishment of the Beaufort West Solar Power Plant Site 1; 14/12/16/3/3/2/773: Establishment of the Beaufort West Solar Power Plant Site 2; 14/12/16/3/3/2/774: Beaufort West Solar Power Plant Site 3.

[43] Extracted and / or summarised from Ekotrust (2020) (see Appendix 2)

Proposed mitigation measures:

- The proposed Fibre Optic Project should adhere to the site-specific environmental management recommendations to ensure that impacts are mitigated as far as possible to reduce its contribution towards cumulative impacts.

Table 43: Impact assessment - cumulative vegetation loss and habitat destruction due to all developments in the Gamka Karoo.

Impact: Cumulative vegetation loss and habitat destruction due to all developments in the Gamka Karoo.	
Status	Negative
Spatial extent	Regional
Duration	Long-term
Consequence (Severity)	Moderate (in Gamka Karoo)
Probability	Likely
Reversibility	Moderate
Irreplaceability	Low
Confidence level of assessment	Medium

Impact significance	
Without mitigation	**With mitigation**
Low	**Very low**

8.4.1.2 Loss of Species of Conservation Concern due to all developments in the Gamka Karoo

The loss of vegetation in the Gamka Karoo might cause the loss of SCC. This would primarily be applicable to threatened and rare plant species that have a restricted distribution range. Although the fibre-optic cable will not contribute to the loss of SCC, the other projects might do so. In the Eastern Upper Karoo the riverine rabbit populations could be affected.

Proposed mitigation measures:

- The proposed Fibre Optic Project should adhere to the site-specific environmental management recommendations to ensure that impacts are mitigated as far as possible to reduce its contribution towards cumulative impacts.

Table 44: Impact assessment – cumulative loss of Species of Conservation Concern in the Gamka Karoo.

Impact: Cumulative loss of Species of Conservation Concern in the Gamka Karoo.	
Status	Negative
Spatial extent	Regional
Duration	Long-term
Consequence (Severity)	Moderate (in Gamka Karoo)
Probability	Likely
Reversibility	Low to moderate
Irreplaceability	Low
Confidence level of assessment	Medium

Impact significance	
Without mitigation	**With mitigation**
Low	**Low**

8.4.1.3 Compromised integrity of CBAs, ESAs and NPAES focus areas due to all developments in the Gamka Karoo

According to the mapping of CBAs in the Western and Northern Cape, several of the proposed new developments are proposed within / partially within CBAs. Development within CBAs is generally not encouraged as such development may result in biodiversity loss and therefore compromise the integrity of the CBA. The loss of the area might also affect the future suitability of the terrain as protected area, although only a small portion next to the Karoo National Park is

earmarked for the National Protected Area Expansion. Considering the large number of developments in the Gamka Karoo, the CBAs in this vegetation type could be compromised and consequently, the biodiversity target for the ecosystem could be affected.

The site survey and this assessment have confirmed that the road reserves in which the Fibre Optic Project is predominantly proposed are not representative of the adjacent land on which the CBA classification has been based. Road reserves have been highly disturbed and degraded and often still contain piles of gravel used for road construction.

Proposed mitigation measures:

- The proposed Fibre Optic Project should adhere to the site-specific environmental management recommendations to ensure that impacts are mitigated as far as possible to reduce its contribution towards cumulative impacts.

Table 45: Impact assessment – cumulative compromised integrity of CBAs, ESAs and NPAES focus areas.

Impact: Cumulative compromised integrity of CBAs, ESAs and NPAES focus areas.	
Status	Negative
Spatial extent	Regional
Duration	Long-term
Consequence (Severity)	Moderate (in Gamka Karoo)
Probability	Likely
Reversibility	Low to moderate
Irreplaceability	Low
Confidence level of assessment	Medium

Impact significance	
Without mitigation	**With mitigation**
Low	**Low**

8.4.1.4 Increased erosion and water runoff due to all developments in the Gamka Karoo

Increased water runoff and erosion, especially on steeper areas, will alter hydrological processes and might affect catchments and downstream habitats. This is primarily relevant in the Upper Karoo Hardeveld Vegetation Type and might affect ecological functioning of the Gamka Karoo.

Proposed mitigation measures:

- The proposed Fibre Optic Project should adhere to the site-specific environmental management recommendations to ensure that erosion impacts are mitigated as far as possible to reduce its contribution towards cumulative impacts.

Table 46: Impact assessment – cumulative increased erosion and runoff.

Impact: Cumulative increased erosion and water runoff.	
Status	Negative
Spatial extent	Regional
Duration	Long-term
Consequence (Severity)	Moderate (in Gamka Karoo)
Probability	Likely
Reversibility	Low to moderate
Irreplaceability	Low
Confidence level of assessment	Medium

Impact significance	
Without mitigation	**With mitigation**
Low	**Low**

8.4.2 Aquatic ecology, biodiversity and species [44]

It is unlikely that the proposed Fibre Optic Project would contribute to additional or ongoing impacts on the aquatic environment. This is based on the fact that once the trenched areas are stable / vegetated, the buried cable sleeves would not create any additional disturbances to the flow regime and aquatic habitats observed. This is assuming that the mitigation in the construction, operational and decommissioning phases are adhered to.

8.4.2.1 Disturbance to watercourse flow regimes and aquatic habitats

Cumulative impact of the present-day roads and other linear infrastructure that require watercourse crossings, combined with the proposed Fibre Optic Project activities that include disturbance to vegetation and soils within watercourses and aquatic zones.

Proposed mitigation measures:

- The proposed Fibre Optic Project should adhere to the site-specific environmental management recommendations to ensure that impacts are mitigated as far as possible to reduce its contribution towards cumulative impacts – including:
  - Avoidance of identified sensitive systems;
  - Utilising existing disturbance corridors (i.e. road reserve);
  - Stabilisation of soils at erosion points;

Table 47: Impact assessment – cumulative disturbance to watercourse flow regimes and aquatic habitats.

Impact: Cumulative disturbance to watercourse flow regimes and aquatic habitats.	
Status	Negative
Spatial extent	Site-specific
Duration	Short-term
Consequence (Severity)	Low
Probability	Unlikely
Reversibility	Moderate
Irreplaceability	Low
Confidence level of assessment	High

Impact significance	
Without mitigation	**With mitigation**
Low	**Very low**

8.4.3 Heritage, archaeology and palaeontology[45]

The proposed fibre line alignment runs predominantly along existing roads and will predominantly be installed below ground. For small portions of the route, the proposed line will be installed overhead. There are existing overhead powerlines and telephone lines that run along much of the proposed Fibre Optic Project route. In general, in terms of impacts to heritage resources, it is preferable to consolidate and concentrate like infrastructure into one location to avoid disruption of the integrity of intact wilderness Karoo landscapes. As such, it is not anticipated that the proposed fibre line will have significant contribution to negative cumulative impacts on heritage resources, including the cultural landscape, as long as the proposed cable runs along existing similar infrastructure and proposed mitigation measures are implemented.

[44] Extracted and / or summarised from EnviroSci (2020) (see Appendix 3)
[45] Extracted and / or summarised from CTS Heritage (2020) (see Appendix 5)

Proposed mitigation measures:

- The proposed Fibre Optic Project should adhere to the site-specific environmental management recommendations to ensure that impacts are mitigated as far as possible in order to reduce its contribution towards cumulative impacts.

Table 48: Impact assessment – cumulative disturbance to or destruction of heritage resources.

Impact: Cumulative disturbance to or destruction of heritage resources.	
Status	Negative
Spatial extent	Site-specific
Duration	Short-term
Consequence (Severity)	Extreme
Probability	Extremely unlikely
Reversibility	Non-reversible
Irreplaceability	High
Confidence level of assessment	High

Impact significance	
Without mitigation	**With mitigation**
Very low	**Very low**

8.4.4 Visual, aesthetic and scenic resources[46]

There would be potential cumulative visual impacts resulting from of an additional overhead cable corridor, when seen together with the existing 22 kV powerline and telephone line. This will be particularly pronounced where overhead fibre optic cabling creates a new linear infrastructure corridor, for example where the fibre optic cabling is on the opposite side of the R381 than the other existing overhead infrastructure.

Proposed mitigation measures:

- Adherence to construction methods and best practice (e.g. trench backfilling in 1 – 2 days).
- SKA fibre optic cables to share corridors of existing powerline and telephone line where possible, and avoid ridgelines / skylines as far as possible.
- Poles and overhead cables to be removed after decommissioning.
- Affected area to be rehabilitated as per terrestrial and aquatic specialist specifications.

Table 49: Impact assessment – cumulative visual impacts during the construction phase.

Impact: Cumulative visual impacts during the construction phase.	
Status	Negative
Spatial extent	Site-specific
Duration	Short-term
Consequence (Severity)	Slight
Probability	Likely
Reversibility	High
Irreplaceability	Negative
Confidence level of assessment	High

Impact significance	
Without mitigation	**With mitigation**
Very low	**Very low**

[46] Extracted and / or summarised from Oberholzer & Lawson (2021) (see Appendix 6)

Table 50: Impact assessment – cumulative visual impacts during the operations and maintenance phase.

Impact: Cumulative visual impacts during the operations and maintenance phase.	
Status	Negative
Spatial extent	Local
Duration	Long-term
Consequence (Severity)	Substantial
Probability	Likely
Reversibility	High
Irreplaceability	Low
Confidence level of assessment	High

Impact significance	
Without mitigation	**With mitigation**
Moderate	**Moderate**

Table 51: Impact assessment – cumulative visual impacts during the decommissioning phase.

Impact: Cumulative visual impacts during the decommissioning phase.	
Status	Negative
Spatial extent	Local
Duration	Long-term
Consequence (Severity)	Substantial
Probability	Likely
Reversibility	High
Irreplaceability	Negative
Confidence level of assessment	High

Impact significance	
Without mitigation	**With mitigation**
Moderate	**Very low**

CHAPTER 9 CONCLUSION AND RECOMMENDATIONS

Box 13: Environmental Impact Statement

Taking into consideration the findings of this BA process, as well as the nature and importance of the proposed Fibre Optic Project, it is the opinion of the EAP that the project is not expected to result in unacceptable negative environmental impacts.

Provided that the specified mitigation and management measures included in the EMPr are effectively implemented and monitored, it is recommended that the project can receive:

1. EA in terms of the EIA Regulations promulgated under the NEMA.
2. GA in terms of the in terms the NWA for non-consumptive water uses.

Need and desirability

The proposed Fibre Optic Project between Beaufort West and Carnarvon forms an important component for the implementation of the overall SKA radio telescope mega-science project. The main project activities and aspects will occur during the construction phase, with limited activities and associated impacts during the operations and maintenance, and decommissioning phases.

Alternatives

The proposed Fibre Optic Project has a specific purpose, i.e. high-speed, low latency data transfer between the SKA radio-telescope and the data processing centre in Cape Town. This purpose can only be reasonably achieved through fibre optic ICT technology and through the shortest possible route between the required start and end points. As such, no other activity and technology alternatives can be considered as appropriate to meet this goal. Routing alternatives were considered during an environmental screening phase (before the BA process was initiated), and the shortest route (Beaufort West-Loxton-Carnarvon) as assessed in this BAR, was found to be preferred from an environmental perspective due to a smaller overall construction phase disturbance footprint, as well as from a technical and financial feasibility perspective.

Construction phase (Low to Very Low, after mitigation)

The cabling is proposed predominantly **underground** within the road reserves of the R381 and R63 between Beaufort West, Loxton and Carnarvon. The impacts of the proposed Fibre Optic Project underground sections are expected to be most pronounced on aspects of terrestrial ecology, aquatic ecology, and heritage features, since the cumulative disturbance footprint of the dug trenches in which the cabling is installed will be approximately 5.5 ha. However, the road reserves are previously disturbed due to road construction and maintenance. Additionally, the dug trenches will be backfilled after the cabling has been installed, allowing vegetation to re-establish. The significance of impacts associated with the underground cabling during the construction phase is expected to be **Low** to **Very Low, after mitigation.** The key mitigation measures include taking care in areas flagged as potentially sensitive (terrestrial ecology and aquatic ecology), and implementing AIS and erosion control, and chance fossil / heritage feature finds protocols.

Operations and maintenance phase (Moderate to Very Low, after mitigation)

In some sections, i.e. the Molteno, Blounek and Roseberg passes, the cabling is proposed **overhead** on timber and concrete poles. The overhead sections will have minimal impact on aspects of terrestrial ecology, aquatic ecology, and heritage features since the physical permanent disturbance footprint is limited to the dug holes (**Very Low, after mitigation**). However, the

overhead sections will result in impact to visual, aesthetic and scenic resources during the operations and maintenance phase. The options to mitigate the visual impacts are constrained by the practical and technical feasibility of installing the cabling in the difficult terrain associated with these sections. As such, the impact of greatest significance for the overhead cabling sections is to visual, aesthetic and scenic resources during the operations and maintenance phase (**Moderate, after mitigation**).

Decommissioning phase

If the proposed cabling ever needs to be decommissioned, it should be possible to restore the areas to pre-construction condition, with an impact significance of **Very Low**, after mitigation, if the overhead cabling is dismantled and removed as per the EMPr requirements.

Cumulative impacts

The study area, especially in the Gamka Karoo region, is experiencing developmental pressures due to potential renewable energy, minerals and hydrocarbons exploration and exploitation and urban expansion, particularly around Beaufort West. However, due to the limited nature of the proposed Fibre Optic Project, its contribution to the cumulative impacts of the Gamka Karoo and the greater region is negligible, with an anticipated cumulative impact significance of **Moderate** to **Very Low**, after mitigation.

EMPr and recommended conditions of authorisation

To ensure the effective implementation of the mitigation and management actions, an EMPr has been compiled as Part B of this BAR. The mitigation measures necessary to ensure that the proposed projects are planned and carried out (construction, operations and maintenance) in an environmentally responsible manner are provided in the EMPr. The EMPr includes the mitigation measures noted in this report and the specialist studies, and provides clear and implementable measures for the proposed project. It must be considered a dynamic document that should be updated as project.

It is recommended that EA be issued for the Fibre Optic Project corridor – i.e. 30 m around centre line of the roads which the cabling will follow (underground) and 30 m around the current engineering design (overhead sections). Within this corridor the fine-scale routing of the fibre optic cable may be adjusted as required to avoid or compensate for any technical difficulties or environmental sensitivities identified in the field during construction.

Additionally, it is recommended that the EA, if granted, stipulates that the activity must commence within five (05) years of from the date of issue, and that construction must be completed within five (05) year of the commencement of the activity.

The following conditions are recommended for inclusion in the EA, if granted:

- **Independent and qualified terrestrial and aquatic ecology specialist/s must be appointed to advise on micro-siting** of the cabling in identified sensitive areas during the construction phase.
    - Unforeseen underground technical difficulties may only become evident during the construction phase, and could result in the fibre optic routing having to be adjusted (within the approved Fibre Optic Project corridor). These adjustments are not anticipated to be significant (from a technical or environmental perspective), but must be carried out under the advice of qualified terrestrial and aquatic ecology specialist/s. In this case, micro-siting is the most important measure to ensure a

precautionary approach, at an appropriate scale and effective avoidance and mitigation of environmental impacts.

- **Temporary construction camps, stockpiles and laydown areas must be located outside of any delineated aquatic systems / watercourses,** and remain within any existing disturbed areas.
- **Permits for the removal of protected flora** in terms of Sections 49 to 51 of the NCNCA (Northern Cape) and Section 63 of the WCNECO (Western Cape) must be obtained (this may be obtained in parallel / after EA, but must be in place before construction).
- **Heritage approval from SAHRA (Western Cape) and HWC (Western Cape) must be obtained** (this may be obtained in parallel / after EA, but must be in place before construction).

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APPENDICES VOLUME

Please refer to the separate Appendices Volume document that contains the following appendices:

Appendix 1	SIP confirmation
Appendix 2	Specialist assessment: Terrestrial Ecology, Biodiversity and Species
Appendix 3	Specialist assessment: Aquatic Ecology, Biodiversity and Species
Appendix 4	Risk matrix: Section 21 (c) and (i) water use Risk Assessment Protocol
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