Mura 1 (Pty) Ltd

MURA 1 SOLAR PHOTOVOLTAIC FACILITY

Draft Basic Assessment Report

MARCH 2023

PUBLIC

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Draft Basic Assessment Report

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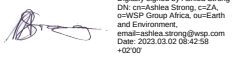
Signature				
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GENERAL SITE INFORMATION

Technical details of the proposed Mura 1 Solar PV Facility		
Location of Site	Between Loxton and Beaufort West in the Beaufort West Local Municipality and the Central Karoo District Municipality in the Western Cape Province	
Description of all affected farm portions and 21 digit SG Codes	**Farm Name**	**21-Digit SG Code**
	Leeuwkloof Farm 43	C00900000000004300000
	Portion 4 of Duiker Kranse Farm 45	C00900000000004500004
Central coordinates of the site and activity location	31°50'20.38"S 22°29'35.79"E	
Total Disturbance Footprint	198 ha	
Design Specifications		
Solar Field	▪ Solar Photovoltaic facility with capacity up to 150 MW	
Solar Farm Substations	▪ Up to two on-site solar substations adjacent to Eskom switching stations that will connect to the approved Nuweveld Collector substation ▪ Maximum height of 12m and will include a high voltage gantry within a 150 m x 75 m substation yard	
BESS and BESS substation	▪ 240 MWac BESS (Lithium-ion or similar solid-state technology) ▪ BESS Substation: maximum height of 12m and will include a high voltage gantry within a 150 m x 75 m substation yard	
Building Infrastructure	▪ Maximum height of 8m and includes: • Offices; • Operational and maintenance (O&M)/ control centre; • Warehouse/workshop; • Ablution facilities; and • Converter/inverter stations.	
Other Infrastructure located within the solar area footprint	▪ Internal underground cables of up to 132 kV; ▪ Internal gravel roads; ▪ Fencing (between 2 – 3 m high) around the PV Facility; ▪ Panel maintenance and cleaning area; ▪ Storm water management system; and ▪ Site camps	
Associated Infrastructure (outside the solar area footprint).	▪ Internal access gravel roads with a footprint of 17 ha: • Up to 4 m wide driving surface and may require side drains on one or both sides.	

	• During construction the roads may be up to 12 m wide, but this will be a temporary impact and rehabilitated following the construction phase. ▪ Site camps: • Up to two 2.2 ha site camps within the access road corridor.

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EMPR

GLOSSARY

Abbreviation	Definition
AC	Alternating current
AEL	Atmospheric Emissions License
AIS	Alien and Invasive Species
ATNS	Air Traffic and Navigation Services
BA	Basic Assessment
BAR	Basic Assessment Report
BWLM	Beaufort West Local Municipality
BESS	Battery Energy Storage System
BMS	Battery Management System
CA	Competent authority
CARA	Conservation of Agricultural Resources Act (No. 43 of 1983)
CBA	Critical Biodiversity Area
CKDM	Central Karoo District Municipality
CCIA	Climate Change Impact Assessment
CSP	Concentrated Solar Power
DALRRD	Department of Agriculture Land Reform and Rural Development
DC	Direct current
DEA&DP	Western Cape Department of Environmental Affairs and Development Planning
DFFE	Department of Forestry, Fisheries and Environment
DMRE	Department of Mineral Resources and Energy
DR	District roads
DWS	Department of Water & Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner

Abbreviation	Definition
ECA	Environmental Conservation Act 73 of 1989
ECO	Environmental Control Officer
EGI	Electrical Grid Infrastructure
EI&ES	Ecological Importance and Ecological Sensitivity
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
EP	Equator Principles
EPFI	Equator Principles Financial Institutions
ERA	Electricity Regulation Act (No. 4 of 2006)
ESA	Early Stone Ages
FI	Financial institutions
GA	General Authorisation
GHG	Greenhouse gas
GIIP	Good international industry practice
GNR	Government Notice Regulation
ha	Hectares
HWC	Heritage Western Cape
IBA	Important Bird & Biodiversity Area
ICAO	International Civil Aviation Organisation
IEP	National Integrated Energy Plan
IFC	International Finance Corporation
IRP	Integrated Resource Plan
KNP	Karoo National Park
LSA	Late Stone Ages
LUPA	Land Use Planning Act (Act 3 of 2014)
MSA	Middle Stone Ages
MR	Main roads

Abbreviation	Definition
Mura 1	Mura 1 (Pty) Ltd
NCPGDP	Northern Cape Provincial Growth and Development Plan
NCSDF	Northern Cape Provincial Spatial Development Framework
NDP	National Development Plan
NEMA	National Environmental Management Act (Act 107 of 1998)
NEMAQA	National Environmental Management: Air Quality Act 39 of 2004
NEMBA	National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
NEMPAA	National Environmental Management Protected Areas Act (No. 57 of 2003)
NHRA	National Heritage Resource Act (Act No. 25 of 1999)
NID	Notification of Intent to Develop
NPAES	National Protected Area Expansion Strategy 2010
NR	National Routes
NWA	National Water Act, 1998 (Act No. 36 of 1998)
O&M	Operational and maintenance
OHSA	Occupational Health and Safety Act (No. 85 of 1993)
PCS	Power Conditioning System
PICC	Presidential Infrastructure Coordinating Commission
PS	Performance Standards
PSDF	Provincial Spatial Development Framework, 2014
PV	Photovoltaic
REC	Recommended ecological condition
REDZ	Renewable Energy Development Zones
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
RFI	Radio Frequency Interference
S&EIA	Scoping and EIA
SABS	South African Bureau of Standards
SACAA	South African Civil Aviation Authority

Abbreviation	Definition
SAHRA	South African Heritage Resources Agency
SAHRA	South African Heritage Resources Agency
SALA	Subdivision of Agricultural Land Act
SANBI	South African National Biodiversity Institute
SANRAL	South African National Roads Agency
SANS	South African National Standards
SARPs	Standards and Recommended Practices
SAWS	South African Weather Service
SDF	Spatial Development Frameworks
SDG	Sustainable Development Goals
SEF	Solar Energy Facilitates
SER	Stakeholder Engagement Report
SG	Surveyor General
SPLUMA	Spatial Planning and Land Use Management Act (Act 16 of 2013)
TOPs	Threatened or Protected Species
TR	Trunk roads
UNDP	United Nations' Development Programmes
WBG	World Bank Group
WCIF	Western Cape Infrastructure Framework
WEF	Wind Energy Facilities
WSP	WSP Group Africa (Pty) Ltd
WUA	Water Use Authorisation
WUL	Water Use License

1 INTRODUCTION

WSP Group Africa (Pty) Ltd (WSP) has been appointed by Mura 1 (Pty) Ltd (Mura 1), to undertake an Environmental Impact Assessment (EIA) to meet the requirements under the National Environmental Management Act (Act 107 of 1998) (NEMA), for the proposed Mura 1 Solar Photovoltaic (PV) Facility between Loxton and Beaufort West in the Beaufort West Local Municipality (BWLM) and the Central Karoo District Municipality (CKDM) (**Figure 1-1** and **Figure 1-2**).

The proposed Mura 1 Solar PV Facility falls within the Beaufort West Renewable Energy Development Zones (REDZ) and will therefore be subject to a Basic Assessment (BA) Process in terms of NEMA (as amended) and Appendix 1 of the EIA Regulations, 2014 promulgated in Government Gazette 40772 and GN R326, R327, R325 and R324 on 7 April 2017. The competent authority (CA) for this BA process is the national Department of Forestry, Fisheries and Environment (DFFE).

1.1 PURPOSE OF THIS REPORT

The BA process is an interdisciplinary procedure to ensure that environmental and social considerations are included in decisions regarding projects. Simply defined, the process aims to identify the possible environmental and social effects of a proposed activity and how those impacts can be mitigated.

The Draft Basic Assessment Report (BAR) (this report) aims to provide stakeholders with information on the proposed development including location, layout and technological alternatives, the scope of the environmental assessment and impacts associated with the proposed development, and the consultation process undertaken through the BA Process

1.2 BACKGROUND INFORMATION

Red Cap Energy is proposing to develop four solar facilities, namely Mura 1, Mura 2, Mura 3, and Mura 4, and an associated grid connection, collectively known as the Mura PV Development between Loxton and Beaufort West. The proposed Mura PV Development is located in close proximity to the approved Nuweveld Wind Farm Development. The Mura PV Development falls partially within the Beaufort West Renewable Energy Development Zones (REDZ). The Mura 1 Solar PV Facility falls within the Beaufort West REDZ and as per GN 142 is therefore subject to an expedited Basic Assessment (BA) Process in terms of NEMA (as amended) and Appendix 1 of the EIA Regulations, 2014 promulgated in Government Gazette 40772 and GN R326, R327, R325 and R324 on 7 April 2017. Mura 2, 3 and 4 fall partially or fully outside of the REDZ and therefore subject to a full S&EIA process in terms of NEMA (as amended) and Appendix 2 and 3 of the of the EIA Regulations, 2014 promulgated in Government Gazette 40772 and GN R326, R327, R325 and R324 on 7 April 2017.

Each solar facility will connect to the Eskom grid via new 132 kV overhead lines (assessed in a separate process to the PV facilities) connecting up to two on-site solar substations via an adjacent Eskom switching stations to the approved Nuweveld Collector Substation.

For the grid connection, an Electrical Grid Infrastructure (EGI) Corridor is proposed and is assessed as a separate project. The grid line is arranged in what is called a "collector ring line". This implies

that it is a circular grid line and not just a single line between the Nuweveld Collector Substation and the Mura facilities. The use of a circular "collector ring line" is an approach used by Eskom and others to improve the grid stability and to ensure that if the grid line is damaged on one side of the "collector ring line", that the solar facilities can still export their energy along the other side of the ring line while the fault is repaired. This allows these facilities to be better integrated into the national grid and to better reduce risks of downtime which enables these solar facility projects to be better adapted to potential amendments to future bidding requirements or to potentially give them a competitive advantage over other similar projects.

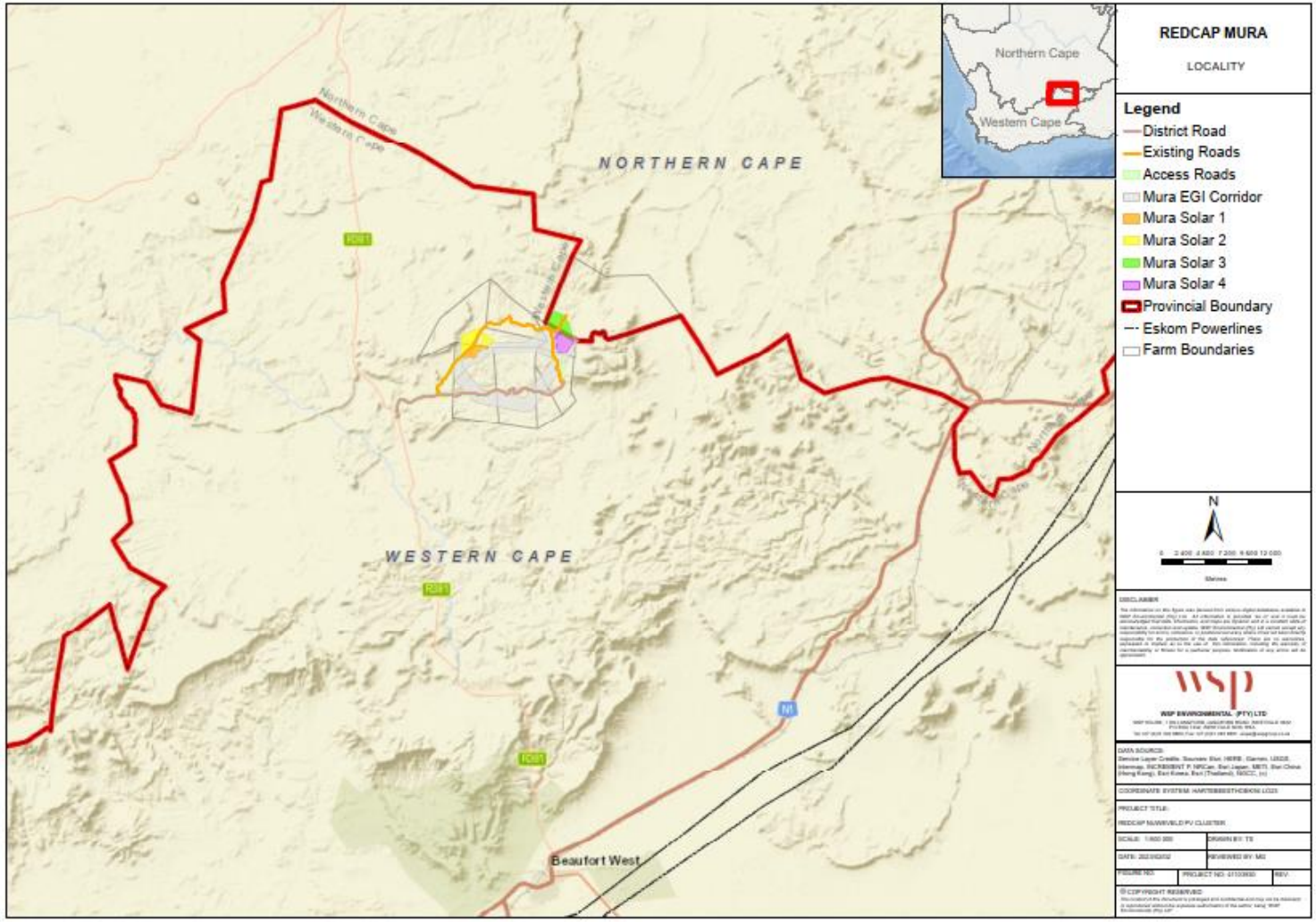


Figure 1-1 – Regional locality map of Mura Solar PV Development

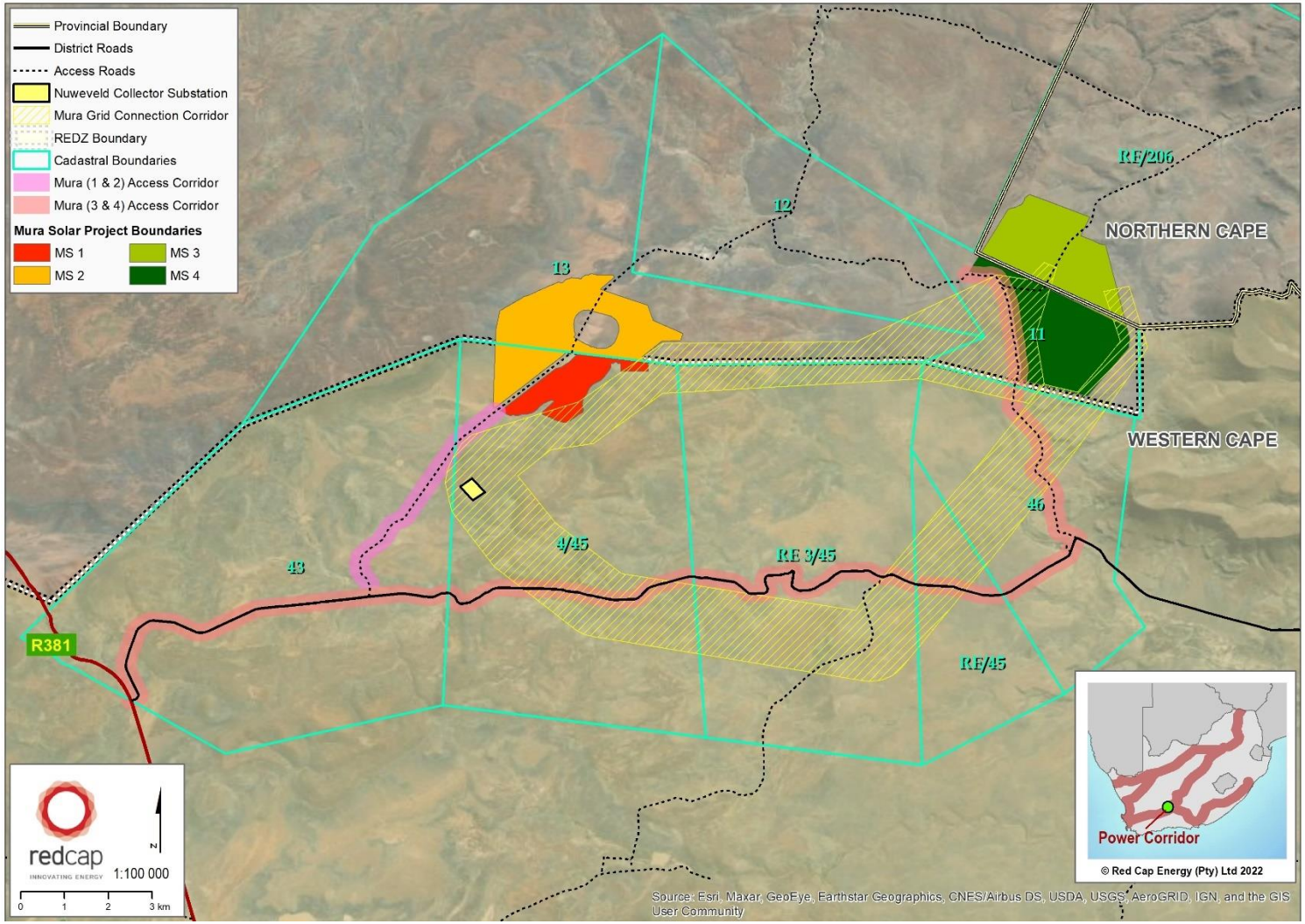


Figure 1-2 – Locality map of Mura Solar PV Development being assessed in the formal environmental impact assessment process

1.3 DETAILS OF KEY ROLE PLAYERS

1.3.1 PROJECT PROPONENT

Mura 1 (Pty) Ltd is the project proponent (Applicant) with regards to this application for the construction and operation of the Mura 1 Solar PV Facility. **Table 1-1** provides the relevant details of the project proponent.

Table 1-1 – Details of Project Proponent

Proponent:	**Mura 1 (Pty) Ltd**
Contact Person:	Lance Blaine
Postal Address	Unit B2, Mainstream Centre, Main Road Hout Bay, Cape Town
Telephone:	021 790 1392
Email:	surina@red-cap.co.za

1.3.2 COMPETENT AUTHORITY

Section 24C(2)(a) of NEMA stipulates that the Minister of Forestry, Fisheries and the Environment ("the Minister") must be identified as the competent authority if the activity has implications for international environmental commitments or relations. GN 779 of 01 July 2016 identifies the Minister as the CA for the consideration and processing of environmental authorisations and amendments thereto for activities related to the Integrated Resource Plan (IRP) 2010 – 2030.

As the proposed Mura 1 Solar PV Development is related to the IRP, DFFE is the CA for the proposed project.

Table 1-2 provides the relevant details of the competent authority on the Project.

Table 1-2 – Competent Authority

Aspect	Competent Authority	Contact Details
Competent Authority: Environmental Authorisation	Department of Forestry, Fisheries, and the Environment (DFFE)	Case Officer: Jay-Jay Mpelane Integrated Environmental Authorisations Email: JMPELANE@dffe.gov.za Tel: 012 399 9404

1.3.3 COMMENTING AUTHORITY

The commenting authorities for the project include:

- Department of Water and Sanitation (DWS);
- Department of Mineral Resources and Energy (DMRE);
- Department of Agriculture, Land Reform and Rural Development (DALRRD);
- Department of Public Works;

- Department of Defence;
- National Department of Transport;
- South African National Roads Agency Limited (SANRAL);
- South African Heritage Resources Agency (SAHRA);
- South African Civil Aviation Authority (CAA);
- Square Kilometre Array (SKA);
- South African Weather Service (SAWS);
- BWLM;
- CKDM;
- WC DEADP;
- Heritage Western Cape (HWC);
- BirdLife South Africa;
- CapeNature;
- Endangered Wildlife Trust; and
- South African National Parks.

Refer to the Stakeholder Engagement Report (SER) in **Appendix D** for a full list of commenting authorities.

1.3.4 ENVIRONMENTAL ASSESSMENT PRACTITIONER

WSP was appointed in the role of Independent Environmental Assessment Practitioner (EAP) to undertake the BA process for the proposed project. The CV of the EAP is available in **Appendix A**. The EAP declaration of interest and undertaking is included in **Appendix B**. **Table 1-3** details the relevant contact details of the EAP.

Table 1-3 – Details of the EAP

EAP:	**WSP Group Africa (Pty) Ltd**
Contact Person:	Ashlea Strong
Physical Address:	Building C, Knightsbridge, 33 Sloane Street, Bryanston, Johannesburg
Postal Address:	P.O. Box 98867, Sloane Park 2151, Johannesburg
Telephone:	011 361 1392
Fax:	011 361 1301
Email:	Ashlea.Strong@wsp.com
EAP Qualifications:	▪ Masters in Environmental Management, University of the Free State ▪ B Tech, Nature Conservation, Technikon SA ▪ National Diploma in Nature Conservation, Technikon SA
EAPASA Registration Number:	EAPASA (2019/1005)

Statement of Independence

Neither WSP nor any of the authors of this Report have any material present or contingent interest in the outcome of this Report, nor do they have any business, financial, personal or other interest that could be reasonably regarded as being capable of affecting their independence. WSP has no beneficial interest in the outcome of the assessment.

1.3.5 SPECIALISTS

Specialist input was required in support of this application for EA. The details of the specialists are provided in **Table 1-4** below. The specialist studies are attached in **Appendix G** and their declarations in **Appendix C**.

Table 1-4 – Details of Specialists

Assessment	Name of Specialist	Company	Sections in Report	Specialist Report attached as
Climate Change	Shantal Beharie	Promethium Carbon	▪ Section 2.7 ▪ Section 6.1.1 ▪ Section 8.1 ▪ Section 9.1 ▪ Section 11.2.1	**Appendix G.1**
Agricultural Compliance Statement	Johann Lanz	Independent	▪ Section 2.7 ▪ Section 6.1.2 ▪ Section 7.1 ▪ Section 8.2 ▪ Section 9.2 ▪ Section 11.2.2	**Appendix G.2**
Terrestrial Biodiversity Compliance Statement	Simon Todd	3Foxes Biodiversity Solutions	▪ Section 2.7 ▪ Section 6.2.1 ▪ Section 7.2 ▪ Section 8.3 ▪ Section 9.3 ▪ Section 11.2.3	**Appendix G.3**
Aquatic Biodiversity Impact Assessment	Antonia (Toni) Belcher	BlueScience (Pty) Ltd	▪ Section 2.7 ▪ Section 6.2.2 ▪ Section 7.3 ▪ Section 8.4 ▪ Section 9.4 ▪ Section 11.2.4	**Appendix G.4**
Plant Species Compliance Statement	Simon Todd	3Foxes Biodiversity Solutions	▪ Section 2.7 ▪ Section 6.2.3 ▪ Section 7.4 ▪ Section 8.5 ▪ Section 9.5 ▪ Section 11.2.5	**Appendix G.5**

Assessment	Name of Specialist	Company	Sections in Report	Specialist Report attached as
Animal Species Compliance Statement	Simon Todd	3Foxes Biodiversity Solutions	▪ Section 2.7 ▪ Section 6.2.4 ▪ Section 7.5 ▪ Section 8.6 ▪ Section 9.6 ▪ Section 11.2.6	**Appendix G.6**
Avifauna Impact Assessment	Jon Smallie	WildSkies Ecological Services (Pty) Ltd	▪ Section 2.7 ▪ Section 6.2.5 ▪ Section 7.6 ▪ Section 8.7 ▪ Section 9.7 ▪ Section 11.2.7	**Appendix G.7**
Archaeological and Cultural Heritage Impact Assessment	Jayson Orton	Asha Consulting	▪ Section 2.7 ▪ Section 6.3.1 ▪ Section 7.7 ▪ Section 8.8 ▪ Section 9.8 ▪ Section 11.2.8	**Appendix G.8**
Palaeontology Impact Assessment	John E. Almond	Natura Viva cc	▪ Section 2.7 ▪ Section 6.3.2 ▪ Section 7.8 ▪ Section 8.9 ▪ Section 11.2.9	**Appendix G.9**
Traffic Assessment	Athol Schwarz	Independent	▪ Section 2.7 ▪ Section 6.3.3 ▪ Section 8.10 ▪ Section 9.9 ▪ Section 11.2.10	**Appendix G.10**
Visual Impact Assessment	Quinton Lawson Bernard Oberholzer	Independent	▪ Section 2.7 ▪ Section 6.3.4 ▪ Section 7.9 ▪ Section 8.11 ▪ Section 9.10 ▪ Section 11.2.11	**Appendix G.11**
Social Impact Assessment	James Kinghorn	Independent Economic Researchers	▪ Section 2.7 ▪ Section 6.3.5 ▪ Section 7.10 ▪ Section 8.12 ▪ Section 9.11 ▪ Section 11.2.12	**Appendix G.12**

Assessment	Name of Specialist	Company	Sections in Report	Specialist Report attached as
Geohydrological Assessment	Shane Teek	GEOSS South Africa (Pty) Ltd	▪ Section 6.1.5	**Appendix G.13**

1.4 BASIC ASSESSMENT TERMS OF REFERENCE

The 2014 EIA Regulations (Government Notice Regulation (GNR) 982), as amended, identifies the proposed solar PV facility development as an activity being subject to an S&EIR process due to the applicability of the EIA Listing Notice 2 (GNR 984, as amended). However, the Mura 1 Solar PV Facility falls within the Beaufort West REDZ and as per GN 142 is therefore subject to an expedited BA Process in terms of NEMA (as amended) and Appendix 1 of the EIA Regulations, 2014 promulgated in Government Gazette 40772 and GN R326, R327, R325 and R324 on 7 April 2017

As defined in Appendix 1 of GNR 982, as amended, the objective of the basic assessment process is to, through a consultative process:

- 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;
- Identify the alternatives considered, including the activity, location, and technology alternatives;
- Describe the need and desirability of the proposed alternatives;
- 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:
    - (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
- 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:
    - (i) identify and motivate a preferred site, activity and technology alternative;
    - (ii) identify suitable measures to avoid, manage or mitigate identified impacts; and
    - (iii) identify residual risks that need to be managed and monitored.

Public participation is a requirement of the BA Process; it consists of a series of inclusive interactions aimed at providing stakeholders with opportunities to express their views, so that these can be considered and incorporated into the BA decision-making process. Effective public participation requires the prior disclosure of relevant and adequate project information to enable stakeholders to understand the risks, impacts, and opportunities of the Proposed Project. The objectives of the public participation process can be summarised as follows:

- Identify relevant individuals, organisations and communities who may be interested in or affected by the Proposed Project;
- Clearly outline the scope of the proposed Project, including the scale and nature of the existing and proposed activities;
- Identify viable proposed Project alternatives that will assist the relevant authorities in making an informed decision;
- Identify shortcomings and gaps in existing information;
- Identify key concerns, raised by Stakeholders that should be addressed in the subsequent specialist studies;
- Highlight the potential for environmental impacts, whether positive or negative; and

To inform and provide the public with information and an understanding of the Proposed Project, issues and solutions.

1.5 BASIC ASSESSMENT REPORT STRUCTURE

As per the EIA Regulations 2014, as amended, Appendix 1 of GNR 982 identifies the legislated requirements that must be contained within a BAR for the CA to consider and come to a decision on the application. **Table 1-5** below details where the required information is located within this report.

Table 1-5 – Legislated Report Requirements as detailed in GNR 982

Appendix 1 of GNR 326	Description	Relevant Report Section
3(1) (a)	Details of the EAP who prepared the report and the expertise of the EAP, including a curriculum vitae	Section 1.3.4 and **Appendix A**
3(1) (b)	The location of the activity	Section 3.1
3(1) (c)	A plan which locates the proposed activity or activities applied for as well as associated structures and infrastructure at an appropriate scale	Section 3.1
3(1) (d)	A description of the scope of the proposed activity	Section 3.4
3(1) (e)	A description of the policy and legislative context within which the development is proposed	Section 5
3(1) (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 3.6
3(1) (g)	A motivation for the preferred site, activity and technology alternative	Section 4
3(1) (h)	A full description of the process followed to reach the proposed alternative within the site	Section 4
3(1) (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	Section 4

Appendix 1 of GNR 326	Description	Relevant Report Section
3(1) (j)	An assessment of each identified potentially significant impact and risk	Section 8
3(1) (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	Section 6, Section 7, Section 8 and Section 11.1
3(1) (l)	An environmental impact statement	Section 10
3(1) (m)	Based on the assessment, and where applicable, impact management measures from specialist reports, the recording of the proposed impact management objectives, and the impact management outcomes for the development for inclusion in the Environmental Management Programme (EMPr).	Section 11.3
3(1) (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.	Section 11.3
3(1) (o)	A description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed	Section 2.7
3(1) (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	Section 12
3(1) (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 conducted, and the post construction monitoring requirements finalised	Section 12
3(1) (r)	An undertaking under oath or affirmation by the EAP	**Appendix B**
3(1) (s)	Where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts	N/A
3(1) (t)	Any specific information that may be required by the competent authority	N/A
3(1) (u)	Any other matters required in terms of section 24(4)(a) and (b) of the Act	N/A

2 BASIC ASSESSMENT PROCESS

2.1 OBJECTIVES OF THE BASIC ASSESSMENT PROCESS AS PER THE PROCEDURAL FRAMEWORK

The BA process consists of various phases with associated timelines as defined in GNR 982. The process can generally be divided into four main phases, namely, (i) a Pre-application Phase, (ii) an Application and Draft BA Phase (current phase); (iii) Final BA Phase and (iv) Authorisation and Appeal Phase.

The main objectives of the phases can be described as follows:

- Pre-Application Phase:
  - Undertake consultation meetings with the relevant authorities to confirm the required process, the general approach to be undertaken and to agree on the public participation plan;
  - Identify stakeholders, including neighbouring landowners/residents and relevant authorities;
- Application and Draft BA Phase:
  - Compile and submit application forms to the CA and pay the relevant application fees;
  - Compile a DBAR describing the affected environment and present an analysis of the environmental issues;
  - Assess in detail the potential environmental and socio-economic impacts of the project;
  - Identify environmental and social mitigation measures to avoid and/or address the identified impacts;
  - Develop environmental and social management plans based on the mitigation measures developed in the DBAR;
  - Inform stakeholders of the proposed project, feasible alternatives and the BA process and afford them the opportunity to register and participate in the process and identify any issues and concerns associated with the proposed project; and
  - Submit the DBAR and the associated EMPr for public consultation and to the CA to for comment.
- Final BA Phase:
  - Incorporate comments received from stakeholders during the DBAR comment period;
  - Amend BAR and the associated EMPr based on the comments received;
  - Should significant amendments be required, release the updated DBAR for a 30-day comment period to provide stakeholders with the opportunity to review the amendments as well as provide additional input if required; and
  - Submit the Final BAR, following the consultation period, to the CA for acceptance/rejection.
- Authorisation and Appeal Phase:
  - The DFEE to provide written notification of the decision to either grant or refuse EA for the proposed project; and
  - Notify all registered stakeholders of the decision and right to appeal.

2.2 DFFE WEB-BASED ENVIRONMENTAL SCREENING TOOL

DFFE has developed the National Web-based Environmental Screening Tool in order to flag areas of potential environmental sensitivity related to a site as well as a development footprint and produces the screening report required in terms of regulation 16 (1)(v) of the EIA Regulations (2014, as amended). *The Notice of the requirement to submit a report generated by the national web-based environmental screening tool in terms of section 24(5)(h) of the NEMA, 1998 (Act No 107 of 1998) and regulation 16(1)(b)(v) of the EIA regulations, 2014, as amended (GN 960 of July 2019)* states that the submission of a report generated from the national web-based environmental screening tool, as contemplated in Regulation 16(1)(b)(v) of the EIA Regulations, 2014, published under Government Notice No. R982 in Government Gazette No. 38282 of 4 December 2014, as amended, is compulsory when submitting an application for environmental authorisation in terms of regulation 19 and regulation 21 of the EIA Regulations, 2014 (as amended) as of 04 October 2019.

The Screening Report generated by the National Web-based Environmental Screening Tool contains a summary of any development incentives, restrictions, exclusions or prohibitions that apply to the proposed development footprint as well as the most environmentally sensitive features on the footprint based on the footprint sensitivity screening results for the application classification that was selected.

A screening report for the proposed Mura 1 Solar PV Facility was generated on 22 September 2022 and is attached as **Appendix F**. The Screening Report for the project identified various sensitivities for the site. The report also generated a list of specialist assessments that should form part of the BA Process based on the development type and the environmental sensitivity of the site. Assessment Protocols in the report provide minimum information to be included in a specialist report to facilitate decision-making.

Table 2-1 below provides a summary of the sensitivities identified for the development footprint.

Table 2-1 – Sensitivities identified in the DFFE Screening Report

Theme	Very High Sensitivity	High Sensitivity	Medium Sensitivity	Low Sensitivity
Agriculture Theme			X	
Animal Species Theme		X		
Aquatic Biodiversity Theme				X
Archaeological and Cultural Heritage Theme				X
Avian Theme				X
Civil Aviation (Solar PV) Theme				X
Defence Theme				X
Landscape (Solar) Theme	X			
Palaeontology Theme	X			

Theme	Very High Sensitivity	High Sensitivity	Medium Sensitivity	Low Sensitivity
Plant Species Theme				X
Radio Frequency Interference (RFI) Theme		X		
Terrestrial Biodiversity Theme				X

Based on the selected classification, and the environmental sensitivities of the proposed development footprint, the following list of specialist assessments have been identified for inclusion in the assessment report as determined by the screening tool:

- Agricultural Impact Assessment;
- Landscape/Visual Impact Assessment;
- Archaeological and Cultural Heritage Impact Assessment ;
- Palaeontology Impact Assessment;
- Terrestrial Biodiversity Impact Assessment;
- Aquatic Biodiversity Impact Assessment;
- Civil Aviation Assessment;
- Defence Assessment;
- RFI Assessment;
- Geotechnical Assessment;
- Socio-Economic Assessment;
- Plant Species Assessment; and
- Animal Species Assessment.

2.2.1 MOTIVATION FOR SPECIALIST STUDIES

The report recognises that “it is the responsibility of the EAP to confirm this list and to motivate in the assessment report, the reason for not including any of the identified specialist study including the provision of photographic evidence of the footprint situation.”

The following specialist assessments have been commissioned for the project based on the environmental sensitivities identified by the Screening Report:

- Agricultural Impact Assessment;
- Landscape/Visual Impact Assessment;
- Archaeological and Cultural Heritage Impact Assessment ;
- Palaeontology Impact Assessment;
- Terrestrial Biodiversity Impact Assessment;
- Aquatic Biodiversity Impact Assessment;
- Socio-Economic Assessment;
- Plant Species Assessment; and
- Animal Species Assessment.

The following specialist studies have been commissioned in addition to those above:

- Avifauna Assessment;
- Traffic Assessment; and

- Climate Change Assessment.

The above specialist studies commissioned were presented to DFFE during the pre-application meeting that was held with on 22 September 2022. The specialist studies commissioned were accepted by the DFFE as per the meeting minutes included in the SER in **Appendix D**.

Four of the identified specialist studies will not be undertaken as part of the BA process for the proposed Mura 1 PV Facility. Motivation for the exclusion of these specialist studies is provided below:

- Geotechnical Assessment:
  - A detailed Geotechnical Assessment will not be undertaken as this will be undertaken during the design phase. The DFFE agreed to this during the pre-application meeting held on 22 September 2022.
- RFI Assessment:
  - An RFI Study will not be undertaken. SKA-SA, the South African Radio Astronomy Observatory and SAWS will, however, be engaged with as part of the Public Participation Process.
  - As this theme has been identified as high, a compliance statement has been prepared by the EAP and included in **Section 7.11.**
- Civil Aviation:
  - A formal Civil Aviation Assessment will not be undertaken as part of the BA Process. Nevertheless, the relevant Authorities have been included on the project stakeholder database. As of the 1st of May 2021, ATNS has been appointed as the new Obstacle application Service Provider for Windfarms and later Solar Plants. Their responsibility would pertain to the assessments, maintenance, and all other related matters in respect to Windfarms and in due time Power Plant assessments. Where required, an Application for the Approval of Obstacles will also be submitted to ATNS and the required permits will be obtained prior to the development of the project. The SACAA has been included on the project stakeholder database. They will be informed of the proposed Project, and comment will be sought. An Application for the Approval of Obstacles will also be submitted to SACAA by the applicant.
  - As this theme has been identified as a low sensitivity, no compliance statement is required.
- Defence:
  - The Department of Defence has been included on the project stakeholder database. They will be informed of the proposed Project, and comment will be sought.
  - As this theme has been identified as a low sensitivity, no compliance statement is required.

Specialist assessments were conducted in accordance with the Procedures for the Assessment and Minimum Criteria for Reporting on identified Environmental Themes, which were promulgated in Government Notice No. 320 of 20 March 2020 and in Government Notice No. 1150 of 30 October 2020 (i.e. “the Protocols”). The assessment protocols followed as well as the site sensitivity verification undertaken by the specialists are indicated in **Section 7**.

2.3 APPLICATION FOR ENVIRONMENTAL AUTHORISATION

The application phase consisted of a pre-application consultation with DFFE and subsequently completing the appropriate application form as well as the submission and registration of the application for EA with the DFFE. The pre-application meeting was held with DFFE on 22 September 2022 (meeting minutes included in the SER in **Appendix D**). The application form will be submitted to the DFFE with the Draft BAR. An application reference number will be included in the Final BAR following acknowledgment of receipt from the DFFE.

2.4 BASELINE ENVIRONMENTAL ASSESSMENT

The description of the environmental attributes of the Project area was compiled through a combination of desktop reviews and site investigations. Desktop reviews made use of available information including existing reports, aerial imagery, and mapping. The specialist teams undertook site investigations, between March and October 2022, to identify sensitive features on site that informed the sensitivity mapping (see **Section 10**) for the Mura 1 Solar PV Facility.

2.5 IMPACT ASSESSMENT METHODOLOGY

2.5.1 ASSESSMENT OF IMPACTS AND MITIGATION

The assessment of impacts and mitigation evaluates the likely extent and significance of the potential impacts on identified receptors and resources against defined assessment criteria, to develop and describe measures that will be taken to avoid, minimise or compensate for any adverse environmental impacts, to enhance positive impacts, and to report the significance of residual impacts that occur following mitigation.

The key objectives of the risk assessment methodology are to identify any additional potential environmental issues and associated impacts likely to arise from the proposed project, and to propose a significance ranking. Issues / aspects will be reviewed and ranked against a series of significance criteria to identify and record interactions between activities and aspects, and resources and receptors to provide a detailed discussion of impacts. The assessment considers direct[1], indirect[2], secondary[3] as well as cumulative[4] impacts.

A standard risk assessment methodology is used for the ranking of the identified environmental impacts pre-and post-mitigation (i.e. residual impact). The significance of environmental aspects is determined and ranked by considering the criteria[5] presented in **Table 2-2.**

[1] Impacts that arise directly from activities that form an integral part of the Project.
[2] Impacts that arise indirectly from activities not explicitly forming part of the Project.
[3] Secondary or induced impacts caused by a change in the Project environment.
[4] Impacts are those impacts arising from the combination of multiple impacts from existing projects, the Project and/or future projects.
[5] The definitions given are for guidance only, and not all the definitions will apply to all the environmental receptors and resources being assessed. Impact significance was assessed with and without mitigation measures in place.

Table 2-2 – Impact Assessment Criterion and Scoring System

Criteria	Score 1	Score 2	Score 3	Score 4	Score 5
Impact Magnitude (M) The degree of alteration of the affected environmental receptor	Very low: No impact on processes	Low: Slight impact on processes	Medium: Processes continue but in a modified way	High: Processes temporarily cease	Very High: Permanent cessation of processes
Impact Extent (E) The geographical extent of the impact on a given environmental receptor	Site: Site only	Local: Inside activity area	Regional: Outside activity area	National: National scope or level	International: Across borders or boundaries
Impact Reversibility (R) The ability of the environmental receptor to rehabilitate or restore after the activity has caused environmental change	Reversible: Recovery without rehabilitation		Recoverable: Recovery with rehabilitation		Irreversible: Not possible despite action
Impact Duration (D) The length of permanence of the impact on the environmental receptor	Immediate: On impact	Short term: 0-5 years	Medium term: 5-15 years	Long term: Project life	Permanent: Indefinite
Probability of Occurrence (P) The likelihood of an impact occurring in the absence of pertinent environmental management measures or mitigation	Improbable	Low Probability	Probable	Highly Probability	Definite
Significance (S) is determined by combining the above criteria in the following formula:	$[S = (E + D + R + M) \times P]$ $Significance = (Extent + Duration + Reversibility + Magnitude) \times Probability$				
Impact Significance Rating					
Total Score	**4 to 15**	**16 to 30**	**31 to 60**	**61 to 80**	**81 to 100**
Environmental Significance Rating (Negative (-))	**Very low**	**Low**	**Moderate**	**High**	**Very High**
Environmental Significance Rating (Positive (+))	**Very low**	**Low**	**Moderate**	**High**	**Very High**

2.5.2 IMPACT MITIGATION

The impact significance without mitigation measures will be assessed with the design controls in place. Impacts without mitigation measures in place are not representative of the proposed development's actual extent of impact and are included to facilitate understanding of how and why mitigation measures were identified. The residual impact is what remains following the application of

mitigation and management measures and is thus the final level of impact associated with the development. Residual impacts also serve as the focus of management and monitoring activities during Project implementation to verify that actual impacts are the same as those predicted in this report.

The mitigation measures chosen are based on the mitigation sequence/hierarchy which allows for consideration of five (5) different levels, which include avoid/prevent, minimise, rehabilitate/restore, offset and no-go in that order. The idea is that when project impacts are considered, the first option should be to avoid or prevent the impacts from occurring in the first place if possible, however, this is not always feasible. If this is not attainable, the impacts can be allowed, however they must be minimised as far as possible by considering reducing the footprint of the development for example so that little damage is encountered. If impacts are unavoidable, the next goal is to rehabilitate or restore the areas impacted back to their original form after project completion. Offsets are then considered if all the other measures described above fail to remedy high/significant residual negative impacts. If no offsets can be achieved on a potential impact, which results in full destruction of any ecosystem for example, the no-go option is considered so that another activity or location is considered in place of the original plan.

The mitigation sequence/hierarchy is shown in **Table 2-2** below.

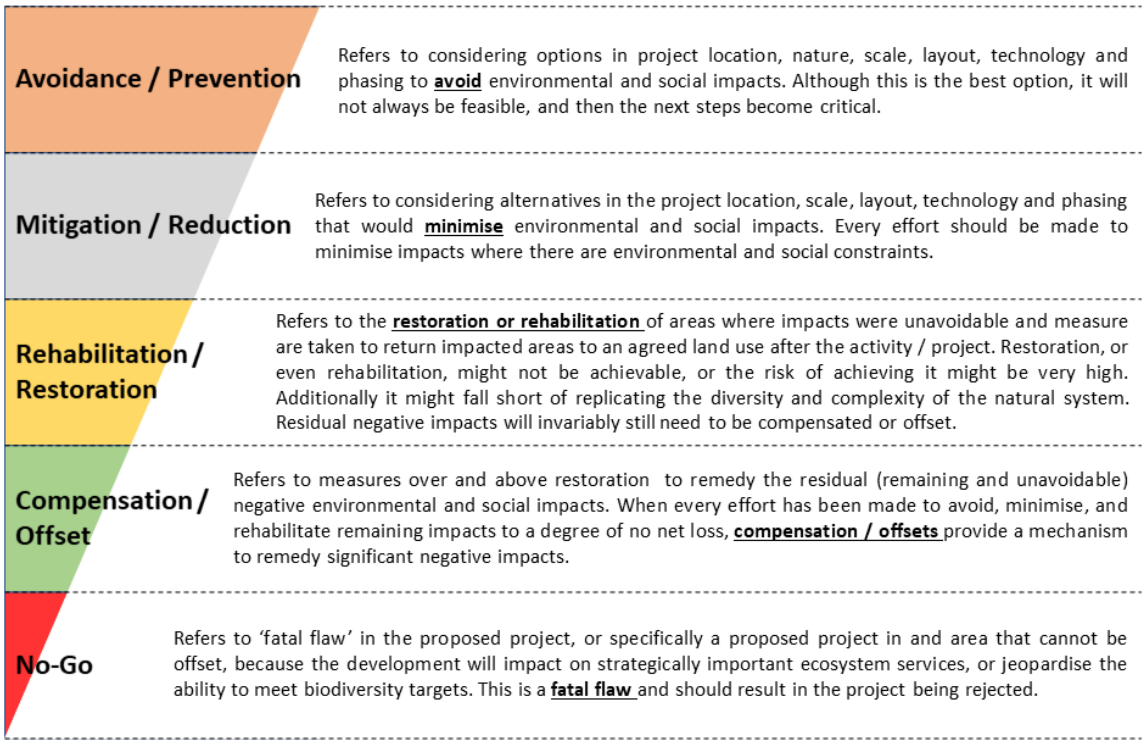


Figure 2-1 - Mitigation Sequence/Hierarchy

The idea is that when project impacts are considered, the first option should be to avoid or prevent the impacts from occurring in the first place if possible, however, this is not always feasible. If this is not attainable, the impacts can be allowed, however they must be minimised as far as possible by considering reducing the footprint of the development for example so that little damage is encountered. If impacts are unavoidable, the next goal is to rehabilitate or restore the areas impacted back to their original form after project completion. Offsets are then considered if all the

other measures described above fail to remedy high/significant residual negative impacts. If no offsets can be achieved on a potential impact, which results in full destruction of any ecosystem for example, the no-go option is considered so that another activity or location is considered in place of the original plan.

2.6 STAKEHOLDER ENGAGEMENT PROCESS

Stakeholder engagement (public participation) is a requirement of the BA process. It consists of a series of inclusive and culturally appropriate interactions aimed at providing stakeholders with opportunities to express their views, so that these can be considered and incorporated into the BA decision-making process. Effective engagement requires the prior disclosure of relevant and adequate project information to enable stakeholders to understand the risks, impacts, and opportunities of the proposed project. The objectives of the stakeholder engagement process can be summarised as follows:

- Identify relevant individuals, organisations and communities who may be interested in or affected by the proposed project;
- Clearly outline the scope of the proposed project, including the scale and nature of the existing and proposed activities;
- Identify viable proposed project alternatives that will assist the relevant authorities in making an informed decision;
- Identify shortcomings and gaps in existing information;
- Identify key concerns, raised by Stakeholders that should be addressed in the specialist studies;
- Highlight the potential for environmental impacts, whether positive or negative; and
- To inform and provide the public with information and an understanding of the proposed project, issues, and solutions.

A SER has been included in **Appendix D** and will be updated in the final BAR, detailing the project's compliance with Chapter 6 of the NEMA EIA Regulations 2014, as amended.

2.6.1 STAKEHOLDER CONSULTATION

Stakeholders were identified and will continue to be identified through several mechanisms. These include:

- Utilising existing databases from other projects in the area (specifically obtaining information from the stakeholder database for the adjacent Nuweveld Wind Farm Development stakeholder database);
- Advertising in the press;
- Placement of community notices;
- Completed comment sheets; and
- Attendance registers at meetings.

All Stakeholders identified to date have been registered on the project stakeholder database. The EAP endeavoured to ensure that individuals/organisations from referrals and networking were notified of the Proposed Project. Stakeholders were identified at the horizontal (geographical) and vertical extent (organisations level).

A list of stakeholders captured in the project database is included in the SER in **Appendix D**.

2.7 ASSUMPTIONS AND LIMITATIONS

General assumptions and limitations:

- The EAP hereby confirms that they have undertaken to obtain project information from the client that is deemed to be accurate and representative of the project;
- Site visits have been undertaken to better understand the project and ensure that the information provided by the client is correct, based on site conditions observed;
- The EAP hereby confirms their independence and understands the responsibility they hold in ensuring all comments received are accurately replicated and responded to within the BA documentation;
- The comments received in response to the public participation process, will be representative of comments from the broader community; and
- Based on the Pre-Application meeting and subsequent minutes, the CA would not require additional specialist input, in order to make a decision regarding the application.

Climate Change Impact Assessment:

- The Mura Solar PV Project is still in the planning phase. Thus, there are some uncertainties regarding final design and implementation of the project. Therefore, the use of a 150 MW plant to do the assessment was done to create an idea of the impact and emissions. Such assessment can be adjusted according to the actual design and capacity of the plant later on. However, it is the opinion of the specialist that sufficient data was provided to cover all significant GHG emission sources.
- The average number of PV panels estimated to be used for the operations of the project were a total of 656 268. However, this equated to a capacity of the facility to be approximately 390MW. As a result of most of the activity data being recorded in terms of a 150MW facility, the number of PV panels were adjusted accordingly. This equated to about 250 000 panels being required for the operation of a 150MW facility and therefore used in the assessment. Noting that should the number of panels reduce, the contribution towards climate change (both the emissions, and the avoided emissions) would also subsequently reduce.
- The Climate Change Impact Assessment (CCIA) makes use of data obtained during a desktop review for the development of this GHG inventory and associated impact assessment. Certain assumptions were made to ensure the development of the most accurate and extensive GHG inventory and the associated impact assessment. These assumptions were made considering the framework required by the EA reporting requirements. It was assumed, based on the specialist's experience, that the following aspects of the Mura Solar PV will not contribute materially towards the GHG footprint of the project during the operational phase:

  - Mobile combustion of diesel and/or petrol fuels in onsite trucks or machinery;
  - Stationary combustion from backup generators;
  - Quantity of construction and municipal waste generated;
  - Purchase of capital goods, such as vehicles; and
  - Business travel.

Terrestrial Biodiversity Compliance Statement:

- It is not possible to confirm the absence of a faunal species with 100% certainty. A species may be absent from an area during sampling but may move through the area occasionally or seasonally.
- Some species are rare or difficult to locate and it may be very difficult to confirm either the absence or presence of such species without long-term studies.
- The presence of such species is assessed in the current study based on observations of such species from the wider area in the various publicly available databases and citizen science websites (Virtual Museum & iNaturalist), as well as the habitat suitability, quality and condition as observed in the field.
- In terms of vegetation, conditions at the time of the initial survey were in a relatively favourable condition for the field assessment as there had been rain prior to sampling and the abundance of annuals and geophytes as relatively high, with many species growing or in flower. Although not all of the PV area could be searched given its' large extent, the footprint area is considered to have been well-covered and it is highly unlikely that there are any significant vegetation features present that would not have been observed during the study.

Aquatic Impact Assessment:

- Limitations and uncertainties often exist within the various techniques adopted to assess the condition of ecosystems. The methodologies and techniques used in this assessment have been developed nationally and are typically of a rapid nature, as is required for this freshwater impact assessment.
- Given the topography at the site, it was not possible to cover the site in a high level of detail, however, extrapolation of the areas ground-truthed to those not covered was thus done using the latest available aerial imagery for the site. No baseline long-term monitoring was undertaken as part of this assessment. In addition, there is very little existing information available for the aquatic features within the study area. Data was utilised for adjacent aquatic ecosystems, and where available, more detailed assessments were used for the aquatic features within the area.
- The nature of the proposed activities, however, also allows them to be placed some distance from any mapped aquatic features such that the significance of likely impacts would be very low. It is usually the associated infrastructure that has the potential to have a greater impact on the aquatic features. The impacts of access roads (assessed in this report) and overhead powerlines (assessed in a separate specialist report) on the aquatic features are, however, well understood and can be effectively mitigated to ensure the impacts remain low. The preferred mitigation measure is to limit the disturbance to aquatic features as far as possible by avoiding and minimising the number of crossings and providing adequate buffer areas. This will also ensure that the cumulative impacts will remain low.
- The level of aquatic assessment undertaken was considered to be adequate for this study. The assessment was undertaken in March 2022 however there had been recent rainfall in the area and sufficient water was present in the rivers at the time of the site visit to allow for the required level of assessment for this study. No further fieldwork will thus be required if the proposed project activities remain outside of the delineated aquatic features and the recommended buffers.

Plant Species Compliance Statement:

- Conditions at the time of the initial survey were in a relatively favourable condition for the field assessment as there had been rain prior to sampling and the abundance of annuals and geophytes as relatively high, with many species growing or in flower.
- Although not all of the PV area could be searched given its' large extent, the footprint area is considered to have been well-covered and it is highly unlikely that there are any significant vegetation features present that would not have been observed during the study.
- Given the extent of the sample track and the relatively favourable conditions at the time of the site visit, there are few limitations and assumptions required with regards to the vegetation of the site and the presence of plant SCC within the PV development footprint.

Animal Species Compliance Statement:

- It is not possible to confirm the absence of a species with 100% certainty. A species may be absent from an area during sampling but may move through the area occasionally or seasonally. This effect is however to a large degree mitigated through the use of the camera traps at the site which provide an effective characterisation of the medium sized and larger fauna of the site.
- Some species are rare or difficult to locate and it may be very difficult to confirm either the absence or presence of such species without long-term studies.
- The presence of such species is assessed in the current study based on observations of such species from the wider area in the various publicly available databases and citizen science websites (Virtual Museum & iNaturalist), as well as the habitat suitability, quality and condition as observed in the field.

Avifauna Impact Assessment:

- Certain biases and challenges are inherent in the methods that have been employed to collect data in this programme. It is not possible to discuss all of them here, and some will only become evident with time and operational phase data, but the following are some of the key points:
- The presence of the ornithologist on site is certain to have an effect on the birds itself. For example during walked transects, certain bird species will flush more easily than others (and therefore be detected), certain species may sit undetected, certain species may flee, and yet others may be inquisitive and approach the observers.

Heritage Impact Assessment:

- The field study was carried out at the surface only and hence any completely buried archaeological sites would not be readily located. Similarly, it is not always possible to determine the depth of archaeological material visible at the surface.
- Cumulative impacts are difficult to assess due to the variable site conditions that would have been experienced in different areas and in different seasons. Survey quality is thus likely to be variable. As such, some assumptions need to be made in terms of what and how much heritage might be impacted by other developments in the broader area.

Traffic Impact Assessment:

The compiling of this combined report for the proposed developments are based on the following assumptions:

- Project

- The report is a combined report that includes all four of the proposed developments.
- The relevant Grid Connection will be included in the relevant proposed developments.
- Each of the proposed developments shall include two Substations, BESS, Office, Ablution, and Operational and Maintenance facilities.
- All proposed developments are to be constructed, simultaneously over a period of 24 months.
- The final layout of each proposed development is pending specialist's recommendations, where applicable.

- Cumulative Effects
  - As part of the Mura Solar Development, four Mura Solar Energy Facilitates (SEFs) are proposed. In addition to the proposed developments, there are several other developments earmarked for construction in the area. Some developments will be implemented sooner than others, thus for the proposed development the following cumulative effects have been assumed to include:
    - The three Nuweveld Wind Energy Facilities (WEFs); assumed to be in the operational phase.
    - The two Hoogland WEF Clusters (North and South); each cluster consisting of two WEFs and associated infrastructure, are assumed to be in the construction phase.
    - The Gamma Grid Connection is assumed to be its construction phase.
  - The construction schedule of the projects listed above together with the proposed developments is unknown, at this point in time. Thus, a conservative (unrealistic) assessment has been adopted in the report, which assumes that all know developments will be either in the operational phase or constructional phase (as defined above), and the traffic of all the projects peak at the same time, resulting in a worst-case scenario.
- Manpower
  - The manpower complement, for each of the proposed developments (including grid connection) is provided below:
    - Mura 1 – 165 individuals.
    - Mura 2 – 435 individuals.
    - Mura 3 – 318 individuals.
    - Mura 4 – 354 individuals.
    - The total manpower complement for the four proposed developments, is in the order of 1 272 individuals.
  - The combined manpower complement, for the operation phase of the three Nuweveld WEF is expected to be in the order of 96 individuals.
  - The combined manpower complement, for the four Hoogland wind farms and associated infrastructure during peak construction phase is assumed to be in the order of 1 200 individuals.
  - The manpower complement for the proposed Gamma Grid Connections during peak construction phase is expected to be in the order of 60 individuals.
- Workforce Distribution
  - No accommodation is provided on-site.

- The workforce for the proposed developments is drawn from various towns within a travel distance of 200 km, and include Beaufort West, Carnarvon, Fraserburg, Hutchinson, Loxton, Murraysburg, Nelspoort and Victoria West.
- The distribution of the workforce is based on the working-age population in each town modified by the weighting factor relating to the distance the various towns are from the proposed developments.
- The number of specialists deployed to the area for the proposed developments is assumed to be nominal and will not adversely affect the distribution as described above.

- Traffic

  - Delivery routes of equipment and materials to the proposed developments from various commercial centres within South Africa will follow well-established road networks.
  - The commuting routes of personnel and delivery routes to the proposed development are subject to the limitations stipulated in the Traffic Management Plan for the project.
  - For analysis purposes the shortest route from the surrounding towns to the proposed developments will be adopted.
  - Construction equipment and materials (other than aggregates) for the proposed development will be transported from the various commercial centres within South Africa.
  - The supply of raw materials for the manufacture of concrete and road construction, as a worst-case scenario, will be sourced from commercial sources outside the proposed development.
  - The maximum payload of general-purpose vehicles used to transport equipment and material to the site is assumed to be in the order of 20 000 kg. However, the Molteno Pass on the TR 05801 and the De Jager's Pass on the DR 02311, shall not be used by vehicles with a gross mass of more than ten tonnes for the commuting of personnel and the transportation of construction equipment and materials.
  - The transportation of personnel shall be provided by either double cab bakkie (4 Pax), minibuses (16 Pax), or Buses (35, 45 and 55 Pax), all vehicles shall be retained on-site during the day.
  - All concrete is to be batched on-site (either within the solar PV areas or within the access road corridors), concrete mixing trucks will only be permitted on the public road network from the batching site (most likely the same sites used for Nuweveld East) to the solar sites.

Visual Impact Assessment:

- Internal access roads will mostly make use of widened existing roads. A panel height of 6m has been used to determine the viewshed of the solar PV facilities.
- Detailed design of these would only become available at a later stage.

Social Impact Assessment:

- The quantification of economic impacts in order to inform the assessment of the significance of impacts was not possible, nor considered necessary, for all impacts. Where possible, quantification focused on impacts considered to be most important in the overall assessment. Assessments of impact significance made without quantification (and based on a consideration of the likely magnitudes of impacts and/or expert judgements) are, however, considered adequate unless otherwise specified.
- All impacts are assessed individually and then as a whole to the degree possible and appropriate. An overall assessment and discussion of net impacts (i.e. whether overall benefits exceed costs)

was undertaken to the degree thought appropriate and justifiable combining quantifiable and unquantifiable impacts. Given uncertainties and the potentially subjective nature of comparisons between impact categories, the emphasis in the report is on presenting assessments of impact categories with less emphasis on trying to reconcile them in an overall assessment of net effects. To a large degree this role of comparing and weighing up different (and hard to reconcile) impacts is the ambit of the relevant decision-making authorities.

- The findings of the assessment reflect the best professional assessment of the author drawing on relevant and available information within the constraints of time and resources thought appropriate and made available for the assessment. See Appendix B for the disclaimer associated with this report.
- The assessment only considers the impacts of the proposed projects and the no-go alternative. It does not make comparisons with other wind energy projects which may or may not be more desirable. The Department of Mineral Resources and Energy (DMRE) is primarily responsible for making the necessary comparisons between projects as part of the process of awarding contracts to aspirant competing renewable energy developers, should these projects be bid in a Renewable Energy Independent Procurement Producer Programme (REIPPPP) bidding round.

3 PROJECT DESCRIPTION

This section provides a description of the location of the project area and the site location alternatives considered for the project. The descriptions encompass the activities to be undertaken during the construction and operational phases as well as the consideration for site accessibility, water demand, supply, storage, and site waste management. This section also considers the need and desirability of the project in accordance with Appendix 1 of GNR 326.

3.1 LOCATION OF THE PROPOSED PROJECT

The proposed Mura 1 Solar PV Facility which includes its access road is located between Loxton and Beaufort West in the BWLM and the CKDM in the Western Cape Province. The proposed Mura 1 Facility will be developed within a project area of approximately 176 hectares (ha), excluding the access road corridor. The site will be accessed via the R381, DR02317 and existing access roads (**Figure 3-1)**. The four solar PV facilities of the Mura Solar Development are located adjacent to each other and as such, the overall locality of the Mura Solar PV Development is included in Figure 1-2. The details of the property associated with the proposed Mura 1 PV Facility, including the 21-digit Surveyor General (SG) codes for the cadastral land parcels are outlined in **Table 3-1**. The co-ordinates of the cadastral land parcels are included in **Table 3-2**. The coordinates of the centre and outer corner points of the development area of the Mura 1 Solar PV Facility are provided in **Table 3-3** and the access road corridor provided in **Table 3-4** below

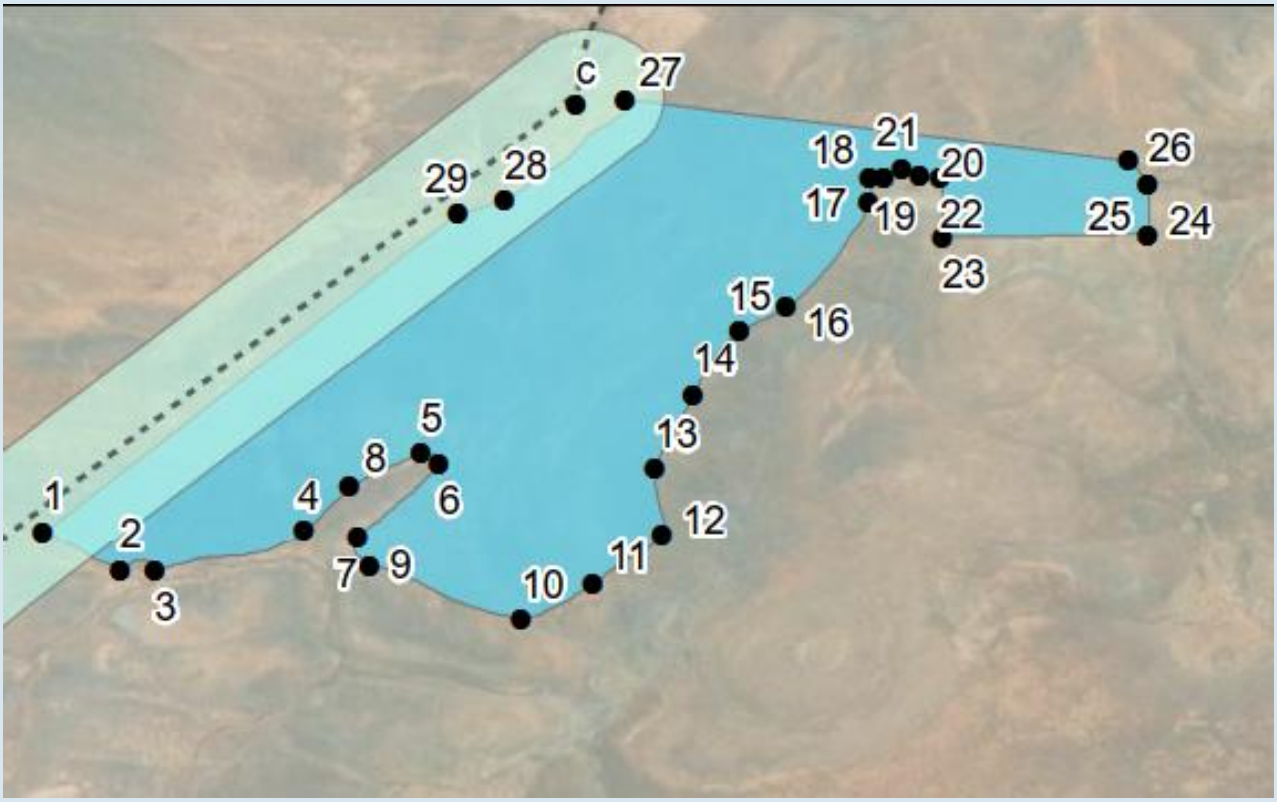
Table 3-1 – Mura 1 Solar PV Facility Affected Farm Portions

Farm Name	21 Digit Surveyor General Code of Each Cadastral Land Parcel
Leeuwkloof Farm 43	C00900000000004300000
Portion 4 of Duiker Kranse Farm 45	C00900000000004500004

Table 3-2 – Coordinate Points of the Cadastral Land Parcel

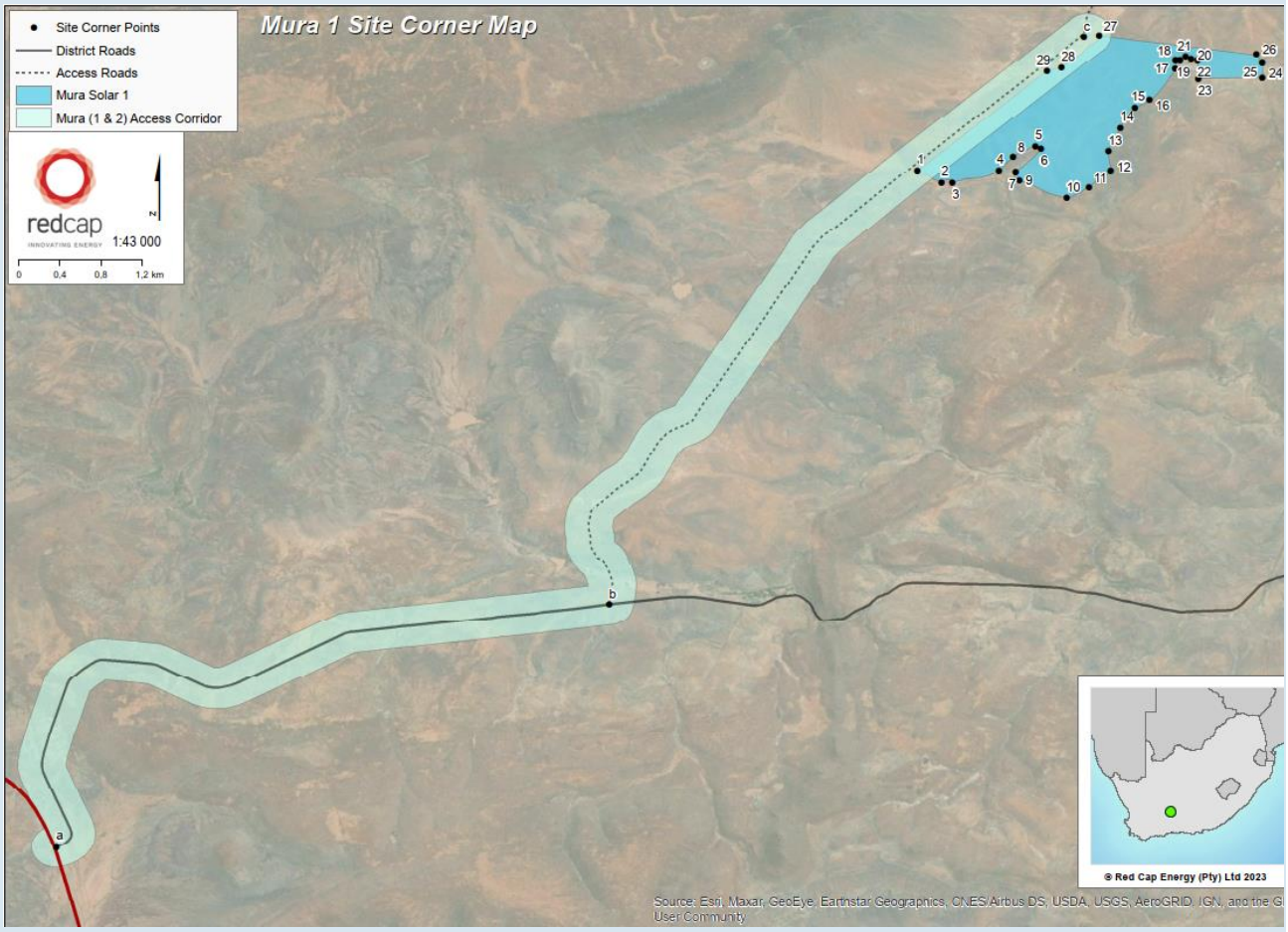
Point	Longitude	Latitude
		
AF	22° 25' 30.549" E	31° 54' 31.383" S
AG	22° 23' 38.105" E	31° 53' 27.670" S
AH	22° 23' 27.895" E	31° 53' 24.545" S
AI	22° 22' 59.281" E	31° 53' 5.869" S
AJ	22° 23' 21.151" E	31° 52' 39.727" S
J	22° 25' 42.416" E	31° 50' 28.752" S
A	22° 28' 23.070" E	31° 49' 26.137" S
B	22° 31' 2.626" E	31° 49' 45.289" S
C	22° 31' 24.038" E	31° 54' 19.973" S
D	22° 28' 9.966" E	31° 53' 55.928" S

Table 3-3 – Mura 1 Solar PV Facility Coordinates

Point	Longitude	Latitude
		
PV Development Area		
Centre Point	22°29'35.79"E	31°50'20.38"S
1	22° 28' 52.540" E	31° 50' 19.187" S
2	22° 29' 0.200" E	31° 50' 22.819" S
3	22° 29' 3.638" E	31° 50' 22.916" S
4	22° 29' 18.258" E	31° 50' 19.093" S
5	22° 29' 29.825" E	31° 50' 11.422" S
6	22° 29' 31.672" E	31° 50' 12.354" S
7	22° 29' 23.662" E	31° 50' 19.734" S
8	22° 29' 22.844" E	31° 50' 14.795" S
9	22° 29' 24.756" E	31° 50' 22.351" S
10	22° 29' 39.743" E	31° 50' 27.704" S
11	22° 29' 46.860" E	31° 50' 24.331" S

Point	Longitude	Latitude
12	22° 29' 53.635" E	31° 50' 19.450" S
13	22° 29' 52.998" E	31° 50' 13.002" S
14	22° 29' 56.695" E	31° 50' 5.618" S
15	22° 30' 1.350" E	31° 49' 59.344" S
16	22° 30' 5.864" E	31° 49' 56.960" S
17	22° 30' 14.076" E	31° 49' 46.729" S
18	22° 30' 14.166" E	31° 49' 44.350" S
19	22° 30' 15.592" E	31° 49' 44.335" S
20	22° 30' 19.141" E	31° 49' 44.170" S
21	22° 30' 17.363" E	31° 49' 43.241" S
22	22° 30' 21.161" E	31° 49' 44.270" S
23	22° 30' 21.305" E	31° 49' 50.074" S
24	22° 30' 41.652" E	31° 49' 49.832" S
25	22° 30' 41.573" E	31° 49' 44.954" S
26	22° 30' 39.665" E	31° 49' 42.532" S
27	22° 29' 49.977" E	31° 49' 36.602" S
28	22° 29' 38.054" E	31° 49' 46.520" S
29	22° 29' 33.526" E	31° 49' 47.820" S

Table 3-4 – Mura 1 and 2 Access Road Coordinates

Point	Longitude	Latitude
		
a (Start)	22° 24' 20.311" E	31° 53' 52.717" S
b (Middle)	22° 27' 15.092" E	31° 52' 36.273" S
c (End)	22° 29' 45.190" E	31° 49' 37.042" S

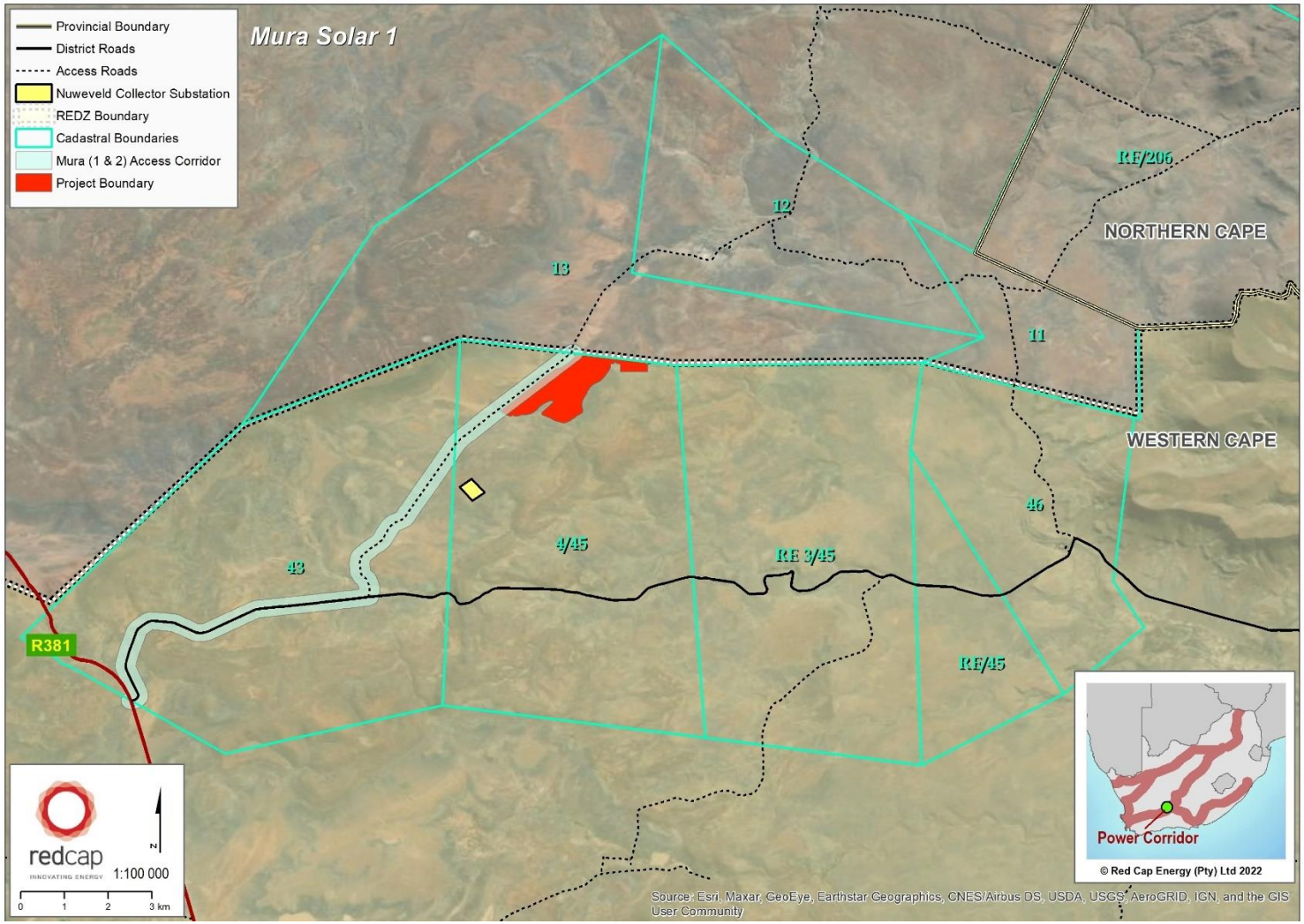


Figure 3-1 – Mura 1 Solar PV Facility

3.2 SOLAR PV GENERATION PROCESS

South Africa experiences some of the highest levels of solar radiation in the world between 4.5 and 6.5kWh/m2/day) and therefore, possesses considerable solar resource potential for solar power generation.

In terms of large-scale grid connected applications the most commonly used technology utilised in South Africa is PV installations and is described in some detail in the following section.

It must be noted that this project is specific to solar power generation through the use of solar PV technology only.

3.2.1 PV AND MOUNTING SYSTEM

Internationally, solar PV is the fastest-growing power generation technology. Approximately 139 GW was added to the installed capacity globally in 2020, increasing the installed capacity by 18% from the previous year. The total capacity from PVs was 760 GW globally, producing approximately 3% of the world's electricity. In South Africa the solar PV installed capacity in 2020 grew by 37% compared to the previous year's value. As much as 3.6 GW of PV is planned to be installed by 2026, with approximately 1.48 GW already installed as recorded in 2019.

Large-scale or utility-scale PV systems are designed for the supply of commercial power into the electricity grid. Large-scale PV plants differ from the smaller units and other decentralised solar power applications because they supply power at the utility level, rather than to local users.

PV cells are made from semi-conductor materials that are able to release electrons when exposed to solar radiation. This is called the photo-electric effect. Several PV cells are grouped together through conductors to make up one module. Modules can be connected together to produce power in large quantities. In PV technology, the power conversion source is via PV modules that convert light directly to electricity.

Solar panels produce direct current (DC) electricity; therefore, PV systems require conversion equipment to convert this power to alternating current (AC), that can be fed into the electricity grid. This conversion is done by inverters. **Figure 3-2** provides an illustration of the main components of a solar PV power plant.

The solar PV panels can be mounted in various ways to ensure the maximum exposure to sunlight. The two main mounting systems that form part of a PV facility are either single axis tracking or fixed axis mounting structures. In the fixed axis mounting structures, the panels are installed and set to face north and does not move to follow the sun. With tracking systems, the panels track the sun and thereby ensure maximum exposure to the sunlight. Both mounting systems are considered for this project.

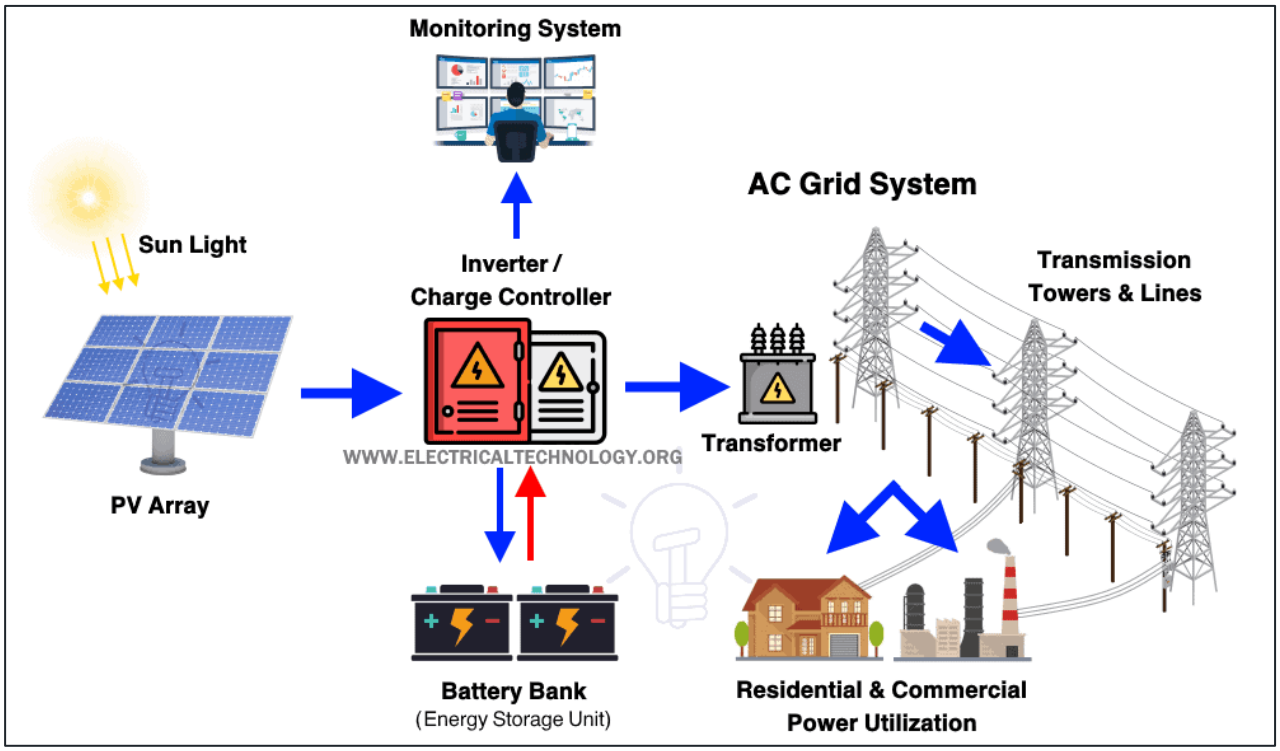


Figure 3-2 - Main components of a Solar PV Plant

Source: *www.electricaltechnology.org/2021/07/solar-power-plant.html*

3.3 BESS TECHNOLOGY

The Mura Solar facility proposal includes the development of a Battery Energy Storage System (BESS). There is a growing need for renewable energy technologies, such as solar and wind, to be able to supply a reliable source of electricity to the grid. Since solar and wind technology depend on whether the sun is shining or the wind is blowing, respectively, these technologies are only efficient when these sources are available. Battery storage systems allow for fluctuating renewable energy sources to be as stable as conventional systems and also provide a means to decouple generation of electricity from its use (i.e. provide electricity to the grid during peak demand) and therefore minimising supply and demand related issues.

Given the ongoing improvement in battery storage technology and the significant advantages of combining battery storage with wind farms, it makes sense to include a battery facility with the solar facility. The BESS is proposed adjacent or slightly removed from the solar facility's substations, within the solar facility's development envelope.

3.3.1 BATTERY TYPE

The BESS will be made up of Lithium-Ion batteries or similar solid-state technology due to them being a mature and safe technology with regard to potential impacts on the environment in a solar facility, modular and easy to install and due to their technical characteristics, will work well as energy storage systems for solar facilities, as well as supporting grid stability.

3.3.2 PHYSICAL DESIGN OF THE BATTERY FACILITY

The battery's smallest component is the "battery cell" which is similar to the batteries that we all use in our appliances. See the diagram below for an overview of the battery make up. These cells have only a very small proportion of their mass made up by liquid, which is the electrolyte and accounts for no more than about 6% of the total mass of the batteries. These cells are completely sealed in the factories when they are manufactured, and no electrolytic liquids are thus handled on site. Furthermore, the small amount of electrolytic liquid within each cell is also almost all absorbed into the solid components in the cell thus making any significant spillage of liquid almost impossible. A number of cells are combined together into "battery modules" in the factories where they are manufactured which again are sealed systems giving secondary containment of any potential minor liquid leak of electrolyte. The modules are then combined into metal "battery racks" and the racks are installed in closed containers further reducing the risk of spillage of any liquid into the environment as the liquid has now been contained three times even though most of it is absorbed within the battery cell.

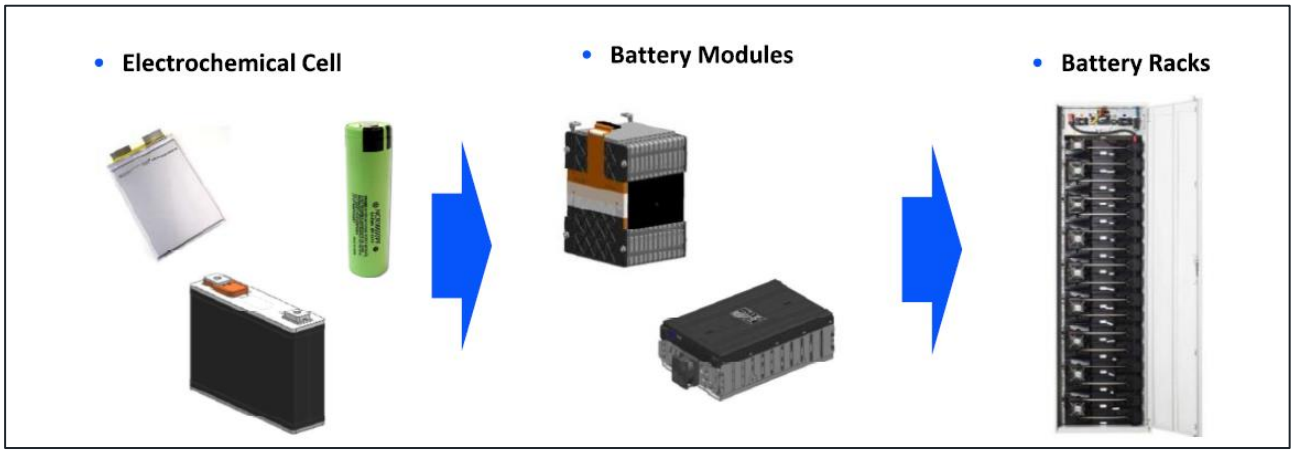


Figure 3-3 – Basics of utility scale batteries

Each container will therefore contain many battery racks, an automated Heating, Ventilation and Air Conditioning (HVAC) system, a fire detection and suppression system (that uses inert gas), battery management system and other electrical components required to manage the batteries. The containers are standard size shipping containers of 12m long x2.5m wide x2.7m high. The addition of the HVAC systems may protrude outside the containers making them a bit longer or higher (but not higher than 4.5m and thus lower than the tallest buildings in the substation). See **Figure 3-4** below that shows a typical layout of one of these containers.

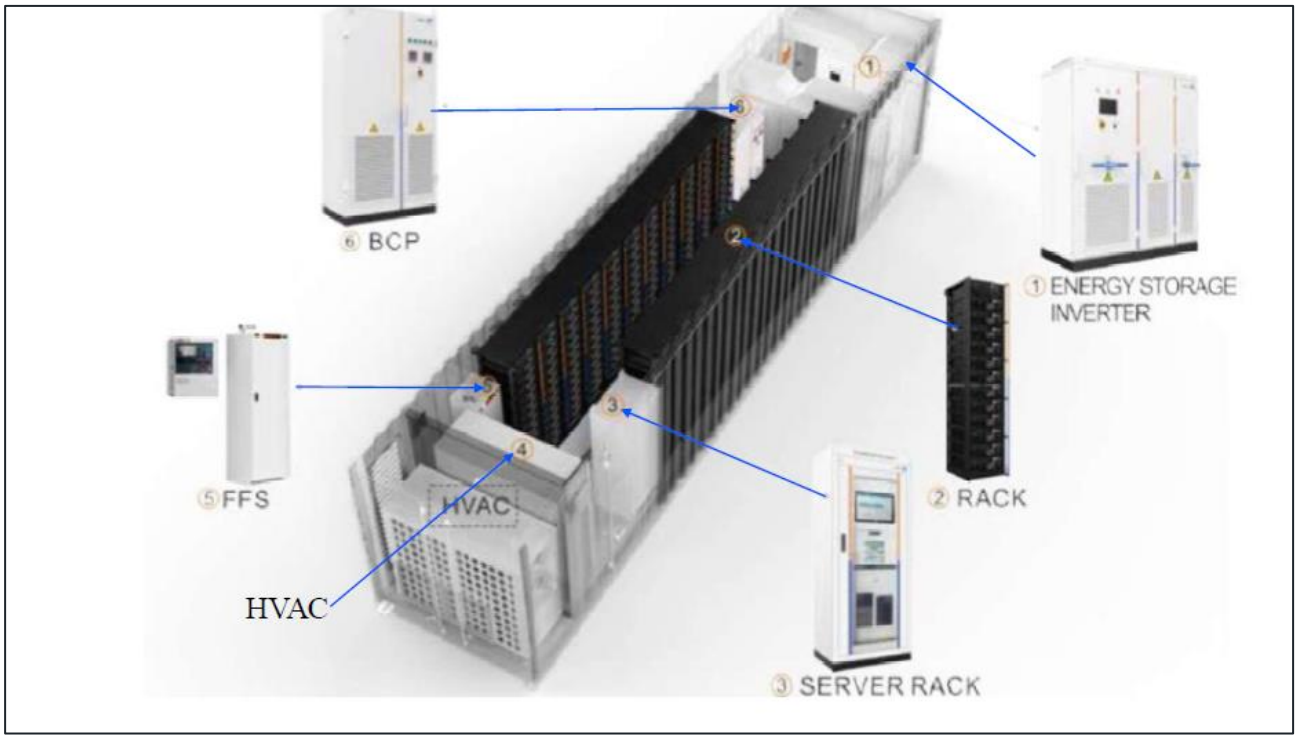


Figure 3-4 – Indicative layout of battery

The size of the battery facility will be a 240 MWac system and will be located in a 4 ha area within the solar facility's development envelope. See **Figure 3-5** below giving an indicative layout of one of these proposed battery facilities.

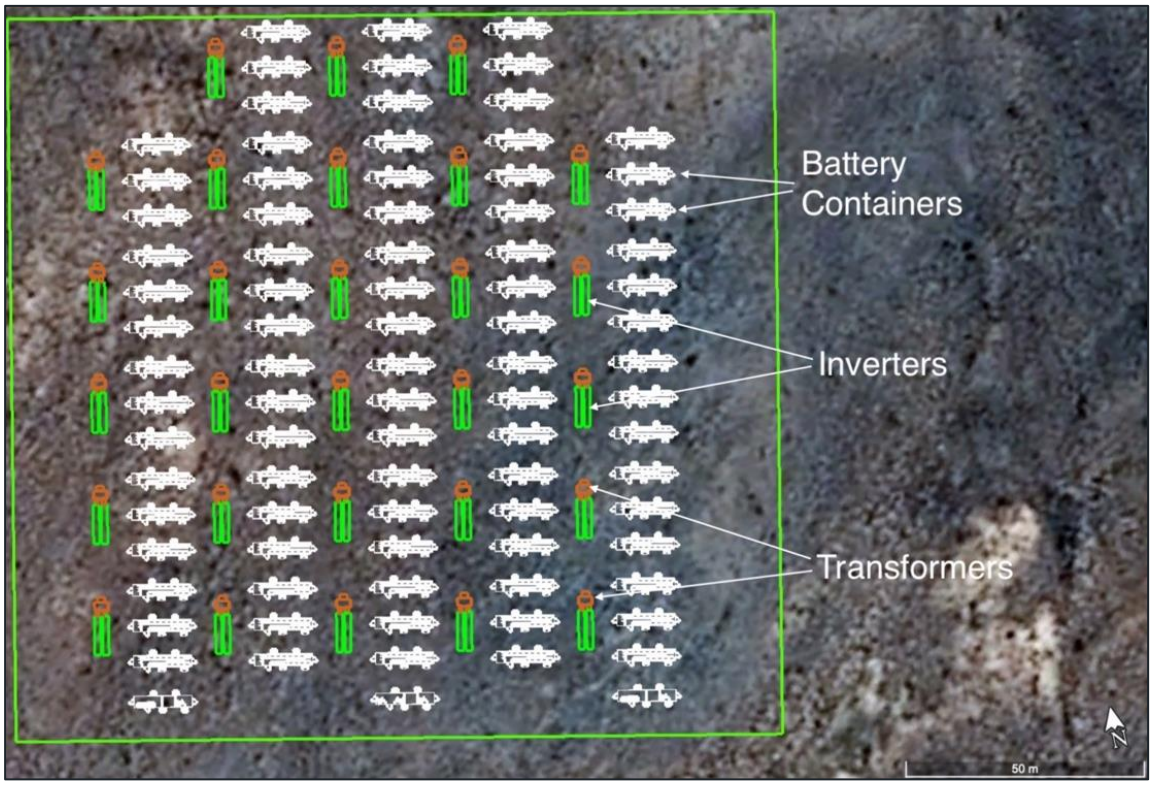


Figure 3-5 - Indicative layout of the BESS

The battery facilities will be located in close proximity to the solar facility's substations and will be linked to the substation via up to 132kV (or less) underground cables and will not have any additional office/ operation/ maintenance infrastructure as those of the substation. In effect, the battery facilities are extensions of the substation infrastructure and, as per the substations, will be contained within a security fence.

The HVAC system that each container has is composed of a number of air conditioning units and a ventilation system to provide both heating and cooling to maintain the internal conditions as per equipment requirements.

3.3.3 COMPLIANCE WITH LOCAL AND INTERNATIONAL STANDARDS

The cells, modules, racks and the complete facility will be compliant with all local laws and regulations and health and safety requirements governing such battery facilities. Over and above that they will comply with international standards such as UN 38.3 (Transportation Testing for Lithium Batteries), UL 1642 (Standard for Safety – Lithium-ion Batteries) and IEC 62619 (Secondary cells and batteries containing alkaline or other non-acid electrolytes Safety requirements for secondary lithium cells and batteries, for use in industrial applications). Furthermore, the battery facility will also comply with standards such as UL 1973 (Batteries for Use in Stationary Applications) and IEC 62619-2017 including thermal runaway non-propagation and safety zone region operation limits and a failure mode analysis. The design will be compliant with UL 9540 (Energy Storage Systems and Equipment): this standard defines the safety requirements for battery installation in industrial and grid connected applications.

3.4 PROJECT INFRASTRUCTURE

The following are proposed as part of the project. The total project area is 198 ha and should be assumed to be wholly transformed. The project footprint will contain the following:

- Solar Field;
- Solar Farm Substations;
- BESS and BESS substation;
- Building Infrastructure;
- Other Infrastructure located within the solar area footprint; and
- Associated Infrastructure (outside the solar area footprint).

These items are discussed in more detail below.

3.4.1 SOLAR FIELD

The total development envelope for project installation is approximately 176 ha to allow for the construction of a PV facility with capacity up to 150 MW. Solar PV modules which convert solar radiation directly into electricity, will have a maximum height of 6m. The solar PV modules will be elevated above the ground and will be located on either single axis tracking structures or fixed tilt mounting structures or similar.

3.4.2 SOLAR FARM SUBSTATIONS

Each solar facility will connect to the Eskom grid via new 132 kV overhead lines (assessed in separate processes to the PV facilities) connecting the up to two on-site solar substations via an adjacent Eskom switching stations to the approved Nuweveld Collector substation.

The substations will have a maximum height of 12m and will include a high voltage gantry within a 150 m x 75 m substation yard

3.4.3 BESS AND BESS SUBSTATION

Each solar farm will have an area up to 4 ha for a 240 MWac BESS. The BESS will be Lithium-ion or similar solid-state technology. The BESS will have a substation with the same specifications as the Solar Farm substations. The BESS will be connected to the solar farm sub/switching stations via an underground high voltage cable.

3.4.4 BUILDING INFRASTRUCTURE

Building infrastructure of up to a maximum height of 8m will be located within the project area. The infrastructure includes:

- Offices;
- Operational and maintenance (O&M)/ control centre;
- Warehouse/workshop;
- Ablution facilities; and
- Converter/inverter stations.

3.4.5 OTHER INFRASTRUCTURE

Other Infrastructure located within the solar area footprint includes:

- Internal underground cables of up to 132 kV;

- Internal gravel roads;
- Fencing (between 2 – 3 m high) around the PV Facility;
- Panel maintenance and cleaning area;
- Storm water management system; and
- Site camps.

3.4.6 ASSOCIATED INFRASTRUCTURE

There will be additional associated Infrastructure outside the solar area footprint but part of the solar project. This includes:

- Internal access gravel roads with a footprint of 17 ha:
  - Up to 4 m wide driving surface and may require side drains on one or both sides.
  - During construction the roads may be up to 12 m wide, but this will be a temporary impact and rehabilitated following the construction phase.
- Site camps:
  - Up to two 2.2 ha site camps within the access road corridor.

3.5 PROPOSED PROJECT DEVELOPMENT ACTIVITIES

3.5.1 CONSTRUCTION PHASE

The construction process will follow industry standard methods and techniques. Key activities associated with the construction phase are described in **Table 3-5**.

Table 3-5 – Construction activities

Activity	Description
Establishment of access and internal roads	Access to the proposed Mura 1 Solar PV facility will be via the R381, DR02317 and existing access roads. Internal gravel roads will be developed. The roads will be up to 4 m wide, but during construction the roads may be up to 12 m wide, however this will be a temporary impact and rehabilitated following the construction phase
Site preparation and establishment	Site establishment will include clearing of vegetation and any bulk earthworks that may be required.
Transport of components and equipment to site	All construction material (i.e. PV support structure materials), machinery and equipment (i.e. graders, excavators, trucks, cement mixers etc.) will be transported to site utilising the national, regional and local road network. Large components (such as substation transformers) may be defined as abnormal loads in terms of the Road Traffic Act (No. 29 of 1989). In such cases a permit may be required for the transportation of these loads on public roads.
Establishment of a laydown area on site	Construction materials, machinery and equipment will be kept at relevant laydown and/or storage areas. Laydown areas (site camps) of approximately up to 2.2ha each have been proposed for this project. The laydown areas will also be utilised for the assembly of the PV panels. The laydown area will limit potential environmental impacts associated with the construction phase by limiting the extent of the activities to one designated area.

Activity	Description
Erection of PV Panels	The PV panels will be arranged in arrays. The frames will be fixed onto vertical posts that will be driven into the ground utilising the relevant foundation method identified during the geotechnical studies, including potentially employing concrete foundations for the panel frames. PV panels will have a maximum height of 6m.
Construction of substation and inverters	The facility output voltage will be stepped up from medium voltage to high voltage in the transformer. The medium voltage cables will be run underground within the facility to a common point before being fed to the onsite substation.
Establishment of ancillary infrastructure	Ancillary infrastructure will include a workshop, storage areas, office, and a temporary laydown area for contractor's equipment.
Rehabilitation	Once all construction is completed on site and all equipment and machinery has been removed from the site, the site will be rehabilitated.

3.5.2 OPERATIONAL PHASE

During operation the key activities will include inspection and maintenance of the solar panels, substations, BESS, and other associated infrastructure.

3.5.3 DECOMMISSIONING PHASE

The decommissioning phase will include activities similar to that of the construction phase as indicated in **Table 3-5**.

3.6 NEED AND DESIRABILITY OF THE PROJECT

South Africa is faced with significant increases in electricity demand and a shortage in electricity supply. South Africa is the seventh highest coal producer in the world, with approximately 77% of the country's electricity generated from coal. This large dependence on coal and its use has also resulted in a variety of negative impacts on the environment, including the contribution to climate change. South Africa is also the highest emitter of greenhouse gases in Africa; attributed to the country's energy-intensive economy that largely relies on coal-based electricity generation.

Renewable energy development is regarded as an important contribution to meeting international and national targets of reducing reliance on fossil fuels, such as coal, which contribute towards greenhouse gas emissions and resultant climate change. The need and desirability of proposed Mura 1 Solar PV Facility has been considered from an international, national, and regional perspective.

3.6.1 INTERNATIONAL PERSPECTIVE

The proposed project will align with internationally recognised and adopted agreements, protocols, and conventions. This includes the Kyoto Protocol (1997) which calls for countries internationally to reduce their greenhouse gas emissions through cutting down on their reliance on fossil fuels and investing in renewable energy technologies for electricity generation. The proposed project will therefore add capacity to the energy sector and generate electricity without greenhouse gas emissions and meet international requirements in this regard.

South Africa is also signatory to the United Nations' Development Programmes' (UNDP) Sustainable Development Goals (SDGs), particularly SGD 7 relating to affordable and clean energy. The

proposed project qualifies as a clean technology that will generate up to 150 MW of affordable energy to contribute to South Africa's energy mix.

The project will also greatly contribute to the countries' efforts to reduce their carbon emissions and play their role as part of the Paris Climate Accord. The Paris Agreement is a legally binding international treaty signed by 196 countries at the COP 21 in Paris, on the 12th of December 2015 to combat climate change. The goal of the Paris Accord is to limit global warming to well below 2 degrees Celsius, compared to industrial levels to avoid catastrophic natural disasters which are driven by the global temperature increase. Therefore, to achieve this long-term temperature goal, countries aim to reach global peaking of greenhouse gas emissions as soon as possible to achieve a climate-neutral world by 2050.

At COP27 President Sameh Shoukry announced the *Sharm el-Sheikh Adaptation Agenda*[6], enhancing resilience for people living in the most climate-vulnerable communities by 2030. The cover decision, known as the Sharm el-Sheikh Implementation Plan, highlights that a global transformation to a low-carbon economy is expected to require investments of at least USD 4-6 trillion a year. The Sharm el-Sheikh Implementation Plan emphasises the urgent need for reduced global greenhouse gas emissions through the use of renewable energy, just energy transition partnerships and other cooperative actions. The Plan further highlights that this is a critical decade of action that requires rapid transformation towards renewable energy.

This renewable energy project aligns with the goals of the Sharm el-Sheikh Implementation Plan and the need to reduce greenhouse gas emissions and rapidly transform towards renewable energy.

3.6.2 NATIONAL PERSPECTIVE

The South African Government, through the IRP, has set a target to secure 17 800 MW of renewable energy by 2030. This is an effort to diversify the country's energy mix in response to the growing electricity demand and promote access to clean sources of energy.

The National Development Plan (NDP) is aimed at reducing and eliminating poverty in South Africa by 2030. The NDP also outlines the need to increase electricity production by 2030, with 20 000 MW of electricity capacity generated from renewable sources in order to move to less carbon-intensive electricity production. The Plan also envisages that South Africa will have an energy sector that provides reliable and efficient energy service at competitive rates, while supporting economic growth through job creation.

The authorisation of the Mura 1 Solar PV Facility will further align with South Africa's National Climate Response White Paper which outlines the countries efforts to manage the impacts of climate change and to contribute to the global efforts to stabilize the greenhouse gases concentrations in the atmosphere.

The proposed Mura 1 Solar Facility will also aid in overcoming the power shortages that are currently faced in the country. In 2022, South Africa witnessed its longest recorded hours of load

[6] https://unfccc.int/news/cop27-reaches-breakthrough-agreement-on-new-loss-and-damage-fund-for-vulnerable-countries

shedding, with the power being off for 1 949 hours between January and September 2022 as shown in **Figure 3-6**. The South African Government has taken strides to try reduce these power cuts through the implementation of bid Windows in Renewable Independent Power Producer Programme (REIPPP) , but it is still expected that the country will undergo more load shedding. Over the years the construction of Solar and Wind facilities has become cheaper, and less time-consuming. Thus, acting as a faster and more efficient method of meeting the ever-growing demand for electricity in the country. Renewable energy is a key factor in the national energy mix and will assist in ensuring that load shedding is reduced in South Africa.

On 16 February 2018, the DFFE gazetted the REDZ and STC and Procedures for the Assessment of Large-scale Wind and Solar Photovoltaic Energy Development Activities (GN 114) and Grid Infrastructure (GN 113). Subsequently, on 26 February 2021 a further three REDZ were gazetted (GN 142).

REDZ are geographical areas where wind and solar PV development can occur in concentrated zones, creating priority areas for investment in the electricity grid and thereby increasing South Africa's green energy map by enabling higher levels of renewable power penetration (Greeneconomy Media, 2019).

The procedure allows for wind and solar PV activities within the eight REDZs and electricity grid expansion within the five power corridors to be subjected to a BA and not a full S&EIA process. In addition, the timeframes associated with the decision on the application is reduced from 107 days to 57 days.

The REDZs support the responsible implementation of the 2019 IRP that was gazetted by the Minister of Mineral Resources and Energy on 17 October 2019. Renewable energy projects that could be developed in these new REDZ have the potential to make significant contributions to mine rehabilitation and to support a just energy transition in the specified areas including where 12 GW of existing coal power stations are planned to be decommissioned by 2030 (CSIR, 2019).

The Mura 1 Solar PV facility falls within the Beaufort West REDZ. The Mura EGI Corridor falls within the Central CST Corridor and predominantly within the REDZ.

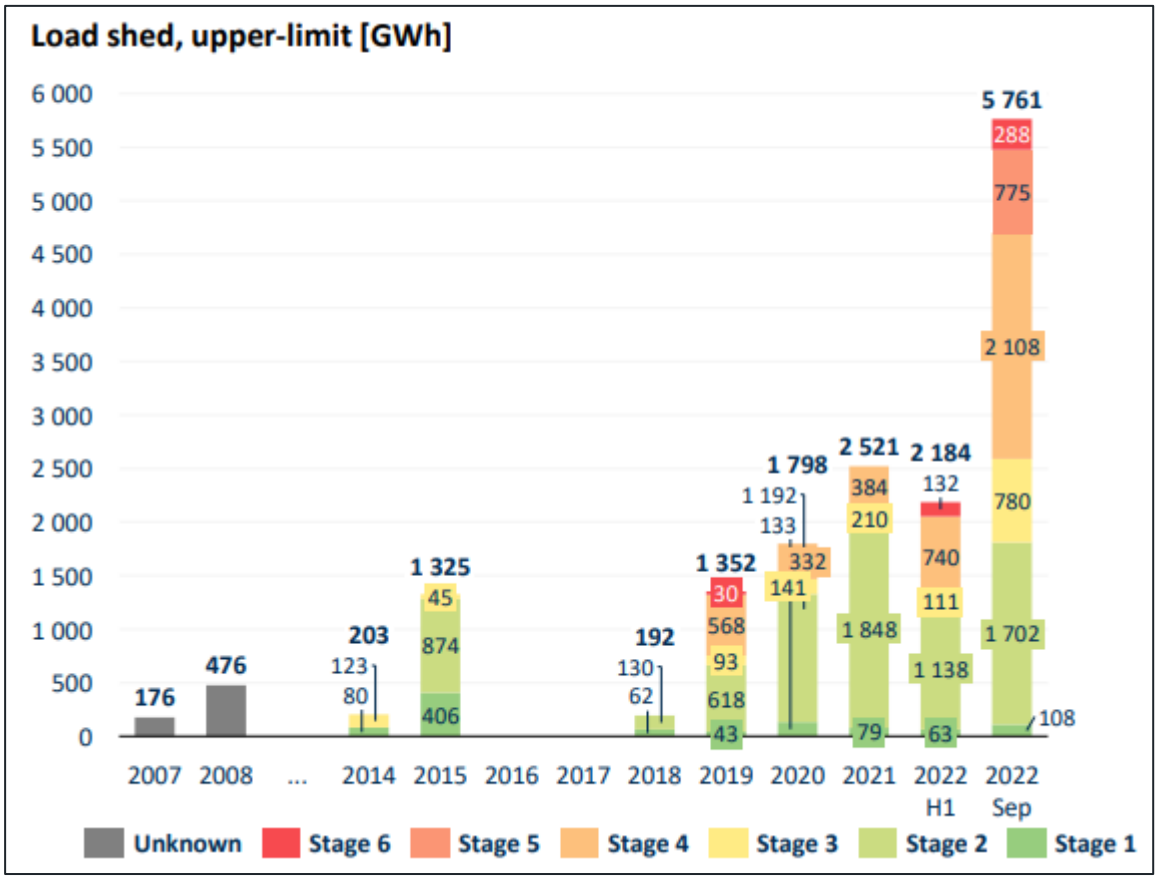


Figure 3-6 - Load shedding hours over the years in South Africa

Source: CSIR (2022)

4 PROJECT ALTERNATIVES

The EIA Regulations of 2014 (as amended) require that the BA process must identify and describe alternatives to the proposed activity that were considered, or motivation for not considering alternatives. Different types or categories of alternatives could be considered including different locations, technology types, and project layouts. The BA Process will holistically assess the impacts and risks of each alternative comparatively, as suggested by Appendix 1 of the EIA Regulations of 2014 (as amended).

All alternatives outlined below are considered both feasible and reasonable with no apparent advantages or disadvantages at this stage of the project. Extensive consideration of alternatives and avoidance of impacts took place in the screening/design phase. This is discussed in detail in the section below.

4.1 SITE ALTERNATIVES

The selection of the Mura Solar PV Development is the outcome of a feasibility assessment by the proponent, which inter alia served to identify site options that would be optimal for energy production and grid interconnection.

4.1.1 SITE SELECTION PROCESS

Red Cap Energy has a wealth of experience in renewable wind energy development in the Beaufort West area and good relationships with the local landowners due to the approved Nuweveld Wind Farm Development and the Hoogland Wind Farm clusters. Generation from the Nuweveld and Hoogland Wind Farms will be connected to the national grid via either an approved 400kV connection from the Nuweveld Collector Substation (approved) to Droërivier (existing Eskom Substation) and/or via a 400kV connection (currently being assessed as part of a separate BA process) to Gamma substation (existing Eskom substation). Red Cap is proposing both these grid connections. The approved Collector Substation is proposed as the connection point for the Mura Solar Development.

Taking technical constraints, resource availability and grid capacity into account, Red Cap identified that up to four solar PV facilities can connect to the approved Collector Substation and subsequently undertook a site selection process to identify where these four facilities can be located.

As part of the initial desktop screening exercise, an area within or adjacent to the Nuweveld Wind Cluster within relative proximity to each of the Nuweveld wind farm switching stations were investigated by applying a 10 km radial buffer to each of the two approved Nuweveld North and West switching stations and Nuweveld Collector Substation.

Based on Red Cap's knowledge of the area and detailed input from specialists that undertook assessments for the Nuweveld Wind Farm Development and Hoogland Cluster, solar constraints were identified within the three initial broad focus areas and used to develop no-go layers. The factors considered in developing the no-go layers were: Critical Biodiversity & Protected Areas, Avifauna (buffers around nests), Bat habitat (rocky crevices only), Ecology (specifically Riverine Rabbit habitat and vegetation), Transmission lines, Airfields (none in the proposed area), Heritage (including palaeontology), Aquatic features including wetlands, dams and rivers. **Figure 4-1** shows a map indicating the no-go layers that were identified by the abovementioned constraints.

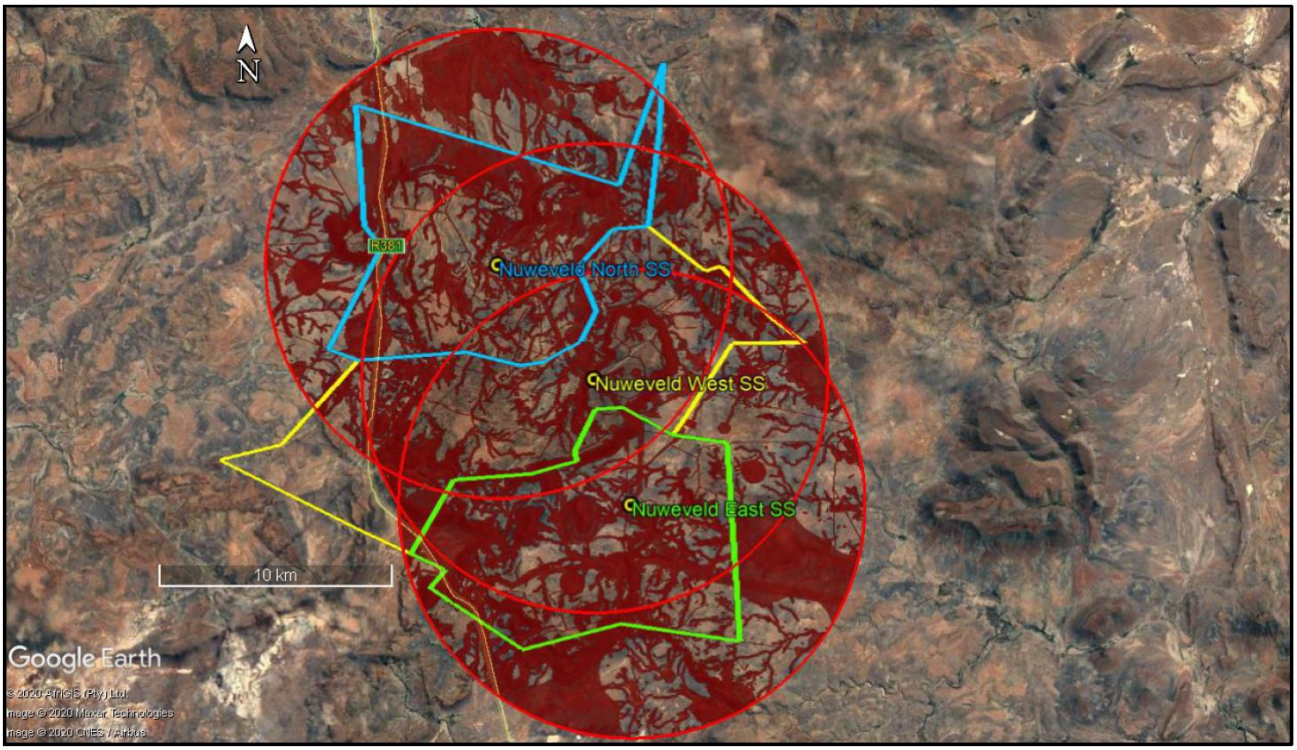


Figure 4-1 - Screening no-go layers from the identified constraints for the potential solar area

These areas were then assessed from a technical perspective by considering specifically slope, aspect, undulation, and access. Taking this into account, five areas with adequate development area (**Table 4-1**) were identified to take forward to a formal screening process (**Figure 4-2**). One of the areas (Area 5) was outside of the initial broad screening areas buffer but was also identified to be suitable for development.

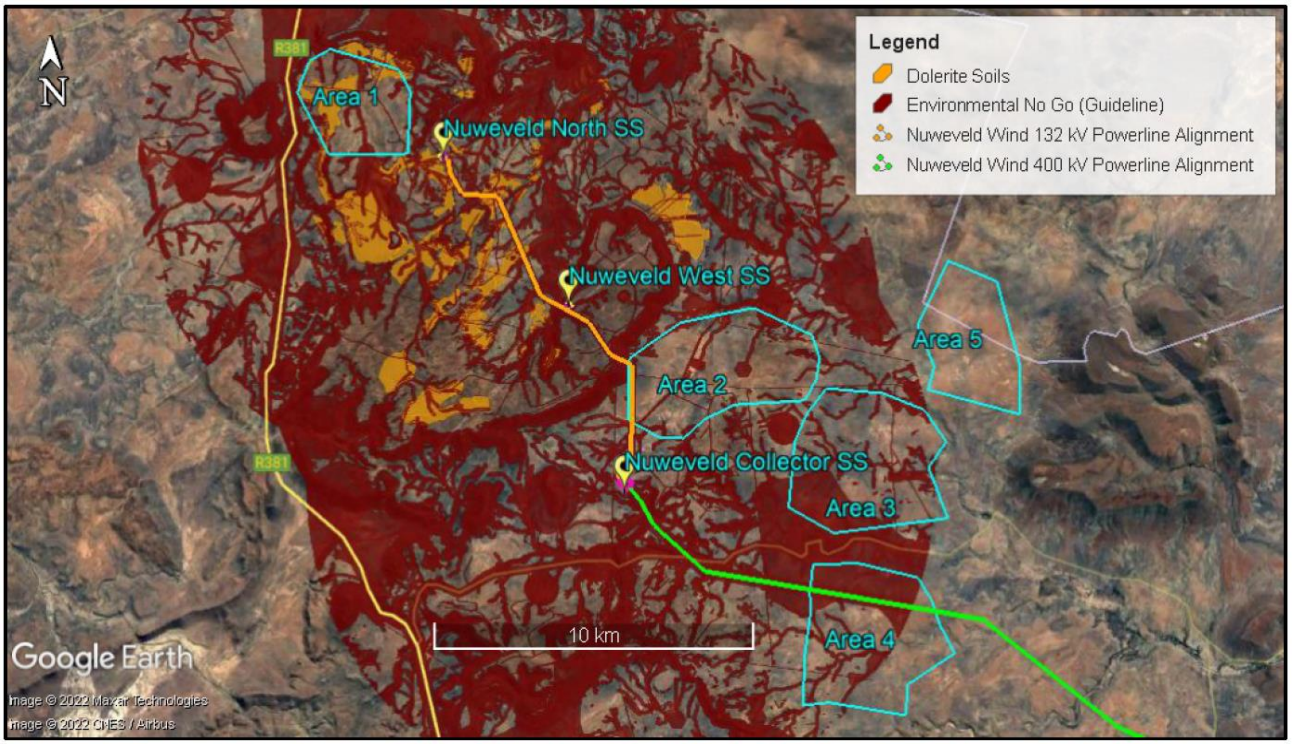


Figure 4-2 - Five potential Mura PV areas

These five areas were then screened from a more detailed technical and environmental perspective. Technical considerations included high-level solar design and the appointed environmental specialists undertook further desk and fieldwork work to provide a more detailed assessment of the environmental features present within these areas. Following this, Areas 1, 3 and 4 were screened out due to several constraints which made development within those areas unfeasible.

The remaining two areas (Areas 2 and 5) available for development were further reduced in size to avoid environmental and technical sensitivities but was determined to still have sufficient remaining development area available to each support two solar PV facilities which then became Mura 1, Mura 2, Mura 3, and Mura 4 (**Table 4-1**). These project sites (see **Figure 4-2**) have been taken forward for further detailed assessment by the appointed specialists and these site boundaries were used as the boundaries presented within the respective specialist's assessments. The assessment footprint of the specialist assessments, specifically for Mura PV 2 is shown below (**Figure 4-3**).

Table 4-1 – Solar PV areas

	Area 1	Area 2		Area 3	Area 4	Area 5	
Screening Phase	1022 Ha	1718 Ha		1779 Ha	1605 Ha	1093 Ha	
Assessment Phase	n/a	176 Ha	484 Ha	n/a	n/a	395 ha	425 ha

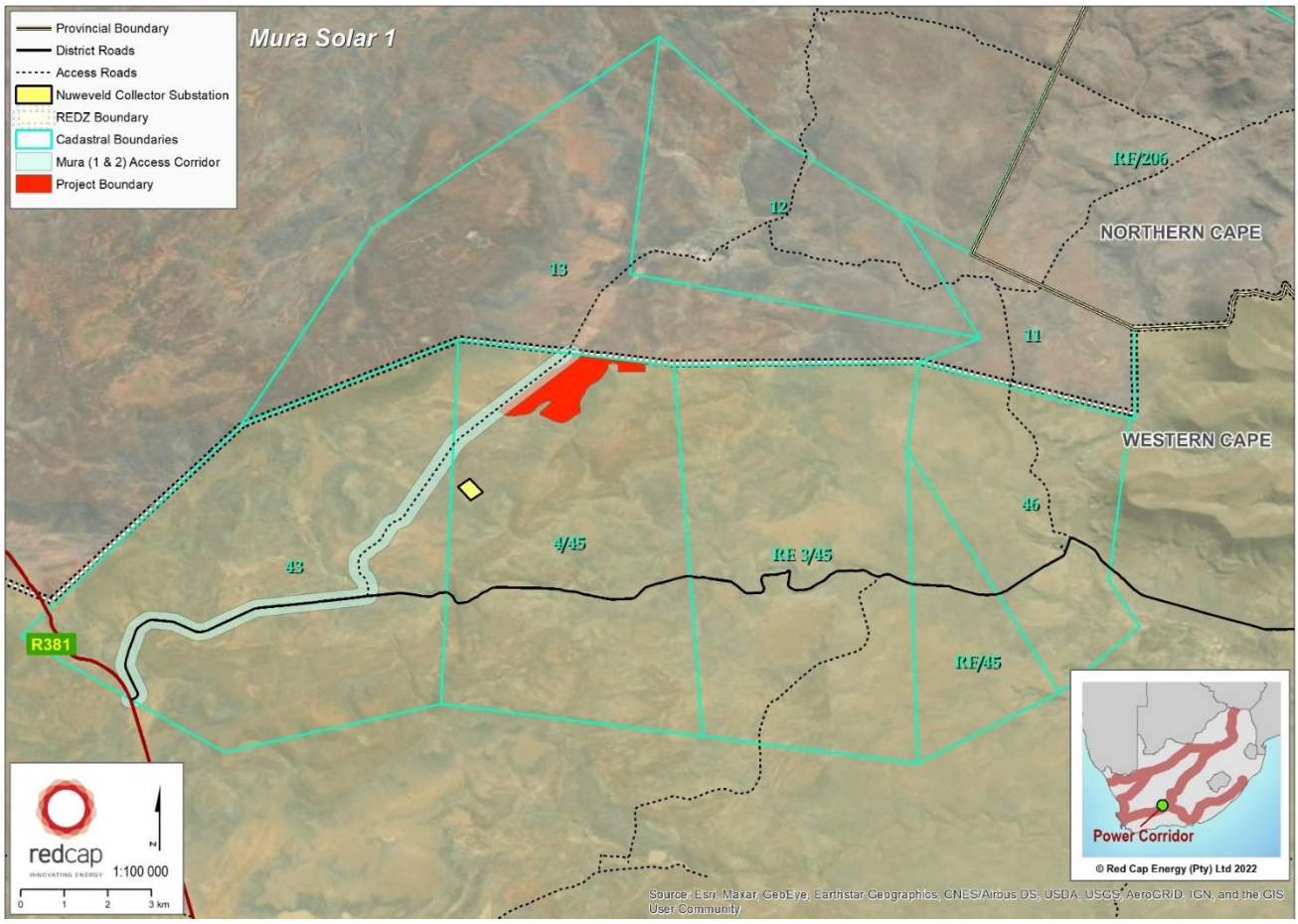


Figure 4-3 - Mura 1 Solar PV Facility and proposed access road corridor

4.2 TECHNOLOGY ALTERNATIVES

4.2.1 SOLAR PV TECHNOLOGY

The Mura 1 Solar PV Facility will utilise solar PV technology to generate power. Therefore, no other technology alternatives are being considered for this project.

4.2.2 BESS TECHNOLOGY

The BESS will be made up of Lithium-Ion batteries or similar solid-state technology due to them being a mature and safe technology with regard to potential impacts on the environment in a solar facility farm, modular and easy to install and due to their technical characteristics, will work well as energy storage systems for solar facilities, as well as supporting grid stability. Please refer to Section 3.4.3 for a detailed description of the BESS. No other BESS technology is being considered for this project..

4.3 LAYOUT ALTERNATIVES

The process undertaken for this project is an iterative design process whereby through various assessment phases and iteratively updating the site sensitivities to avoid environmental features (as outlined within **Section 4.1.1**) the site boundaries were determined and further assessed by the specialists to determine the Development Envelope for the facility. The Development Envelope

would avoid all the no-go areas identified by the specialists but any layout within the Development Envelope (and associated restrictions/exceptions) would be seen as acceptable. Therefore, no layout alternatives are being considered for this project.

4.4 NO-GO ALTERNATIVE

In the “no project” alternative, the Mura 1 Solar PV Facility project will not be developed. In this scenario, there could be a missed opportunity to address the need for increase in renewable energy generation in an effort to mitigate against concerns of climate change and exploitation of non-renewable resources. The no-go alternative would not assist in responding to the growing electricity demand in South Africa and would not contribute to the reliability of electricity supply at a national scale. Conversely, negative environmental impacts of the project (as outlined in Section 8) associated with the development of the Mura 1 Solar PV Facility would be avoided.

Specialists have considered the no-go alternative and the following has been concluded:

- Agriculture:
  - The one identified potential impact is that due to irregular rainfall in the area, which is likely to be exacerbated by climate change, agriculture in the area will come under increased pressure in terms of economic viability.
  - The development offers an alternative income source to agriculture, but it restricts agricultural use of the site.
  - Therefore, even though the excluded land has low agricultural production potential, the negative agricultural impact of the development is more significant than that of the no-go alternative, and so, purely from an agricultural impact perspective, the no-go alternative is the preferred alternative between the development and the no-go.
  - However, the no-go option would prevent the proposed development from contributing to the environmental, social and economic benefits associated with the development of renewable energy in South Africa.
- Aquatic
  - Potential very low-significance impacts on aquatic ecology would be avoided should the No-Go alternative be selected.
  - The impacts assessed in this report would be applicable to any layout alternative that avoided high-sensitivity areas (with the exception of the widening of existing roads and the construction of underground cables) identified in the aquatic biodiversity report and limited the placement of infrastructure in areas of medium aquatic sensitivity as far as reasonably possible, provided that the mitigation specified in the aquatic biodiversity report and in the EMPr are implemented.
- Animal and Plant:
  - Under the no-go alternative, the current landuse consisting of extensive livestock grazing would continue. When applied correctly, such livestock grazing is considered to be largely compatible with long-term biodiversity conservation, although in practice there are some negative effects associated with such landuse such as predator control and negative impacts on habitat availability for the larger ungulates that would historically have utilised the area. Under the current circumstances, the no-go alternative is considered to represent a low long-

term negative impact on the environment but has less impact than the loss of habitat resulting from the construction of the PV facility.

- Avifauna:
  - The No-Go alternative or status quo would not impact on avifauna in any new way. Farming does have its' own impacts on birds, but they have evolved into co-existing for the large part, and most of the site is not intensively farmed (it being mostly livestock grazing).
- Heritage
  - If the project were not implemented, the site would stay as it currently is (impact significance of neutral). Although the heritage impacts with implementation would be greater than the existing impacts, the loss of socio-economic benefits is more significant and suggests that the No-Go option is less desirable in heritage terms.
- Traffic
  - If the proposed development does not materialise, the increase in the traffic volume will not transpire, resulting in the following impacts:
    - Road Degradation: Less traffic on the roads means that the rate of degradation to the roads will be less. However, the maintenance of the roads will not be augmented by the proposed development. Improved maintenance of the roads will improve the quality of life for the road users and could increase the economic opportunities in the area. The status quo is therefore rated as of low negative significance.
    - Road Safety: Less traffic on the roads means less probability of an incident, reducing the likelihood of a fatality. Therefore, the impact is neutral.
    - Statement: The improved road maintenance counteracts the negative impacts on the road network due to the development and economic prospects the development will bring to the local community and the impact the development has on a national scale.
- Visual
  - The No-Go alternative would result in no visual impacts and thus the status quo would remain.

5 GOVERNANCE FRAMEWORK

5.1 NATIONAL LEGAL AND REGULATORY FRAMEWORK

The South African regulatory framework establishes well-defined requirements and standards for environmental and social management of industrial and civil infrastructure developments. Different authorities at both national and regional levels carry out environmental protection functions. The applicable legislation and policies are shown in **Table 5-1**.

Table 5-1 – Applicable National Legislation[7]

Legislation	Description of Legislation and Applicability
The Constitution of South Africa (No. 108 of 1996)	The Constitution cannot manage environmental resources as a stand-alone piece of legislation hence additional legislation has been promulgated in order to manage the various spheres of both the social and natural environment. Each promulgated Act and associated Regulations are designed to focus on various industries or components of the environment to ensure that the objectives of the Constitution are effectively implemented and upheld in an on-going basis throughout the country. In terms of Section 7, a positive obligation is placed on the State to give effect to the environmental rights.
National Environmental Management Act (No. 107 of 1998)	In terms of Section 24(2) of the NEMA, the Minister may identify activities, which may not commence without prior authorisation. The Minister thus published GNR 983 (as amended) (Listing Notice 1), GNR 984 (as amended) (Listing Notice 2) and GNR 985 (as amended) (Listing Notice 3) listing activities that may not commence prior to authorisation. The regulations outlining the procedures required for authorisation are published in the EIA Regulations of 2014 (GNR 982) (as amended). Listing Notice 1 identifies activities that require a BA process to be undertaken, in terms of the EIA Regulations, prior to commencement of that activity. Listing Notice 2 identifies activities that require an S&EIR process to be undertaken, in terms of the EIA Regulations, prior to commencement of that activity. Listing Notice 3 identifies activities within specific areas that require a BA process to be undertaken, in terms of the EIA Regulations, prior to commencement of that activity. WSP undertook a legal review of the listed activities according to the proposed project description to conclude that the activities listed in in this section are considered applicable to the development: A S&EIR process must be followed. An EA is required and will be applied for with the DFFE.
Listing Notice 1: GNR 983	**Activity 11**

[7] It should be noted that all dimensions outlined in relation to Listing Notice 1, 2 and 3 are provisional and are subject to final design.

Legislation	Description of Legislation and Applicability
	The development of facilities or infrastructure for the transmission and distribution of electricity— *(i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts* **Description:** The site is currently zoned as agricultural land and falls outside the urban area. The Mura 1 Solar PV Facility will include up to two solar farm substations, and one BESS substation, of up to 132 kV each and internal underground cables of up to 132 kV.
	Activity 12 *The development of—* *(ii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs—* *(a) within a watercourse; or* *(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse* **Description:** The Mura 1 Solar PV Facility will have internal underground cables and internal gravel roads that will have an up to 4m wide driving surface and may require side drains on one or both sides. During construction the access roads may be up to 12m wide but this will be a temporary impact and rehabilitated following the construction phase. The internal underground cables, internal gravel roads and access roads may require a total construction area of more than 100m^2 within 32 m of a watercourse.
	Activity 14 *The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 80 but not exceeding 500 cubic metres* **Description:** The solar facility would erect temporary fuel (and lubricants) and powder cement storage facilities during the construction phase. The combined storage capacity of all of the above facilities/infrastructure will exceed 80m^3 but will be below 500m^3.
	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.*

Legislation	Description of Legislation and Applicability
	Description: Internal underground cables, internal gravel roads and the access roads, including stormwater control infrastructure, will collectively require the excavation, infilling or removal of soil exceeding 10m^3 from delineated watercourses on site.
	Activity 28 *Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture, game farming, equestrian purposes or afforestation on or after 01 April 1998 and where such development:* *(ii) will occur outside an urban area, where the total land to be developed is bigger than 1 ha;* **Description:** The proposed site is zoned as agricultural land and will continue to be used for agricultural purposes should the proposed project receive environmental authorisation. The project extent of Mura 1 Solar PV Facility is 198 ha. This area will be fully transformed with solar panels or other supporting infrastructure (including the substations, BESS, building infrastructure, internal underground cables, internal gravel access roads, fencing, panel maintenance and cleaning area, stormwater management system and construction work area or the access roads).
	Activity 56 *The widening of a road by more than 6 m, or lengthening of a road by more than 1 km –* *(ii) where no reserve exists, where the existing road is wider than 8 metres;* **Description:** Existing roads may require widening of up to 12 m during construction accommodate the movement of heavy vehicles.
Listing Notice 2: GNR 984	**Activity 1** *The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more, excluding where such development of facilities or infrastructure is for photovoltaic installations and occurs:* *(a) within an urban area; or* *(b) on existing infrastructure.* **Description:** The Mura 1 Solar PV Facility will generate up to 150 MW of electricity output from a renewable resource.

Legislation	Description of Legislation and Applicability
	Activity 15 *The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for—* *(i) the undertaking of a linear activity; or* *(ii) maintenance purposes undertaken in accordance with a maintenance management plan* **Description:** The project extent of Mura 1 Solar PV Facility is 198 ha. This area will be fully transformed. It is likely that at least 20 ha of indigenous vegetation will be removed.
Listing Notice 3: GNR 985	**Activity 4** *The development of a road wider than 4 metres with a reserve less than 13,5 metres.* *In i. Western Cape:* *ii. Areas outside urban areas* *(aa) Areas containing indigenous vegetation* **Description:** The Mura 1 Solar PV Facility will have internal gravel roads that will have an up to 4 m wide driving surface and may require side drains on one or both sides. During construction, the access roads may be up to 12 m wide but this will be a temporary impact and rehabilitated following the construction phase.
	Activity 12: *The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan.* *In i. Western Cape:* *ii. Within critical biodiversity areas identified in bioregional plans;* **Description:** The project footprint of Mura 1 Solar PV Facility is not located within a CBA however the access road corridor overlaps with a CBA. The access road corridor overlaps with a CBA. During construction, the access roads may be up to 12 m wide but this will be a temporary impact and rehabilitated following the construction phase. The widening of the existing road within this area would be more than 300 m^2. It is likely that at least 300 m^2 of indigenous vegetation will be removed.
	Activity 14:

Legislation	Description of Legislation and Applicability
	The development of— *(ii) infrastructure or structures with a Physical footprint of 10 Square metres or more;* *where such development occurs—* *(a) within a watercourse;* *(c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse;* *In i. Western Cape:* *ii. Outside urban areas:* *(ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans* **Description:** There are a few small ESAs present within the Mura 1 Solar PV Facility site and access road corridor that are associated with the minor drainage features that occur within the site. It is proposed that the roads are widened up to 12m during construction. The development within the PV facility footprint (including panels, gravel roads, cables etc.) and the widening of the existing road within these areas would be more than 10m^2.
	Activity 18: *The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre.* *In i. Western Cape:* *ii. All areas outside urban areas:* *(aa) Areas containing indigenous vegetation* **Description:** Existing roads may require widening of up to 12 m during construction, to accommodate the movement of heavy vehicles, this will be a temporary impact. The widening of the roads may take place in areas containing indigenous vegetation.
	Activity 23 *The expansion of* *(ii) infrastructure or structures where the physical footprint is expanded by 10 square metres or more;* *Where such expansion occurs-* *(a) within a watercourse* *In i. Western Cape:* *i. Outside urban areas:*

Legislation	Description of Legislation and Applicability
	(ff): Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans. **Description:** There are a few small ESAs present within the Mura 1 Solar PV Facility site and access road corridor that are associated with the minor drainage features that occur within the site. It is proposed that the roads are widened up to 12m during construction. The expansion of the existing road within these areas would be more than 10m^2.
Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes (GNR 320, 20 March 2020 and GNR 1150, 30 October 2020)	The protocols provide the criteria for specialist assessment and minimum report content requirements for impacts for various environmental themes for activities requiring environmental authorisation. The protocols replace the requirements of Appendix 6 of the EIA Regulations, 2014, as amended. The assessment and reporting requirements of the protocols are associated with a level of environmental sensitivity identified by the national web based environmental screening tool (screening tool). The following environmental themes were applicable to the Mura 1 Solar PV Facility: ▪ Agriculture Theme ▪ Animal Species Theme ▪ Aquatic Biodiversity Theme ▪ Archaeological and Cultural Heritage Theme ▪ Avian Theme ▪ Civil Aviation (Solar PV) Theme ▪ Defence Theme ▪ Landscape (Solar) Theme ▪ Palaeontology Theme ▪ Plant Species Theme ▪ Radio Frequency Interference (RFI) Theme ▪ Terrestrial Biodiversity Theme
Renewable Energy Development Zones and Strategic Transmission Corridors	On 16 February 2018, the DFFE gazetted the Renewable Energy Development Zones (REDZs) and Strategic Transmission Corridors and Procedures for the Assessment of Large-scale Wind and Solar Photovoltaic Energy Development Activities (GN 114) and Grid Infrastructure (GN 113). Subsequently, on 26 February 2021 a further three REDZ were gazetted (GN 142). The procedure allows for wind and solar PV activities within the eight REDZs and electricity grid development within the five power corridors to be subjected to a BA and not a full S&EIA process. In addition, the timeframes associated with the decision on the application is reduced from 107 days to 57 days. **The Mura 1 Solar PV Facility is located within a REDZ and within the Central Strategic Corridor.**
National Environmental Management: Waste Act (59 of 2008) (NEM:WA)	This Act provides for regulating waste management in order to protect health and the environment by providing reasonable measures for the prevention of pollution and ecological degradation. The Act also provides for the licensing and control of waste management activities through GNR.

Legislation	Description of Legislation and Applicability
	921 (2013): List of Waste Management Activities that Have, or are Likely to Have, a Detrimental Effect on the Environment. The proposed project does not constitute a Listed Activity requiring a Waste Management Licence (WML) as defined in GNR 921. However, the contents of this BA Report will include reasonable measures for the prevention of pollution and good international industry practice (GIIP).
National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)	The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA) was promulgated in June 2004 within the framework of NEMA to provide for the management and conservation of national biodiversity. The NEMBA's primary aims are for the protection of species and ecosystems that warrant national protection, the sustainable use of indigenous biological resources, the fair and equitable sharing of benefits arising from bioprospecting involving indigenous biological resources. In addition, the NEMBA provides for the establishment and functions of a South African National Biodiversity Institute (SANBI). SANBI was established by the NEMBA with the primary purpose of reporting on the status of the country's biodiversity and conservation status of all listed threatened or protected species and ecosystems. The terrestrial biodiversity assessment (**Appendix G.3**) identifies no CBAs within the Mura 1 footprint area. The CBA maps indicate the most efficient selection and classification of land portions requiring safeguarding in order to meet national biodiversity objectives. The Conservation of Agricultural Resources Act (No. 43 of 1983) (CARA) Regulations with regards to alien and invasive species have been superseded by the National Environmental Management: Biodiversity Act, 2004 (Act no. 10 of 2004) – Alien and Invasive Species (AIS) Regulations which became law on 1 October 2014. Specific management measures for the control of alien and invasive plants will be included in the Environmental Management Programme (EMPr).
National Environmental Management Protected Areas Act (No. 57 of 2003)	The purpose of the National Environmental Management Protected Areas Act (No. 57 of 2003) (NEMPAA) is to, *inter alia*, provide for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes. To this end, it provides for the declaration and management of various types of protected areas. Section 50(5) of NEMPAA states that "no development, construction or farming may be permitted in a nature reserve or world heritage site without the prior written approval of the management authority." According to the National Parks Area Expansion Strategy (NPAES), there are no areas within the study area that have been identified as priority areas for inclusion in future protected areas. The study area is therefore outside the NPAES focus area.
The National Water Act (No. 36 Of 1998)	The National Water Act, 1998 (Act No. 36 of 1998) (NWA) provides the framework to protect water resources against over exploitation and to ensure that there is water for social and economic development, human needs and to meet the needs of the aquatic environment.

Legislation	Description of Legislation and Applicability
	The Act defines water source to include watercourses, surface water, estuary or aquifer. A watercourse is defined in the Act as a river or spring, a natural channel in which water flows regularly or intermittently, a wetland, lake or dam into which or from which water flows, and any collection of water that the Minister may declare a watercourse. Section 21 of the Act outlines a number of categories that require a water user to apply for a Water Use License (WUL) and Section 22 requires water users to apply for a General Authorisation (GA) with the Department of Water and Sanitation (DWS) if they are under certain thresholds or meet certain criteria. The list of water uses applicable to the proposed Project include: a) Taking water from a water resource; c) Impeding or diverting the flow of water in a watercourse; g) Disposing of waste in a manner which may detrimentally impact on a water resource; i) Altering the bed, banks, course or characteristics of a watercourse; The DWS will make the final decision on water uses that are applicable to the project through a pre-application meeting after which a Water Use Authorisation Application (WUA) as determined by the risk assessment will be undertaken in compliance with procedural regulations published by the DWS within General Notice 267 (GN267). These regulations specify required information per water use and the reporting structure of required supporting technical information.
The National Heritage Resources Act (No. 25 Of 1999)	The National Heritage Resource Act (Act No. 25 of 1999) (NHRA) serves to protect national and provincial heritage resources across South Africa. The NHRA provides for the protection of all archaeological and palaeontological sites, the conservation and care of cemeteries and graves by the South African Heritage Resources Agency (SAHRA) and lists activities that require any person who intends to undertake to notify the responsible heritage resources agency and furnish details regarding the location, nature, and extent of the proposed development. Part 2 of the NHRA details specific activities that require a Heritage Impact Assessment (HIA) that will need to be approved by SAHRA. Parts of Section 35, 36 and 38 apply to the proposed project, principally: ▪ Section 35 (4) - No person may, without a permit issued by the responsible heritage resources authority- • destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite; • destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite. ▪ Section 38 (1) Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as- • any development or other activity which will change the character of a site— (i) exceeding 5 000 m2 in extent, must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.

Legislation	Description of Legislation and Applicability
	In terms of Section 38(8), approval from the heritage authority is not required if an evaluation of the impact of such development on heritage resources is required in terms of any other legislation (such as NEMA), provided that the consenting authority ensures that the evaluation of impacts fulfils the requirements of the relevant heritage resources authority in terms of Section 38(3) and any comments and recommendations of the relevant resources authority with regard to such development have been taken into account prior to the granting of the consent. However, should heritage resources of significance be affected by the proposed Mura 1 Solar PV Facility, a permit is required to be obtained prior to disturbing or destroying such resources as per the requirements of Section 48 of the NHRA, and the SAHRA Permit Regulations (GN R668). A Heritage Report (**Appendix G.8**) has been carried out by a suitably qualified specialist, revealing: ■ Stone artefacts from the Later Stone Age (LSA) located to the south of Mura 1. The proposed project will be loaded onto the SAHRIS portal for comment by SAHRA and HWC.
Noise Control Regulations in terms of the Environmental Conservation, 1989 (Act 73 of 1989)	In South Africa, environmental noise control has been in place for three decades, beginning in the 1980s with codes of practice issued by the South African National Standards (formerly the South African Bureau of Standards, SABS) to address noise pollution in various sectors of the country. Under the previous generation of environmental legislation, specifically the Environmental Conservation Act 73 of 1989 (ECA), provisions were made to control noise from a National level in the form of the Noise Control Regulations (GNR 154 of January 1992). In later years, the ECA was replaced by the National Environmental Management Act 107 of 1998 (NEMA) as amended. The National Environmental Management: Air Quality Act 39 of 2004 (NEMAQA) was published in line with NEMA and contains noise control provisions under Section 34: (1) The minister may prescribe essential national standards – (a) for the control of noise, either in general or by specific machinery or activities or in specified places or areas; or (b) for determining – (i) a definition of noise; and (ii) the maximum levels of noise. (2) When controlling noise, the provincial and local spheres of government are bound by any prescribed national standards. Under NEMAQA, the Noise Control Regulations were updated and are to be applied to all provinces in South Africa. The Noise Control Regulations give all the responsibilities of enforcement to the Local Provincial Authority, where location specific by-laws can be created and applied to the locations with approval of Provincial Government. Where province-specific regulations have not been promulgated, acoustic impact assessments must follow the Noise Control Regulations. Furthermore, NEMAQA prescribes that the Minister must publish maximum allowable noise levels for different districts and national noise standards. These have not yet been accomplished and as a result all monitoring and

Legislation	Description of Legislation and Applicability
	assessments are done in accordance with the South African National Standards (SANS) 10103:2008 and 10328:2008.
National Environment Management Air Quality Act (No. 39 of 2004)	The National Environment Management: Air Quality Act (No. 39 of 2004) (NEMAQA) came into effect on 11 September 2005. Persons undertaking such activities listed under GNR 893, as amended, are required to possess an Atmospheric Emissions License (AEL). The National Dust Control Regulations (GNR 827) were promulgated in terms of Section 32 of NEMAQA, which aim at prescribing general measures for the control of dust in both residential and non-residential areas. Although no AEL will be required for the construction and operation of the Mura 1 Solar PV Facility, the dust control regulations will be applicable during construction.
Conservation of Agricultural Resources Act (No. 43 of 1983)	The Conservation of Agricultural Resources Act (Act 43 of 1983) (CARA) provides for the implementation of control measures for soil conservation works as well as alien and invasive plant species in and outside of urban areas. In terms of the amendments to the regulations under the CARA, landowners are legally responsible for the control of alien species on their properties. Various Acts administered by the DFFE and the DWS, as well as other laws (including local by-laws), spell out the fines, terms of imprisonment and other penalties for contravening the law. Although no fines have yet been placed against landowners who do not remove invasive species, the authorities may clear their land of invasive alien plants and other alien species entirely at the landowners' cost and risk. The CARA Regulations with regards to alien and invasive species have been superseded by NEMBA Alien and Invasive Species (AIS) Regulations which became law on 1 October 2014.
Civil Aviation Act (No. 13 of 2009)	Civil aviation in South Africa is governed by the Civil Aviation Act (Act 13 of 2009). This Act provides for the establishment of a stand-alone authority mandated with controlling, promoting, regulating, supporting, developing, enforcing and continuously improving levels of safety and security throughout the civil aviation industry. This mandate is fulfilled by South African Civil Aviation Authority (SACAA) as an agency of the Department of Transport (DoT). SACAA achieves the objectives set out in the Act by complying with the Standards and Recommended Practices (SARPs) of the International Civil Aviation Organisation (ICAO), while considering the local context when issuing the South African Civil Aviation Regulations (SA CARs). As of the 1st of May 2021, Air Traffic and Navigation Services (ATNS) has been appointed as the new Obstacle application Service Provider for Windfarms and later Solar Plants. Their responsibility would pertain to the assessments, maintenance, and all other related matters in respect to Windfarms and in due time Power Plant assessments. The DFFE Screening Tool Report identified Civil Aviation as having low sensitivity for the proposed Mura 1 Solar PV Facility, and no major or other types of civil aviation aerodromes.

Legislation	Description of Legislation and Applicability
	ATNS and SACAA will be included on the project stakeholder database. They will be informed of the proposed Project, and comment will be sought from these authorities as applicable.
Occupational Health and Safety Act (No. 85 of 1993)	The National Occupational Health and Safety Act (No. 85 of 1993) (OHSA) and the relevant regulations under the Act are applicable to the proposed project. This includes the Construction Regulations promulgated in 2014 under Section 43 of the Act. Adherence to South Africa's OHSA and its relevant Regulations is essential.
National Energy Act (No. 34 of 2008)	The National Energy Act aims to ensure that diverse energy resources are available, in sustainable quantitates, and at affordable prices, to the South African economy in support of economic growth and poverty alleviation, taking into account environmental management requirements and interactions amongst economic sectors. The main objectives of the Act are to: ▪ Ensure uninterrupted supply of energy to the Republic; ▪ Promote diversity of supply of energy and its sources; ▪ Facilitate effective management of energy demand and its conservation; ▪ Promote energy research; ▪ Promote appropriate standards and specifications for the equipment, systems and processes used for producing, supplying and consuming energy; ▪ Ensure collection of data and information relating to energy supply, transportation and demand; ▪ Provide for optimal supply, transformation, transportation, storage and demand of energy that are planned, organised and implemented in accordance with a balanced consideration of security of supply, economics, consumer protection and a sustainable development; ▪ Provide for certain safety, health and environment matters that pertain to energy; ▪ Facilitate energy access for improvement of the quality of life of the people of Republic; ▪ Commercialise energy-related technologies; ▪ Ensure effective planning for energy supply, transportation, and consumption; and ▪ Contribute to sustainable development of South Africa's economy. In terms of the act, the Minister of Energy is mandated to develop and, on an annual basis, review and publish the Integrated Energy Plan (IEP) in the Government Gazette. The IEP analyses current energy consumption trends within different sectors of the economy (i.e. agriculture, commerce, industry, residential and transport) and uses this to project future energy requirements, based on different scenarios. The IEP and the Integrated Resource Plan are intended to be updated periodically to remain relevant. The framework is intended to create a balance between energy demand and resource availability so as to provide low-cost electricity for social and economic development, while taking into account health, safety and environmental parameters.
Electricity Regulation Act (No. 4 of 2006)	The Electricity Regulation Act (No. 4 of 2006) (ERA) aims to: ▪ Achieve the efficient, effective, sustainable and orderly development and operation of electricity supply infrastructure in South Africa;

Legislation	Description of Legislation and Applicability
	▪ Ensure that the interests and needs of present and future electricity customers and end users are safeguarded and met, having regard to the governance, efficiency. effectiveness and long-term sustainability of the electricity supply industry within the broader context of economic energy regulation in the Republic: ▪ Facilitate investment in the electricity supply industry; ▪ Facilitate universal access to electricity; ▪ Promote the use of diverse energy sources and energy efficiency; ▪ Promote competitiveness and customer and end user choice; and ▪ Facilitate a fair balance between the interests of customers and end users, licensees, investors in the electricity supply industry and the public. The Act establishes a National Energy Regulator as the custodian and enforcer of the National Electricity Regulatory Framework. The Act also provides for licenses and registration as the manner in which generation, transmission, distribution, trading and the import and export of electricity are regulated.

5.2 POLICIES AND PLANS

Table 5-2 summarised key policies and plans as an outline of the governance framework for the project.

Table 5-2 – Applicable Regional Policies and Plans

Applicable Policy	Description of Policy
National Development Plan	The National Development Plan aims to eliminate poverty and reduce inequality by 2030. The NDP identifies a number of enabling milestones. Of relevance to the proposed development the NDP refers to the need to produce sufficient energy to support industry at competitive prices and ensure access for poor households, while reducing carbon emissions per unit of power by about one-third. In this regard the infrastructure is not just essential for faster economic growth and higher employment. It also promotes inclusive growth, providing citizens with the means to improve their own lives and boost their incomes. Infrastructure is essential to development. Chapter 3, Economy and Employment, identifies some of the structural challenges specific to South Africa, including an energy constraint that will act as a cap on growth and on options for industrialisation. The NDP notes that from an environmental perspective South Africa faces several related challenges. The reduction of greenhouse gas emissions and shift to a green low-carbon economy, is one of these challenges. In terms of implementation the NDP identifies three phases. The first two are of specific relevance to the proposed project. The first phase (2012–2017) notes that ensuring the supply of energy and water is reliable and sufficient for a growing economy. The second phase (2018–2023) involves building on the first phase to lay the foundations for more intensive improvements in productivity. The provision of affordable and reliable energy is a key requirement for this to take place.

Applicable Policy	Description of Policy
	Chapter 4, Economic infrastructure, notes that economic infrastructure provides the foundation for social and economic development. In this regard South Africa must invest in a strong network of economic infrastructure designed to support the country's medium- and long-term economic and social objectives. The plan envisages that, by 2030, South Africa will have an energy sector that promotes: ▪ Economic growth and development through adequate investment in energy infrastructure. The sector should provide reliable and efficient energy service at competitive rates, while supporting economic growth through job creation. ▪ Environmental sustainability through efforts to reduce pollution and mitigate the effects of climate change. More specifically, South Africa should have adequate supply security in electricity and in liquid fuels, such that economic activity, transport, and welfare are not disrupted. The plan sets out steps that aim to ensure that, in 20 years, South Africa's energy system looks very different to the current situation. In this regard coal will contribute proportionately less to primary-energy needs, while gas and renewable energy resources, will play a much larger role.
Integrated Resource Plan 2010 – 2030	The IRP is an electricity capacity plan which aims to provide an indication of the country's electricity demand, how this demand will be supplied and what it will cost. On 6 May 2011, the then Department of Energy (DoE) released the Integrated Resource Plan 2010-2030 (IRP 2010) in respect of South Africa's forecast energy demand for the 20-year period from 2010 to 2030. The promulgated IRP 2010–2030 identified the preferred generation technology required to meet expected demand growth up to 2030. It incorporated government objectives such as affordable electricity, reduced greenhouse gas (GHG) emissions, reduced water consumption, diversified electricity generation sources, localisation and regional development. The IRP recognises that solar PV, wind and CSP with storage present an opportunity to diversify the electricity mix, to produce distributed generation and to provide off-grid electricity. Renewable technologies also present huge potential for the creation of new industries, job creation and localisation across the value chain.
New Growth Path	Government released the New Economic Growth Path Framework on 23 November 2010. The aim of the framework is to enhance growth, employment creation and equity. The policy's principal target is to create five million jobs over the next 10 years and reflects government's commitment to prioritising employment creation in all economic policies. The framework identifies strategies that will enable South Africa to grow in a more equitable and inclusive manner while attaining South Africa's developmental agenda. Central to the New Growth Path is a massive investment in infrastructure as a critical driver of jobs across the economy. In this regard the framework identifies investments in five key areas namely: energy, transport, communication, water, and housing.
National Infrastructure Plan	The South African Government adopted a National Infrastructure Plan (NIP) in 2012. The NIP aims to transform the South African economic landscape while simultaneously creating significant numbers of new jobs and strengthening the delivery of basic services. It outlines the challenges and enablers which needs to be addressed in the building and developing of infrastructure. The Presidential Infrastructure Coordinating Commission

Applicable Policy	Description of Policy
	(PICC) was established by the Cabinet to integrate and coordinate the long-term infrastructure build. The plan also supports the integration of African economies. In terms of the plan Government will invest R827 billion over the next three years to build new and upgrade existing infrastructure. The aim of the investments is to improve access by South Africans to healthcare facilities, schools, water, sanitation, housing and electrification. The plan also notes that investment in the construction of ports, roads, railway systems, electricity plants, hospitals, schools and dams will contribute to improved economic growth.
Integrated Energy Plan	The development of a National IEP was envisaged in the White Paper on the Energy Policy of the Republic of South Africa of 1998 and, in terms of the National Energy Act, 2008 (Act No. 34 of 2008), the Minister of Energy is mandated to develop and, on an annual basis, review and publish the IEP in the Government Gazette. The purpose of the IEP is to provide a roadmap of the future energy landscape for South Africa which guides future energy infrastructure investments and policy development. The IEP notes that South Africa needs to grow its energy supply to support economic expansion and in so doing, alleviate supply bottlenecks and supply-demand deficits. In addition, it is essential that all citizens are provided with clean and modern forms of energy at an affordable price. As part of the Integrated Energy Planning process, eight key objectives are identified, namely: ▪ Objective 1: Ensure security of supply. ▪ Objective 2: Minimise the cost of energy. ▪ Objective 3: Promote the creation of jobs and localisation. ▪ Objective 4: Minimise negative environmental impacts from the energy sector. ▪ Objective 5: Promote the conservation of water. ▪ Objective 6: Diversify supply sources and primary sources of energy. ▪ Objective 7: Promote energy efficiency in the economy. ▪ Objective 8: Increase access to modern energy. The IEP provides an assessment of current energy consumption trends within different sectors of the economy (i.e., agriculture, commerce, industry, residential and transport) and uses this information to identify future energy requirements, based on different scenarios. The scenarios are informed by different assumptions on economic development and the structure of the economy and also take into account the impact of key policies such as environmental policies, energy efficiency policies, transport policies and industrial policies, amongst others. Based on this information the IEP then determines the optimal mix of energy sources and technologies to meet those energy needs in the most cost-effective manner for each of the scenarios. The associated environmental impacts, socio-economic benefits and macroeconomic impacts are also analysed. The IEP is therefore focused on determining the long-term energy pathway for South Africa, taking into account a multitude of factors which are embedded in the eight objectives. As part of the analysis four key scenarios were developed, namely the Base Case, Environmental Awareness, Resource Constrained and Green Shoots scenarios: ▪ The Base Case Scenario assumes that existing policies are implemented and will continue to shape the energy sector landscape

Applicable Policy	Description of Policy
	going forward. It assumes moderate economic growth in the medium to long term. ▪ The Environmental Awareness Scenario is characterised by more stringent emission limits and a more environmentally aware society, where a higher cost is placed on externalities caused by the supply of energy. ▪ The Resource Constrained Scenario in which global energy commodity prices (i.e. coal, crude oil and natural gas) are high due to limited supply. ▪ The Green Shoots Scenario describes an economy in which the targets for high economic growth and structural changes to the economy, as set out in the National Development Plan (NDP), are met. The IEP notes that South Africa should continue to pursue a diversified energy mix which reduces reliance on a single or a few primary energy sources. In terms of existing electricity generation capacity, the IEP indicates that existing capacity starts to decline notably from 2025, with significant plant retirement occurring in 2031, 2041 and 2048. By 2050 only 20% of the current electricity generation capacity remains. As a result, large investments are required in the electricity sector in order to maintain an adequate supply in support of economic growth. By 2020, various import options become available, and some new coal capacity is added along with new wind, solar and gas capacity. The mix of generation capacity technologies by 2050 is considerably more diverse than the current energy mix, across all scenarios. The main differentiating factors between the scenarios are the level of demand, constraints on emission limits and the carbon dioxide externality costs. In all scenarios the energy mix for electricity generation becomes more diverse over the period to 2050, with coal reducing its share from about 85% in 2015 to 15–20% in 2050 (depending on the scenario). Solar, wind, nuclear, gas and electricity imports increase their share. The Environmental Awareness and Green Shoots scenarios take on higher levels of renewable energy. An assessment of each scenario against the eight objectives with reference to renewable energy notes while all scenarios seek to ensure that costs are minimised within the constraints and parameters of each scenario, the Base Case Scenario presents the least cost followed by the Environmental Awareness, Resource Constrained and Green Shoots scenarios respectively when total energy system costs are considered. In terms of promoting job creation and localisation potential the Base Case Scenario presents the greatest job creation potential, followed by the Resource Constrained, Environmental Awareness and Green Shoots scenarios respectively. In all scenarios, approximately 85% of total jobs are localisable. For electricity generation, most jobs result from solar technologies followed by nuclear and wind, with natural gas and coal making a smaller contribution. The Environmental Awareness Scenario, due to its stringent emission constraints, shows the lowest level of total emissions over the planning horizon. This is followed by the Green Shoots, Resource Constrained and Base Case scenarios. These trends are similar when emissions are considered cumulatively and individually by type.
National Protected Area Expansion Strategy, 2010	The National Protected Area Expansion Strategy 2010 (NPAES) areas were identified through a systematic biodiversity planning process. They present the best opportunities for meeting the ecosystem-specific protected area targets set in the NPAES and were designed with strong emphasis on climate change resilience and requirements for protecting freshwater

Applicable Policy	Description of Policy
	ecosystems. These areas should not be seen as future boundaries of protected areas, as in many cases only a portion of a particular focus area would be required to meet the protected area targets set in the NPAES. They are also not a replacement for fine scale planning which may identify a range of different priority sites based on local requirements, constraints and opportunities (NPAES, 2010). According to the NPAES, there are no areas within the study area that have been identified as priority areas for inclusion in future protected areas. The study area is therefore outside the NPAES focus area.

5.3 PROVINCIAL AND MUNICIPAL LEGAL AND REGULATORY FRAMEWORK

Table 5-3 – Provincial Plans

Applicable Plan	Description of Plan
Western Cape Nature Conservation Laws Amendment Act (Act No 3 of 2000):	This Act lists Protected species, requiring permits for removal (CapeNature) relating to The Nature and Environmental Conservation Ordinance, 1974.
Western Cape Spatial Development Framework (2014)	The Western Cape Provincial Spatial Development Framework, 2014 (PSDF) is an approved structure plan in terms of the Spatial Planning and Land Use Management Act (Act 16 of 2013) (SPLUMA) and the Land Use Planning Act (Act 3 of 2014) (LUPA) and aims to give spatial expression to the NDP and One Cape 2040 initiatives. It provides guidelines for district, metropolitan and local municipal spatial initiatives such as Integrated Development Plans (IDPs) and Spatial Development Frameworks (SDFs). The PSDF is a broad-based document and does not control development or land use proposals at a micro-scale (e.g. individual properties). It is, however, relevant in setting out overarching planning policy guidelines adopted by the Provincial Government, and major development applications need to take guidance from and be evaluated in terms of these policy guidelines. The Western Cape PSDF is underpinned by three interrelated themes, namely: ▪ Sustainable use of the Western Cape's spatial assets (resources); ▪ Opening up opportunities in the Provincial space-economy (space economy); and ▪ Developing integrated and sustainable settlements (settlement). The WCPSDF also includes the following spatial agenda: ▪ Grow the Province's economy in partnership with the private sector, non-government and community based organisations; ▪ Use infrastructure investment as the primary lever to ensure urban and rural spatial transitions; and ▪ Improve the sustainable use of the Province's spatial assets and resources. Key spatial challenges are outlined in Chapter 2 of the PSDF. Energy security and climate change response are identified as key high-level future risk factors. With regard to energy use, the PSDF notes that the Cape Metro (albeit the province's most efficient user) and West Coast regions are

Applicable Plan	Description of Plan
	the Province's main energy users. It further notes that the Western Cape's electricity is primarily drawn from the national grid, which is dominated by coal-based power stations, and that the province currently has a small emergent renewable energy sector in the form of wind and solar generation facilities located in its more rural, sparsely populated areas. With regard to renewable energy, the following policy provisions are of relevance: ▪ Policy R.4.6: Pursue energy diversification and energy efficiency in order for the Western Cape to transition to a low carbon, sustainable energy future, and delink economic growth from energy use. ▪ R.4.7: Support emergent Independent Power Producers (IPPs) and sustainable energy producers (wind, solar, biomass and waste conversion initiatives) in suitable rural locations (as per recommendations of the Strategic Environmental Assessments for wind energy (DEA&DP) and renewable energy (DFFE). Water scarcity is identified as probably the key risk associated with climate change. Policy provisions are made with regard to climate change adaptation and mitigation. Concerning renewable energy, the following is of relevance: ▪ R.4.16: Encourage and support renewable energy generation at scale.
Western Cape Infrastructure Framework (2013)	The Western Cape Infrastructure Framework (WCIF) (2013) was developed by the WCP Provincial Department of Transport and Public Works in terms of the Provincial Government's mandate to coordinate provincial planning under Schedule 5A of the Constitution. The objective of the WCIF is to align the planning, delivery and management of infrastructure to the strategic agenda and vision for the province, as outlined in the 2009-2014 Draft Provincial Strategic Plan. The One Cape 2040 and 2013 Green is Smart strategy were other key informants. The document notes that given the status quo of infrastructure in the province, and the changing and uncertain world facing the Western Cape over the 2-3 decades a new approach to infrastructure is needed. Namely one that satisfies current needs and backlogs, maintains the existing infrastructure, and plans proactively for a desired future outcome. The 2040 vision requires a number of transitions to shift fundamentally the way in which infrastructure is provided and the type of infrastructure provided in WCP. The WCIF addresses new infrastructure development under five major 'systems' (themes), and outlines priorities for each. Energy is one of the 'systems' identified. The document notes that a provincial demand increase of 3% per year is anticipated for the period 2012-2040. Key priorities are in matching energy generation/ sourcing with the demand needed for WCP economic growth. Additionally, the energy focus should be on lowering the provincial carbon footprint, with an emphasis on renewable and locally generated energy. Three key transitions are identified for the WCP Energy 'system' infrastructure, namely: ▪ Shifting transport patterns to reduce reliance on liquid fuels. ▪ Promoting natural gas as a transition fuel by introducing gas processing and transport infrastructure. ▪ Promoting the development of renewable energy plants in the province and associated manufacturing capacity

Applicable Plan	Description of Plan
Central Karoo District Municipality IDP 2017-2022, 2nd Review 2021–2022	At the district level, the IDP highlights the following projects, identified in the District LED Strategy: ■ Infrastructure development to increase access for businesses and households; ■ Business support programmes to retain existing businesses and encourage start-up or relocating businesses to enter the area; ■ Spatial planning to promote land acquisition and property development for businesses and households; ■ Skills programmes to respond to business and government for greater productivity and efficiency; and ■ Social development programmes to increase participation in the local economy and build better lifestyles for the community. The CKDM IDP goes on to mention the importance of establishing an LED unit to coordinate activities, as well as the Economic Recovery Plan being drafted to respond to the economic impact of the COVID-19 pandemic.
Beaufort West Local Municipality 2021-2022 review of the 2017-2022 IDP	In terms of future economic development goals, the 2021-2022 review of the 2017-2022 IDP is most instructive. According to this plan, the Municipal Strategic Programme is aligned to 5 Key Performance Areas: ■ KPA 1: Basic service delivery and infrastructure development ■ KPA 2: Economic development ■ KPA 3: Institutional development and municipal transformation ■ KPA 4: Financial viability and management ■ KPA 5: Good governance and community participation KPA 2 above (economic development) is linked to the following strategies: ■ To use municipal and government funded projects as means to create jobs and reduce poverty ■ To facilitate development and growth of SMME's ■ To establish and strengthen LED Structures ■ To facilitate Education and Skills Development for Cooperatives & SMME's ■ To provide SMME Support and Capacity building ■ To manage and enhance the performance of the municipality

5.4 INTERNATIONAL STANDARDS AND GUIDELINES

5.4.1 IFC PERFORMANCE STANDARDS

The International Finance Corporation (IFC) is an international financial institution that offers investment, advisory, and asset management services to encourage private sector development in developing countries. The IFC is a member of the World Bank Group (WBG) and is headquartered in Washington, D.C., United States. It was established in 1956 as the private sector arm of the WBG to advance economic development by investing in strictly for-profit and commercial projects that purport to reduce poverty and promote development.

The IFC's stated aim is to create opportunities for people to escape poverty and achieve better living standards by mobilizing financial resources for private enterprise, promoting accessible and competitive markets, supporting businesses and other private sector entities, and creating jobs and delivering necessary services to those who are poverty-stricken or otherwise vulnerable. Since

2009, the IFC has focused on a set of development goals that its projects are expected to target. Its goals are to increase sustainable agriculture opportunities, improve health and education, increase access to financing for microfinance and business clients, advance infrastructure, help small businesses grow revenues, and invest in climate health.

The IFC is owned and governed by its member countries but has its own executive leadership and staff that conduct its normal business operations. It is a corporation whose shareholders are member governments that provide paid-in capital and which have the right to vote on its matters. Originally more financially integrated with the WBG, the IFC was established separately and eventually became authorized to operate as a financially autonomous entity and make independent investment decisions. It offers an array of debt and equity financing services and helps companies face their risk exposures, while refraining from participating in a management capacity. The corporation also offers advice to companies on making decisions, evaluating their impact on the environment and society, and being responsible. It advises governments on building infrastructure and partnerships to further support private sector development.

The IFC's Sustainability Framework articulates the Corporation's strategic commitment to sustainable development and is an integral part of IFC's approach to risk management. The Sustainability Framework comprises IFC's Policy and Performance Standards on Environmental and Social Sustainability, and IFC's Access to Information Policy. The Policy on Environmental and Social Sustainability describes IFC's commitments, roles, and responsibilities related to environmental and social sustainability. IFC's Access to Information Policy reflects IFC's commitment to transparency and good governance on its operations and outlines the Corporation's institutional disclosure obligations regarding its investment and advisory services. The Performance Standards (PSs) are directed towards clients, providing guidance on how to identify risks and impacts, and are designed to help avoid, mitigate, and manage risks and impacts as a way of doing business in a sustainable way, including stakeholder engagement and disclosure obligations of the client in relation to project-level activities. In the case of its direct investments (including project and corporate finance provided through financial intermediaries), IFC requires its clients to apply the PSs to manage environmental and social risks and impacts so that development opportunities are enhanced. IFC uses the Sustainability Framework along with other strategies, policies, and initiatives to direct the business activities of the Corporation to achieve its overall development objectives. The PSs may also be applied by other financial institutions (FIs).

The Project is considered a Category B project in terms of the IFC Policy on E&S Sustainability (2012), having the potential to cause limited adverse environmental or social risks and/or impacts that are few in number, generally site specific, largely reversible, and readily addressed through mitigation measures.

The objectives and applicability of the eight PSs are outlined in **Table 5-4.**

Table 5-4 – Objectives and Applicability of the IFC Performance Standards

Reference	Requirements	Project Specific Applicability
Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts		

Reference	Requirements		Project Specific Applicability
Overview	Performance Standard 1 underscores the importance of managing environmental and social performance throughout the life of a project. An effective Environmental and Social Management System (ESMS) is a dynamic and continuous process initiated and supported by management, and involves engagement between the client, its workers, local communities directly affected by the project (the Affected Communities) and, where appropriate, other stakeholders.		
Objectives	▪ To identify and evaluate environmental and social risks and impacts of the project. ▪ To adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimize, and, where residual impacts remain, compensate/offset for risks and impacts to workers, Affected Communities, and the environment. ▪ To promote improved environmental and social performance of clients through the effective use of management systems. ▪ To ensure that grievances from Affected Communities and external communications from other stakeholders are responded to and managed appropriately. ▪ To promote and provide means for adequate engagement with Affected Communities throughout the project cycle on issues that could potentially affect them and to ensure that relevant environmental and social information is disclosed and disseminated.		
Aspects	1.1	Policy	The IFC Standards state under PS 1 (Guidance Note 23) that "*the breadth, depth and type of analysis included in an ESIA must be proportionate to the nature and scale of the proposed project's potential impacts as identified during the course of the assessment process*." This document is the draft deliverable from the BA process undertaken for the proposed Project. The impact assessment comprehensively assesses the key environmental and social impacts and complies with the requirements of the South African EIA Regulations. In addition, an EMPr has been compiled and is included in **Appendix H**.
	1.2	Identification of Risks and Impacts	
	1.3	Management Programmes	
	1.4	Organisational Capacity and Competency	
	1.5	Emergency Preparedness and Response	
	1.6	Monitoring and Review	
	1.7	Stakeholder Engagement	
	1.8	External Communication and Grievance Mechanism	
	1.9	Ongoing Reporting to Affected Communities	
Performance Standard 2: Labour and Working Conditions;			
Overview	Performance Standard 2 recognises that the pursuit of economic growth through employment creation and income generation should be accompanied by protection of the fundamental rights of workers.		
Objectives	▪ To promote the fair treatment, non-discrimination, and equal opportunity of workers. ▪ To establish, maintain, and improve the worker-management relationship. ▪ To promote compliance with national employment and labour laws.		

Reference	Requirements		Project Specific Applicability
	▪ To protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties, and workers in the client's supply chain. ▪ To promote safe and healthy working conditions, and the health of workers. ▪ To avoid the use of forced labour.		
Aspects	2.1	▪ Working Conditions and Management of Worker Relationship ▪ Human Resources Policy and Management ▪ Working Conditions and terms of Engagement ▪ Workers organisation ▪ Non- Discrimination and Equal Opportunity ▪ Retrenchment ▪ Grievance Mechanism	Even though the nature and scale of the project is considered to be small, PS2 is considered applicable as a contractor will be appointed to undertake the required scope of work. This BA Report and the EMPr, however, incorporate the requirements for compliance with local and international Labour and Working legislation and good practice on the part of the contractors. Formal human resource and labour policies will be compiled in the event that the project is developed in the future as part of the project specific ESMS/corporate ESMS
	2.2	▪ Protecting the Workforce ▪ Child Labour ▪ Forced Labour	
	2.3	Occupational health and Safety	
	2.4	Workers Engaged by Third Parties	
	2.5	Supply Chain	
Performance Standard 3: Resource Efficiency and Pollution Prevention			
Overview	Performance Standard 3 recognises that increased economic activity and urbanisation often generate increased levels of pollution to air, water, and land, and consume finite resources in a manner that may threaten people and the environment at the local, regional, and global levels. There is also a growing global consensus that the current and projected atmospheric concentration of greenhouse gases (GHG) threatens the public health and welfare of current and future generations. At the same time, more efficient and effective resource use and pollution prevention and GHG emission avoidance and mitigation technologies and practices have become more accessible and achievable in virtually all parts of the world.		
Objectives	▪ To avoid or minimise adverse impacts on human health and the environment by avoiding or minimising pollution from project activities. ▪ To promote more sustainable use of resources, including energy and water. ▪ To reduce project related GHG emissions.		
Aspects	3.1	▪ Policy Resource Efficiency ▪ Greenhouse Gases ▪ Water Consumption	PS3-related impacts, such as the management of construction waste, hazardous substances, and stormwater are assessed in **Section 8** of this report.

Reference	Requirements		Project Specific Applicability
	3.2	▪ Pollution Prevention ▪ Air Emissions ▪ Stormwater ▪ Waste Management ▪ Hazardous Materials Management ▪ Pesticide use and Management	There are no material resource efficiency issues associated with the Project. The EMPr will include general resource efficiency measures. The project is not GHG emissions intensive however a Climate Change Assessment has been undertaken and is included in **Appendix G.1**. The Mura 1 PV Facility seeks to facilitate resource efficiency and pollution prevention by contributing to the South African green economy. Dust air pollution in the construction phase has been adequately addressed in the EMPr (**Appendix H**). The Project will not result in the release of industrial effluents. Potential pollution associated with sanitary wastewater is low and mitigation measures have been included in the EMPr. Land contamination of the site from historical land use (i.e. low intensity agricultural / grazing) is not considered to be a cause for concern. The waste generation profile of the project is not complex. Waste mitigation and management measures have been included in EMPr. Hazardous materials are not a key issue; small quantities of construction materials (oil, grease, diesel fuel etc.) are the only wastes expected to be associated with the project. The EMPr identifies these anticipated hazardous materials and recommends relevant mitigation and management measures.
Performance Standard 4: Community Health, Safety, and Security			
Overview	Performance Standard 4 recognizes that project activities, equipment, and infrastructure can increase community exposure to risks and impacts.		
Objectives	▪ To anticipate and avoid adverse impacts on the health and safety of the Affected Community during the project life from both routine and non-routine circumstances. ▪ To ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to the Affected Communities		
Aspects	4.1	▪ Community Health and Safety ▪ Infrastructure and Equipment Design and Safety ▪ Hazardous Materials Management and Safety ▪ Ecosystem Services ▪ Community Exposure to Disease ▪ Emergency Preparedness and Response	The requirements included in PS 4 have addressed in the BA process and the development of the EMPr (**Appendix H**). The following generic plans have been included in the EMPr: ▪ Emergency Response Plan; ▪ Transport Management Plan; ▪ HIV/AIDS Management Plan; and ▪ Security Policy. All plans will be made site specific as part of the financial close process, in the event that the project is developed in the future.

Reference	Requirements		Project Specific Applicability
	4.2	Security Personnel	
Performance Standard 5: Land Acquisition and Involuntary Resettlement			
Overview	Performance Standard 5 recognises that project-related land acquisition and restrictions on land use can have adverse impacts on communities and persons that use this land. Involuntary resettlement refers both to physical displacement (relocation or loss of shelter) and to economic displacement (loss of assets or access to assets that leads to loss of income sources or other means of livelihood) as a result of project-related land acquisition and/or restrictions on land use.		
Objectives	▪ To avoid, and when avoidance is not possible, minimise displacement by exploring alternative project designs. ▪ To avoid forced eviction. ▪ To anticipate and avoid, or where avoidance is not possible, minimise adverse social and economic impacts from land acquisition or restrictions on land use by (i) providing compensation for loss of assets at replacement cost and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected. ▪ To improve, or restore, the livelihoods and standards of living of displaced persons. ▪ To improve living conditions among physically displaced persons through the provision of adequate housing with security of tenure at resettlement sites.		
Aspects	5.1	▪ Displacement ▪ Physical Displacement ▪ Economic Displacement ▪ Private Sector Responsibilities under Government Managed Resettlement	PS5 is not applicable to the proposed Mura 1 Solar PV Facility as no physical or economic displacement or livelihood restoration will be required. The proposed Mura Solar PV Facility is located on privately owned land that is utilised for agriculture by the landowners. The significance of all potential agricultural impacts is kept low by the very small proportion of the land that is impacted. An Agricultural Potential Assessment has been undertaken and is included in **Appendix G.2.**
1Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources			
Overview	Performance Standard 6 recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are fundamental to sustainable development.		
Objectives	▪ To protect and conserve biodiversity. ▪ To maintain the benefits from ecosystem services. ▪ To promote the sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities.		
Aspects	6.1	Protection and Conservation of Biodiversity	Mura 1 does not fall within any CBAs. A Terrestrial Biodiversity Compliance Statement as well as an Avifaunal Impact Assessment and Aquatic Biodiversity Impact Assessment have been included in the proposed scope. The methodologies for the specialist assessments include a combination of literature review, in-field surveys and

Reference	Requirements		Project Specific Applicability
			sensitivity mapping. This substantively complies with the PS 6 general requirements for scoping and baseline assessment for determination of biodiversity and ecosystem services issues. The determination of habitat sensitivity was undertaken within the legal and best practice reference framework for South Africa. The prevalence of invasive alien species will be determined, and mitigation and management measures are included in the EMPr.
Performance Standard 7: Indigenous People			
Overview	Performance Standard 7 recognizes that Indigenous Peoples, as social groups with identities that are distinct from mainstream groups in national societies, are often among the most marginalized and vulnerable segments of the population. In many cases, their economic, social, and legal status limits their capacity to defend their rights to, and interests in, lands and natural and cultural resources, and may restrict their ability to participate in and benefit from development. Indigenous Peoples are particularly vulnerable if their lands and resources are transformed, encroached upon, or significantly degraded.		
Objectives	▪ To ensure that the development process fosters full respect for the human rights, dignity, aspirations, culture, and natural resource-based livelihoods of Indigenous Peoples. ▪ To anticipate and avoid adverse impacts of projects on communities of Indigenous Peoples, or when avoidance is not possible, to minimize and/or compensate for such impacts. ▪ To promote sustainable development benefits and opportunities for Indigenous Peoples in a culturally appropriate manner. ▪ To establish and maintain an ongoing relationship based on Informed Consultation and Participation (ICP) with the Indigenous Peoples affected by a project throughout the project's life-cycle. ▪ To ensure the Free, Prior, and Informed Consent (FPIC) of the Affected Communities of Indigenous Peoples when the circumstances described in this Performance Standard are present. ▪ To respect and preserve the culture, knowledge, and practices of Indigenous Peoples.		
Aspects	7.1	General ▪ Avoidance of Adverse Impacts ▪ Participation and Consent	As per the international instruments under the United Nations (UN) Human Rights Conventions, no indigenous peoples are present within the study area.
	7.2	Circumstances Requiring Free, Prior, and Informed Consent ▪ Impacts on Lands and Natural Resources Subject to Traditional Ownership or Under Customary Use ▪ Critical Cultural Heritage	

Reference	Requirements		Project Specific Applicability
		▪ Relocation of Indigenous Peoples from Lands and Natural Resources Subject to Traditional Ownership or Under Customary Use	
	7.3	Mitigation and Development Benefits	
	7.4	Private Sector Responsibilities Where Government is Responsible for Managing Indigenous Peoples Issues	
Performance Standard 8: Cultural Heritage			
Overview	Performance Standard 8 recognizes the importance of cultural heritage for current and future generations.		
Objectives	▪ To protect cultural heritage from the adverse impacts of project activities and support its preservation. ▪ To promote the equitable sharing of benefits from the use of cultural heritage.		
Aspects	8.1	Protection of Cultural Heritage in Project Design and Execution	A Heritage Assessment (**Appendix G.8**) has been carried out by a suitably qualified specialist. A Chance Find Procedure has been included in the EMPr (**Appendix H**).

5.4.2 WORLD BANK GROUP ENVIRONMENTAL HEALTH AND SAFETY GUIDELINES

In support of the Performance Standards, the World Bank Group (WBG) has published a number of Environmental Health and Safety (EHS) Guidelines. The EHS Guidelines are technical reference documents that address IFC's expectations regarding the industrial pollution management performance of its projects. They are designed to assist managers and decision makers with relevant industry background and technical information. This information supports actions aimed at avoiding, minimising, and controlling EHS impacts during the construction, operation, and decommissioning phase of a project or facility. The EHS Guidelines serve as a technical reference source to support the implementation of the IFC Performance Standards, particularly in those aspects related to PS3: Pollution Prevention and Abatement, as well as certain aspects of occupational and community health and safety.

Where host country regulations differ from the levels and measures presented in the EHS Guidelines, projects seeking international funding may be expected to achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, a full and detailed justification for any proposed alternatives is required.

The following IFC / WBG EHS Guidelines have been generally consulted during the preparation of the BA in order to aid the identification of EHS aspects applicable to the project:

- Electric Power Transmission and Distribution (2007) - information relevant to power transmission between a generation facility and a substation located within an electricity grid, in addition to power distribution from a substation to consumers located in residential, commercial, and industrial areas
- General EHS Guidelines – this includes a section on a range of environmental, occupational health and safety, community health and safety, and construction activities that would apply to the project. The guideline also contains recommended guidelines adopted form the World Health Organisation (WHO) for ambient air and water quality, which are referred to in the relevant impact assessment sections in the ESIA report.

5.4.3 EQUATOR PRINCIPALS

The Equator Principles (EPs) is a risk management framework, adopted by financial institutions, for determining, assessing, and managing environmental and social risk in projects and is primarily intended to provide a minimum standard for due diligence to support responsible risk decision-making.

The EPs apply globally to all industry sectors and to five financial products 1) Project Finance Advisory Services, 2) Project Finance, 3) Project-Related Corporate Loans, 4) Bridge Loans and 5) Project-Related Refinance and Project-Related Acquisition Finance. The relevant thresholds and criteria for application is described in detail in the Scope section of the EP. Currently 125 Equator Principles Financial Institutions (EPFIs) in 37 countries have officially adopted the EPs, covering the majority of international project finance debt within developed and emerging markets. EPFIs commit to implementing the EPs in their internal environmental and social policies, procedures and standards for financing projects and will not provide Project Finance or Project-Related Corporate Loans to projects where the client will not, or is unable to, comply with the EPs.

While the EPs are not intended to be applied retroactively, EPFIs apply them to the expansion or upgrade of an existing project where changes in scale or scope may create significant environmental and social risks and impacts, or significantly change the nature or degree of an existing impact. The EPs have greatly increased the attention and focus on social/community standards and responsibility, including robust standards for indigenous peoples, labour standards, and consultation with locally affected communities within the Project Finance market.

The EPs have also helped spur the development of other responsible environmental and social management practices in the financial sector and banking industry and have supported member banks in developing their own Environmental and Social Risk Management Systems.

The requirements and applicability of the EPs are outlined in **Table 5-5**.

It should be noted that Principles 8 and 10 relate to a borrower's code of conduct and are therefore not considered relevant to the BA process and have not been included in this discussion.

Table 5-5 - Requirements and Applicability of the Equator Principles

Requirement		Project Specific Applicability
Principle 1: Review and Categorisation		
Overview	When a project is proposed for financing, the EPFI will, as part of its internal social and	Based upon the significance and scale of the Project's environmental and social

Requirement		Project Specific Applicability
	environmental review and due diligence, categorise such project based on the magnitude of its potential impacts and risks in accordance with the environmental and social screening criteria of the IFC. Using categorisation, the EPFI's environmental and social due diligence is commensurate with the nature, scale, and stage of the Project, and with the level of environmental and social risks and impacts. The categories are: ▪ Category A: Projects with potential significant adverse environmental and social risks and/or impacts that are diverse, irreversible or unprecedented; ▪ Category B: Projects with potential limited adverse environmental and social risks and/or impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures; and ▪ Category C: Projects with minimal or no adverse environmental and social risks and/or impacts.	impacts, the proposed project is regarded as a Category B project i.e. a project with potential limited adverse environmental or social risks and/or impacts that are few in number, generally site-specific, largely reversible, and readily addressed through mitigation measures.
Principle 2: Environmental and Social Assessment		
Overview	For all Category A and Category B Projects, the EPFI will require the client to conduct an appropriate Assessment process to address, to the EPFI's satisfaction, the relevant environmental and social risks and scale of impacts of the proposed Project (which may include the illustrative list of issues found in Exhibit II). The Assessment Documentation should propose measures to minimise, mitigate, and where residual impacts remain, to compensate/offset/remedy for risks and impacts to Workers, Affected Communities, and the environment, in a manner relevant and appropriate to the nature and scale of the proposed Project. The Assessment Documentation will be an adequate, accurate and objective evaluation and presentation of the environmental and social risks and impacts, whether prepared by the client, consultants or external experts. For Category A, and as appropriate, Category B Projects, the Assessment Documentation includes an Environmental and Social Impact Assessment (ESIA). One or more specialised studies may also need to be undertaken. For other Category B and potentially C Projects, a limited or focused environmental or social	This document is the draft deliverable from the BA process undertaken for the proposed Project. The impact assessment comprehensively assesses the key environmental and social impacts and complies with the requirements of the South African EIA Regulations (2014, as amended). In addition, a site-specific EMPr has been compiled and is included in **Appendix H**, which is to be read in conjunction with the generic powerline and substation EMPRs.

Requirement		Project Specific Applicability
	assessment may be appropriate, applying applicable risk management standards relevant to the risks or impacts identified during the categorisation process.	
Principle 3: Applicable Environmental and Social Standards		
Overview	The Assessment process should, in the first instance, address compliance with relevant host country laws, regulations and permits that pertain to environmental and social issues. The EPFI's due diligence will include, for all Category A and Category B Projects globally, review and confirmation by the EPFI of how the Project and transaction meet each of the Principles. For Projects located in Non-Designated Countries, the Assessment process evaluates compliance with the then applicable IFC PS and WBG EHS Guidelines. For Projects located in Designated Countries, compliance with relevant host country laws, regulations and permits that pertain to environmental and social issues.	As South Africa has been identified as a non-designated country, the reference framework for environmental and social assessment is based on the IFC PS. In addition, this BAR process has been undertaken in accordance with NEMA (the host country's relevant legislation).
Principle 4: Environmental and Social Management System and Equator Principles Action Plan		
Overview	For all Category A and Category B Projects, the EPFI will require the client to develop or maintain an Environmental and Social Management System (ESMS). Further, an Environmental and Social Management Plan (ESMP) will be prepared by the client to address issues raised in the assessment process and incorporate actions required to comply with the applicable standards. Where the applicable standards are not met to the EPFI's satisfaction, the client and the EPFI will agree on an Equator Principles Action Plan (EPAP). The EPAP is intended to outline gaps and commitments to meet EPFI requirements in line with the applicable standards.	A formal project specific ESMS will be compiled in the event that the project is developed in the future. Management and monitoring plans outlines in the EMPr will serve as the basis for an ESMS for the proposed Project.
Principle 5: Stakeholder Engagement		
Overview	EPFI will require the client to demonstrate effective Stakeholder Engagement as an ongoing process in a structured and culturally appropriate manner with Affected Communities Workers and, where relevant, Other Stakeholders. For Projects with potentially significant adverse impacts on Affected Communities, the client will conduct an	The BA process includes an extensive stakeholder engagement process which complies with the South African EIA Regulations. The process includes consultations with local communities, nearby businesses, and a range of government sector stakeholders (state owned enterprises, national, provincial and local departments).

Requirement		Project Specific Applicability
	Informed Consultation and Participation process. To accomplish this, the appropriate assessment documentation, or non-technical summaries thereof, will be made available to the public by the borrower for a reasonable minimum period in the relevant local language and in a culturally appropriate manner. The borrower will take account of and document the process and results of the consultation, including any actions agreed resulting from the consultation. Disclosure of environmental or social risks and adverse impacts should occur early in the Assessment process, in any event before the Project construction commences, and on an ongoing basis.	The stakeholder engagement process solicits interest from potentially interested parties through the placement of site notices and newspaper advertisements as well as written and telephonic communication. The stakeholder engagement process is detailed in **Section 2.6**.
Principle 6: Grievance Mechanism		
Overview	For all Category A and, as appropriate, Category B Projects, the EPFI will require the client, as part of the ESMS, to establish effective grievance mechanisms which are designed for use by Affected Communities and Workers, as appropriate, to receive and facilitate resolution of concerns and grievances about the Project's environmental and social performance. The borrower will inform the Affected Communities and Workers about the grievance mechanism in the course of the stakeholder engagement process and ensure that the mechanism addresses concerns promptly and transparently, in a culturally appropriate manner, and is readily accessible, at no cost, and without retribution to the party that originates the issue or concern.	The EMPr includes a Grievance Mechanism Process for Public Complaints and Issues. This procedure effectively allows for external communications with members of the public to be undertaken in a transparent and structured manner. This procedure will be revised and updated as part of the EMPr amendment process in the event that the project is developed in the future and incorporated into the Project specific ESMS.
Principle 7: Independent Review		
Overview	For all Category A and, as appropriate, Category B Projects, an Independent Environmental and Social Consultant, not directly associated with the client, will carry out an Independent Review of the Assessment Documentation including the ESMPs, the ESMS, and the Stakeholder Engagement process documentation in order to assist the EPFI's due diligence, and assess Equator Principles compliance.	This principle will only become applicable in the event that the project is developed in the future.
Principle 9: Independent Monitoring and Reporting		

Requirement		Project Specific Applicability
Overview	To assess Project compliance with the Equator Principles after Financial Close and over the life of the loan, the EPFI will require independent monitoring and reporting for all Category A, and as appropriate, Category B projects. Monitoring and reporting should be provided by an Independent Environmental and Social Consultant; alternatively, the EPFI will require that the client retain qualified and experienced external experts to verify its monitoring information, which will be shared with the EPFI in accordance with the frequency required.	This principle will only become applicable in the event that the project is developed in the future.

5.5 OTHER GUIDELINES AND BEST PRACTICE RECOMMENDATIONS

5.5.1 GENERIC EMPR RELEVANT TO AN APPLICATION FOR SUBSTATION AND OVERHEAD ELECTRICITY TRANSMISSION AND DISTRIBUTION INFRASTRUCTURE

NEMA requires that an EMPr be submitted where an EIA has been identified as the environmental instrument to be utilised as the basis for a decision on an application for environmental authorisation. The content of an EMPr must either contain the information set out in Appendix 4 of the EIA Regulations, 2014, as amended, or must be a generic EMPr relevant to an application as identified and gazetted by the Minister in a government notice. Once the Minister has identified, through a government notice, that a generic EMPr is relevant to an application for EA, that generic EMPr must be applied by all parties involved in the EA process, including, but not limited to, the applicant and the CA.

GN 435 of 22 March 2019 identified a generic EMPr relevant to applications for substations and overhead electricity transmission and distribution infrastructure which require authorisation in terms of Section 42(2) of NEMA. Applications for overhead electricity transmission and distribution infrastructure that trigger Activity 11 of Listing Notice 1 or Activity 9 of Listing Notice 2 and any other listed or specified activities must use the generic EMPr.

The objective of the generic EMPr is "*to prescribe and pre-approve generally accepted impact management outcomes and impact management actions, which can commonly and repeatedly be used for the avoidance, management and mitigation of impacts and risks associated with the development or expansion of overhead electricity transmission and distribution infrastructure. The use of a generic EMPr is intended to reduce the need to prepare and review individual EMPrs for applications of a similar nature*."[8]

The generic EMPr (for Substations) has been included in the Site-Specific EMPr (**Appendix H**).

[8] DEA (2019) *Appendix 1: Generic Environmental Management Programme (EMPr) for the Development and Expansion for Overhead Electricity Transmission and Distribution Infrastructure*

5.6 ADDITIONAL PERMITS AND AUTHORISATIONS

Table 5-6 outlines the additional permits and authorisations required for the proposed development, as well as the relevant Competent Authorities responsible.

Table 5-6 – Additional Permits and Authorisations required for the proposed development

Permits / Authorisation	Legislation	Relevant Authority	Status
Notification Of Intent To Develop (NID) Section 38 (1) and Section 38 (8)	Section 38 (1) & (8) of the NHRA	HWC and SAHRA	Submitted
Subdivision of Agricultural Land Act (SALA) Consent / Change of Land Use (re-zoning)	Subdivision of Agricultural Land Act (Act No. 70 of 1970) / Spatial Planning and Land Use Management Act (Act No. 16 of 2013) (SPLUMA)	DALRRD	An application will be submitted following the PPP of the BA Report
Water Use Licence / General	National Water Act (Act No. 36 of 1998)	Department of Water and Sanitation	An application will be submitted during or following the conclusion of the BA process
Obstacle Permit	Civil Aviation Act (Act 13 of 2009)	Air Traffic and Navigation Services / Civil Aviation Authority	An application will be submitted during or following the conclusion of the BA process
Section 53 Approval	Minerals and Petroleum Resources Development Act (No. 28 of 2002)	Department of Mineral Resources and Energy	An application will be submitted during or following the conclusion of the BA process
Permits for removal or destruction of Threatened or Protected Species (TOPs)	NEM:BA (ToPS), Northern Cape Nature Conservation Act (Act no. 9 of 2009) and Western Cape Nature Conservation Laws Amendment Act (Act No 3 of 2000):	Cape Nature	Permits will be obtained prior to the commencement of construction.

6 BASELINE ENVIRONMENT

The following chapter presents an overview of the biophysical and socio-economic environment in which the proposed Project is located. It is important to gain an understanding of the Project area and its surroundings, as it will provide for a better understanding of the receiving environment in which the Project is being considered.

The description of the baseline environment is essential in that it represents the conditions of the environment before the construction of the proposed Project (i.e. the current, or status quo, environment) against which environmental impacts of the proposed Project can be assessed and future changes monitored.

The area has previously been studied to some extent and is recorded in various sources. Consequently, some components of the baseline have been generated based on literature review. However, where appropriate, baseline information has been supplemented or generated by specialists appointed to undertake baseline and impact assessments for the proposed Project.

6.1 PHYSICAL ENVIRONMENT

6.1.1 CLIMATE

The following is extracted from the Climate Change Assessment compiled by Promethium Carbon and included as ***Appendix G.1.***

The proposed Project falls within the arid, desert, cold climate zone. The area experiences warm to hot summers and cool, dry winters. The near-historical (since 1980) Mean annual temperature is 15.2 ±0.6°C. Mean maximum temperatures range from around 27°C in summer (January and February) to 12°C in winter (June and July). Temperatures occasionally exceed 35°C but rarely beyond 40°C in summer. during the recent historical period (since ca. 1980) there have been an average of 8 very hots days (> 35°C) per annum. Two years in the last decade had over 20 very hot days (2015 and 2016; both also intense drought years). Mean minimum temperatures range from 0°C in July to 13°C in February. Freezing nights (below 0°) occur regularly between May and October.

Mean annual rainfall is 274 ±80 mm/year. Rainfall peaks in March with a mean of 35 mm and there is less than 15 mm of rainfall per month from July to September. Extreme rainfall days (> 20 mm) are rare with 1.7 days. yr-1 since 1980.

Mean wind speed is approximately 6.5 km/h peaking in spring (October and November) and lowest in autumn (March and April). Mean wind speed has been relatively constant over the last four decades. The vast majority of wind is from north-westerly direction (**Figure 6-1**).

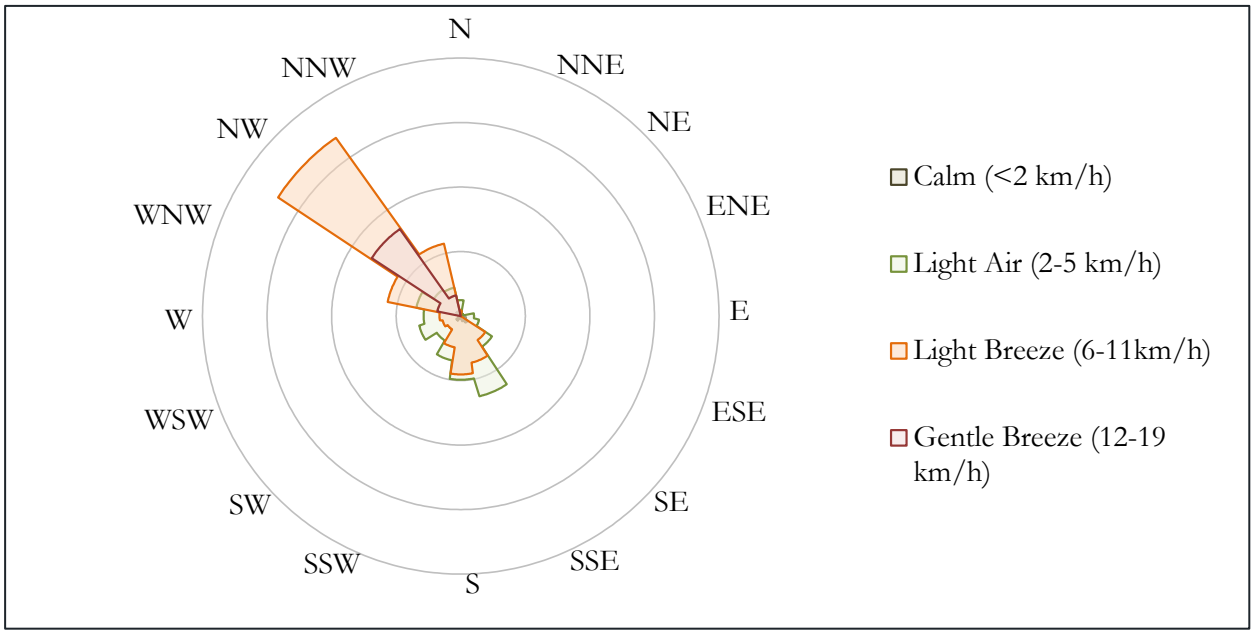


Figure 6-1 - Wind rose based on mean monthly wind speed and direction since 1980 near the Mura Solar PV site

6.1.1.1 Climate trends and projected climate change

Temperature

Mean annual temperature around the Project area has increased by approximately 1.0°C since the early 1980s thus showing an increasing trend of approximately 0.025°C per year. Temperatures are predicted to continue to rise under all SSPs. By 2050 median temperatures could increase from the current (last five years) mean (±16.0°C) to ±16.5°C under SSP1 through to ±17.4°C as under SSP5 (**Figure 6-2**).

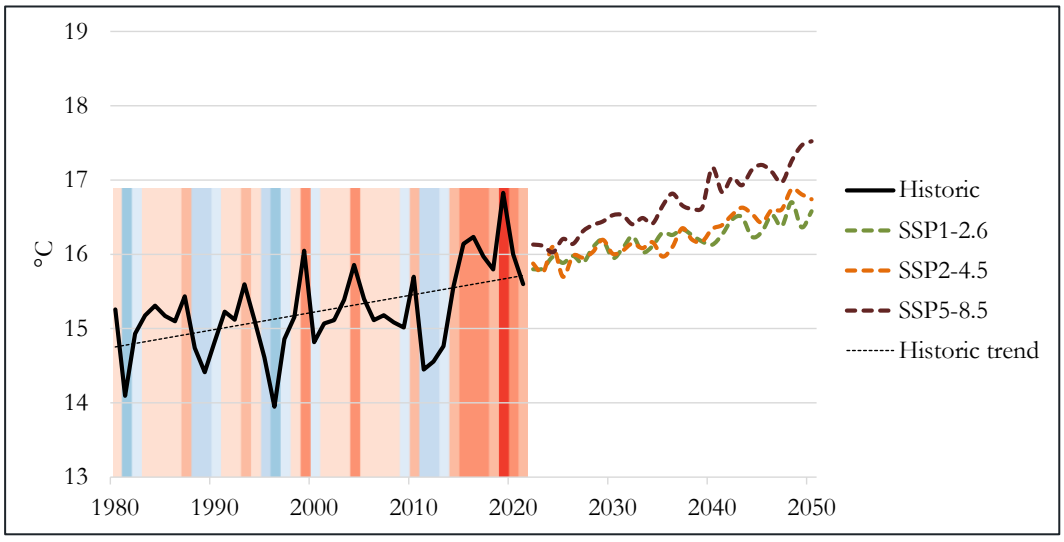


Figure 6-2 - Near-historical and projected mean annual temperature for the Mura Solar PV Project area

The near historical trend in very hot days shows a gradual increase with a sharper increase since ca. 2013; 2015 and 2016, both years during which an intense drought persisted, had over 20 very hot days each. The last decade has seen an average of 13.3 very hot days per year. A significant increase in the number of very hot days is projected under all three SSPs (**Figure 6-3**). The trend is particularly strong under SSP5. By 2050, the number of very hot days per annum is projected to range from ±21 days under SSP1 to ±27 days under SSP5; thus, more than doubling from the current number. By 2100, the number of very hot days could exceed 90 per annum under SSP5, 50 days per annum under SSP2 and 30 days per annum under SSP1.

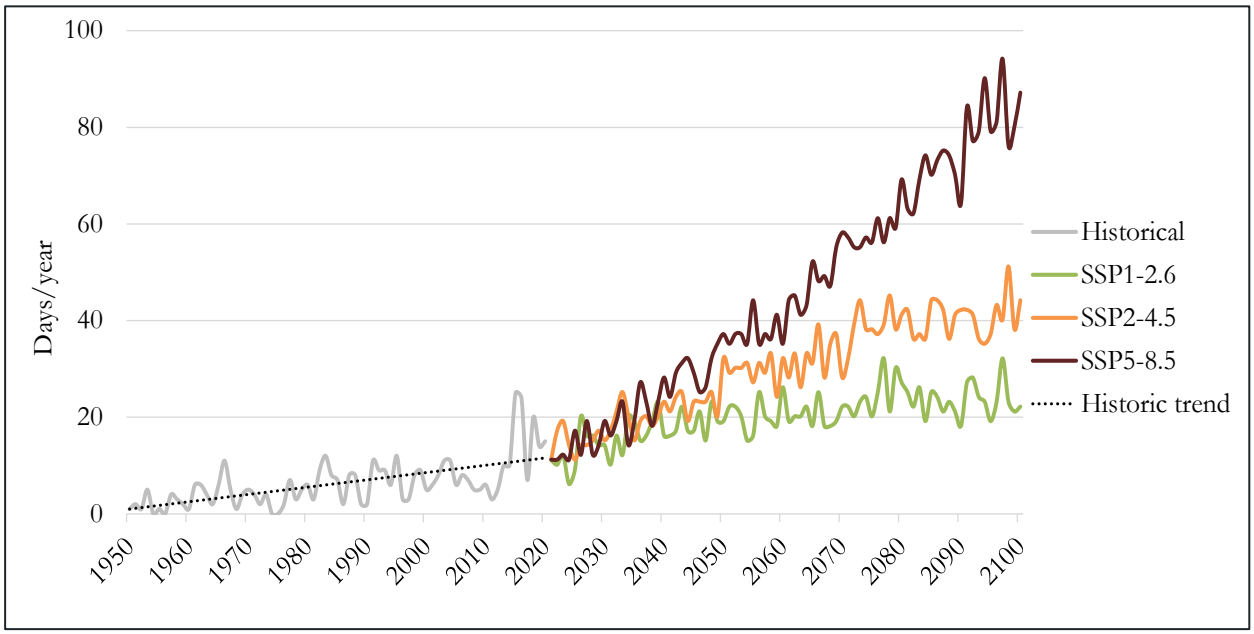


Figure 6-3 - Number of very hot days per annum between 1950 and 2020 and the projected number of very hot days up to 2100 under three SSP trajectories for the Mura Solar PV Project area

Precipitation

Near historical (since 1980) mean annual precipitation around the Project site shows a decreasing trend. There has been a strong recent decline; the last five consecutive years have had less than 250 mm per year with the lowest rainfall experience in 2019 (**Figure 6-4**). Projected annual precipitation shows a continued but weaker decreasing trend under the three SSP trajectories. Annual rainfall is likely to be between 150-250 mm by 2050; slightly higher than recent amounts but lower than the historical long-term average (**Figure 6-2**).

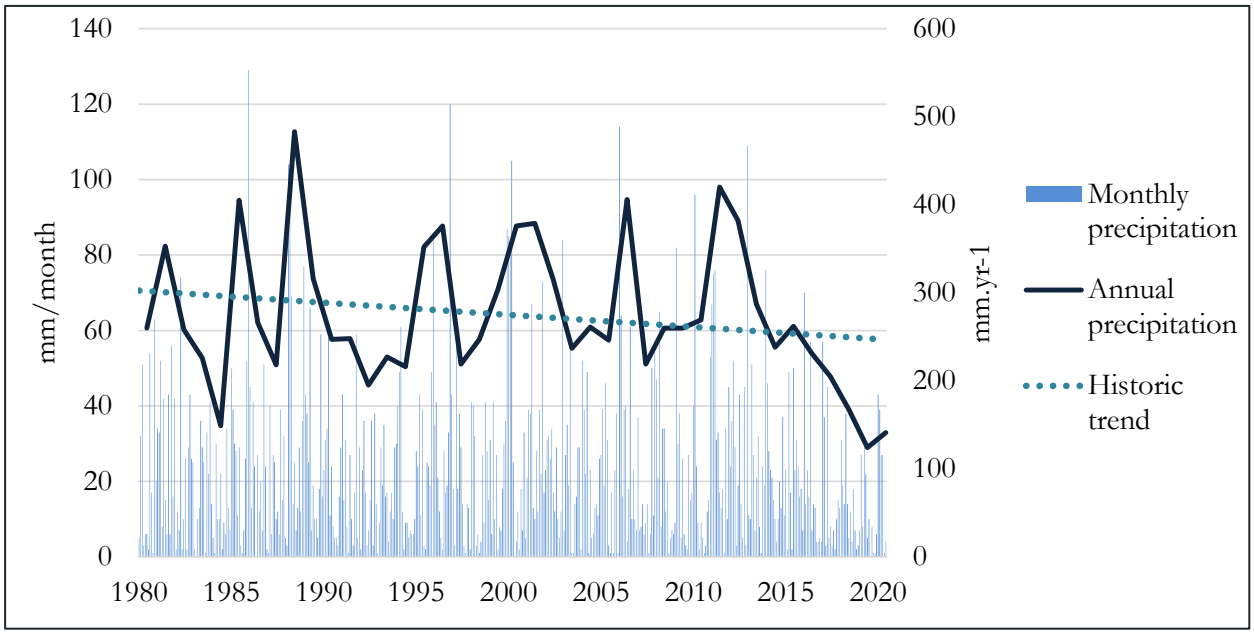


Figure 6-4 - Mean monthly precipitation and mean annual precipitation for the Mura Solar PV Project area

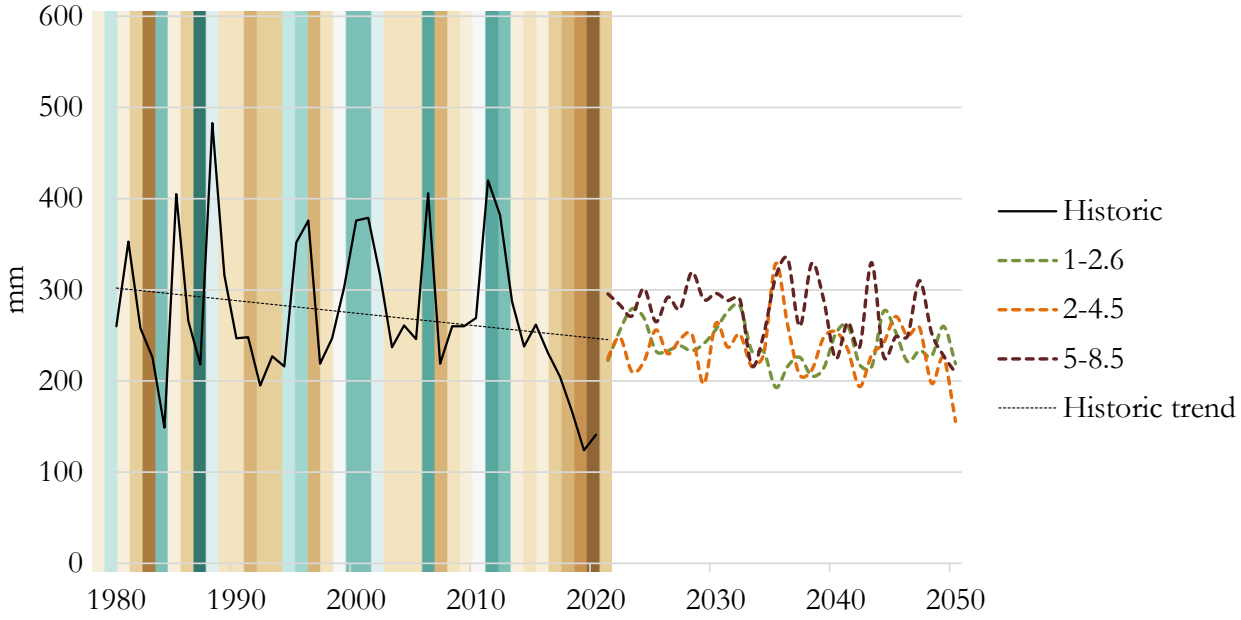


Figure 6-5 - Near historical mean annual precipitation and projected trends in precipitation under three SSP trajectories for the Mura Solar PV Project area

Because mean annual precipitation is so variable (**Figure 6-4**) and modelling precipitation is more challenging than temperature (due to several factors including topographic influence, isolated occurrence and non-linear interaction), it is useful to assess extreme rainfall events. Since the Project areas site is in an arid area with an average of < 2mm of precipitation a day, the number of days with 20 mm of rain becomes a good indicator of heavy rainfall days.

The Project area has experienced an average of 1.7 heavy rainfall days per annum since 1980, with five heavy rainfall days occurring during 2000. The number of heavy rainfall days up until 2050 is projected to be around 2-3 days per annum under the three SSPs assessed, and thus a slight increase from the current number (**Figure 6-6**). It can be concluded that rainfall is likely to decline slightly overall but may be more concentrated during storm events.

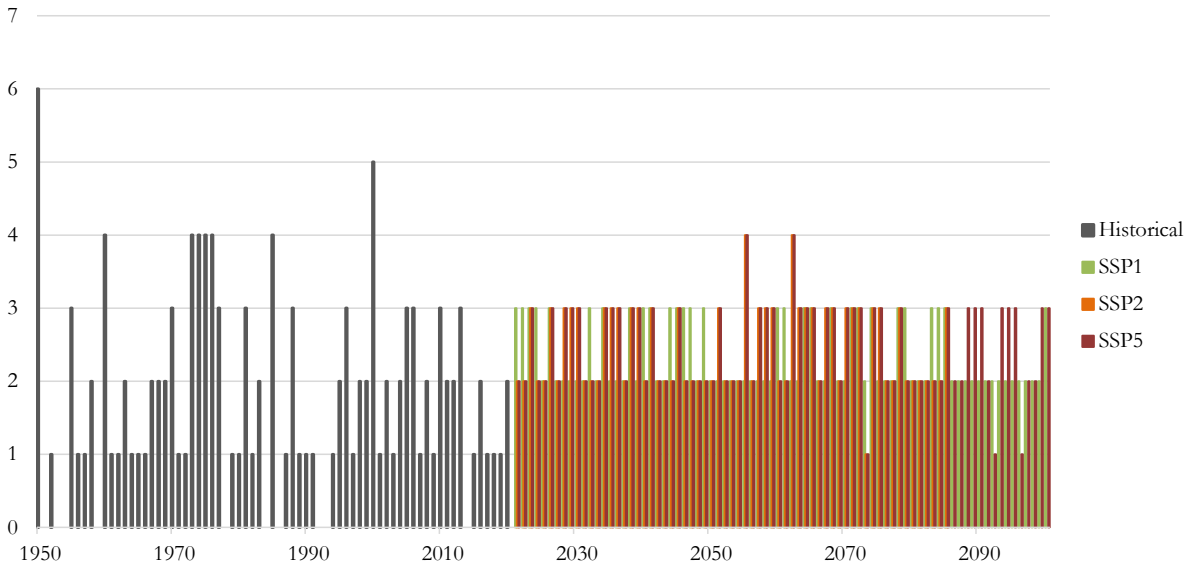


Figure 6-6 - Near-historical and projected number of heavy rainfall days per annum at the Mura Solar PV Project area. Copernicus Climate Change Service (C3S) and CMIP6

6.1.2 AGRICULTURAL POTENTIAL

*The following is extracted from the Agricultural Compliance Statement compiled by Johann Lanz and included as **Appendix G.2**.*

The arid climate (low rainfall of between 171 and 212 mm per annum and high evaporation of between 1,274 and 1,312 mm per annum) (Schulze, 2009) is the limiting factor for land capability, regardless of the soil capability and terrain. Moisture availability is very limiting to any kind of agricultural production. Moisture availability is insufficient for crop production without irrigation and the potential agricultural land use of the site is therefore limited to grazing. The land has a low long term grazing capacity of 28 hectares per large stock unit.

The land type data shows the dominant soils to be shallow on underlying rock and hardpan carbonate. A low agricultural sensitivity is entirely appropriate for the site, which is unsuitable for crop production.

6.1.3 GEOLOGICAL CONTEXT

*The following is extracted from the Palaeontological Study compiled by Natura Viva cc and included as **Appendix G.9**.*

The geology of the project area is outlined on 1: 250 000 geological sheet 3122 Victoria West (Council for Geoscience, Pretoria) (**Figure 6-7**). Illustrated accounts of portions of the combined project area have already been provided in previous PIA reports by the author for the Nuweveld Cluster WEFs and Nuweveld Gamma Grid Connection (Almond 2020a, 2020b, Almond 2022c).

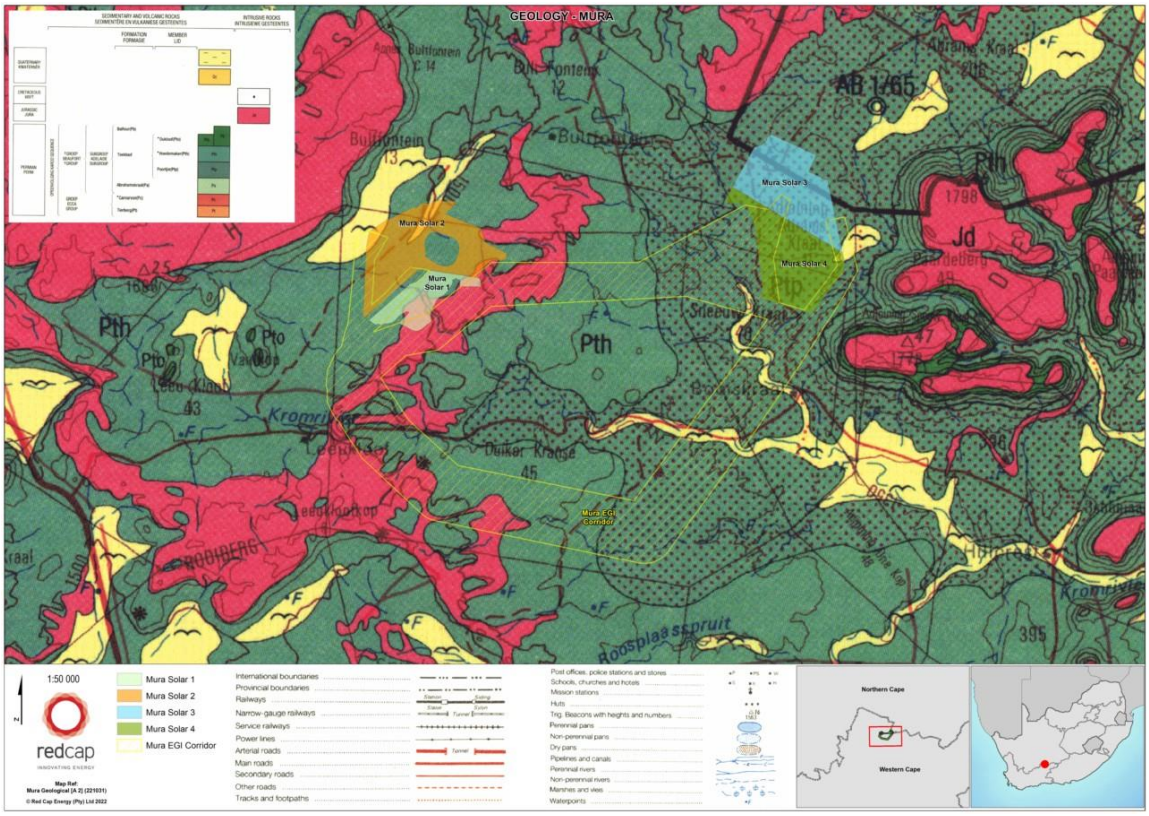


Figure 6-7 - Extract from 1: 250 000 geology sheet 3122 Victoria West showing the project area

The project area is situated in the west-central sector of the Main Karoo Basin of the RSA and is largely underlain at depth by continental (fluvial / lacustrine) sediments of the Lower Beaufort Group / Adelaide Subgroup (Karoo Supergroup) of latest Middle to earliest Late Permian age (c. 260 to 256 Ma = million years ago). According to the current 1: 250 000 geological map, which probably requires revision, the Beaufort Group sedimentary succession represented within the project area is assigned to the lower part of the Teekloof Formation - viz. the sandstone-dominated, prominent-weathering Poortjie Member and the overlying mudrock-dominated, more recessive weathering Hoedemaker Member. Although this remains to be confirmed, it is considered likely that the bedrocks directly underlying the solar PV and EGI project footprints can be largely assigned to the upper part of the Poortjie Member and the lower part of the Hoedemaker Member. Large portions of the Beaufort Group outcrop have been extensively baked and mineralised by voluminous intrusions of the Early Jurassic Karoo Dolerite Suite in the vicinity, such as the major sills capping the Harpuisberg in the west, the Perdeberg in the east and the Taaibosberg to the north (Duncan & Marsh 2006). The palaeoenvironmentally and palaeobiologically critical boundary between the Middle and Late Permian Periods at c. 260 Ma lies within the lower part of the Poortjie Member (**Figure 6-9**). The Oukloof Member sandstone package overlying the Hoedemaker Member is not mapped within the project area itself but occurs just outside this on higher hillslopes on the Perdeberg in the east and Vaalkop in the west.

It is noted that the member-scale lithostratigraphy and associated biostratigraphical zonation of the Lower Beaufort Group succession in this sector of the Main Karoo Basin - including the long-distance correlation of the main channel sandstone packages such as the Poortjie Member -

remains unresolved (cf Day & Rubidge 2020a, Almond 2022c). The diachronous contact between the Poortjie and Hoedemaker Members in the western sector of the study area is transitional over an interval some 25-30 m. It is marked here by the Reiersvlei Meanderbelt package identified by Smith (1987, 2021) and is of considerable palaeontological as well as palaeoenvironmental interest. The precise level of the contact is arbitrary to an extent and has been variously interpreted in maps and scientific literature. On the 1: 250 000 geological map (**Figure 6-7**) the entire Reiersvlei Meander Belt seems to have been incorporated within the upper Poortjie Member which extends well up the lower slopes of Perdeberg. Smith and Keyser (1995) place the contact at the top of the last thick, multistorey channel sandstone of the Poortjie Member (excluding the Reiersvlei package). The stratigraphic column in Maharaj et al. (2019) appears to place the contact at the incoming of thick reddish mudrock packages above Reiersvlei Meanderbelt 2, while the column in Smith et al. (2021) places it lower down within a red bed succession at the level of Meanderbelt 1 of the Reiersvlei package. Given these ambiguities, the stratigraphic position of the geological and fossil sites mentioned in this report provisionally follows that shown on the published 1: 250 000 geological map.

The Poortjie – Hoedemaker transition zone characterised by a succession of thin, single-storey channel sandstones and intervening, predominantly reddish-brown mudrocks (Smith & Keyser 1995, Paiva 2015, Maharaj et al. 2019, Smith et al. 2021). This stratigraphic interval records the transition from thick, multi-storey channel sandstones dominated by downstream accretion process typical of the Poortjie Member to laterally accreting, meandering river systems of the Hoedemaker Member (**Figure 6-8**). The transition is accompanied by more frequent development of crevasse splay deposits and calcareous palaesols on the floodplain driven by increased aridification in the Karoo Basin and aggradation of the Reiersvlei Meanderbelt sedimentary prism (Maharaj et al. 2019, Smith et al. 2021). In contrast, a subsidence-driven transition is favoured by Paiva (2015).

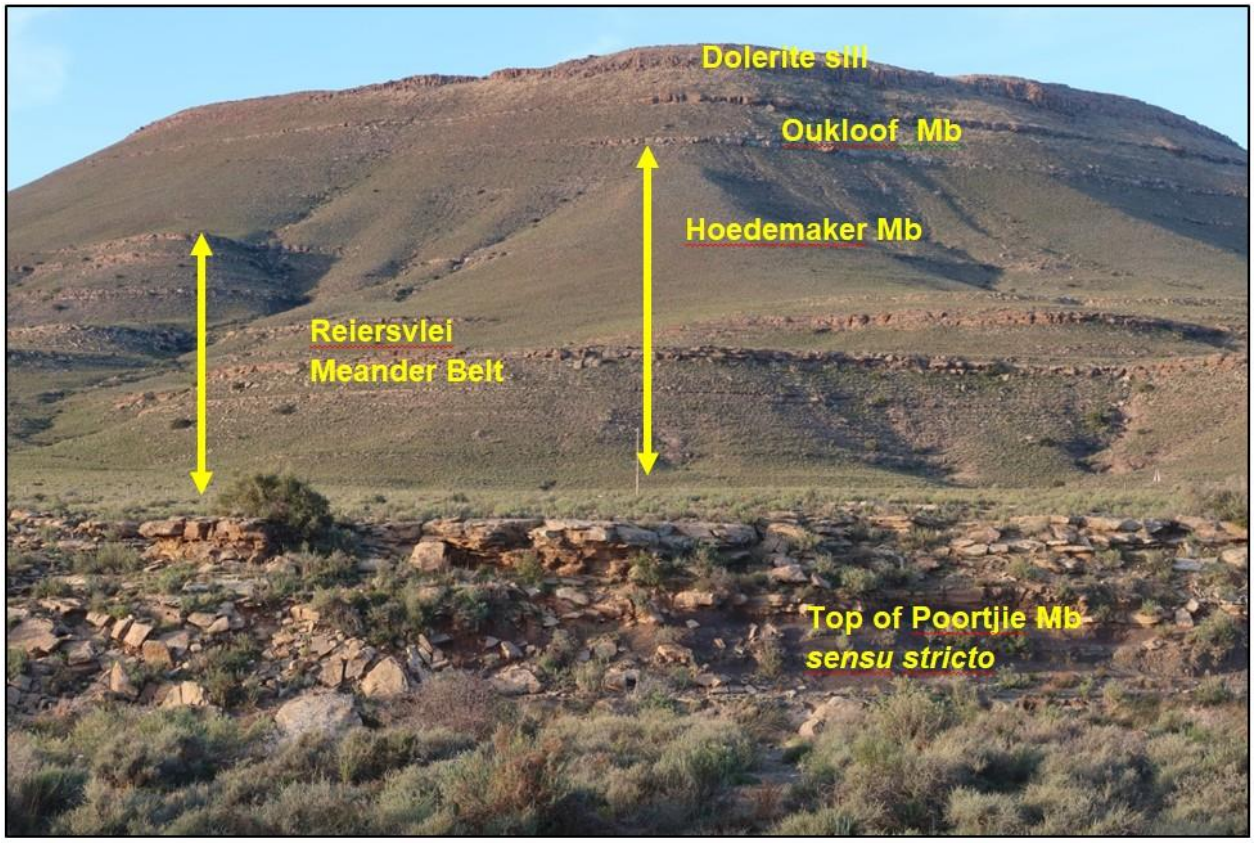


Figure 6-8 - South-western slopes of Perdeberg near Booiskraal homestead showing one possible interpretation of the main lithostratigraphic subunits of the lower Teekloof Formation that are represented in the broader project area

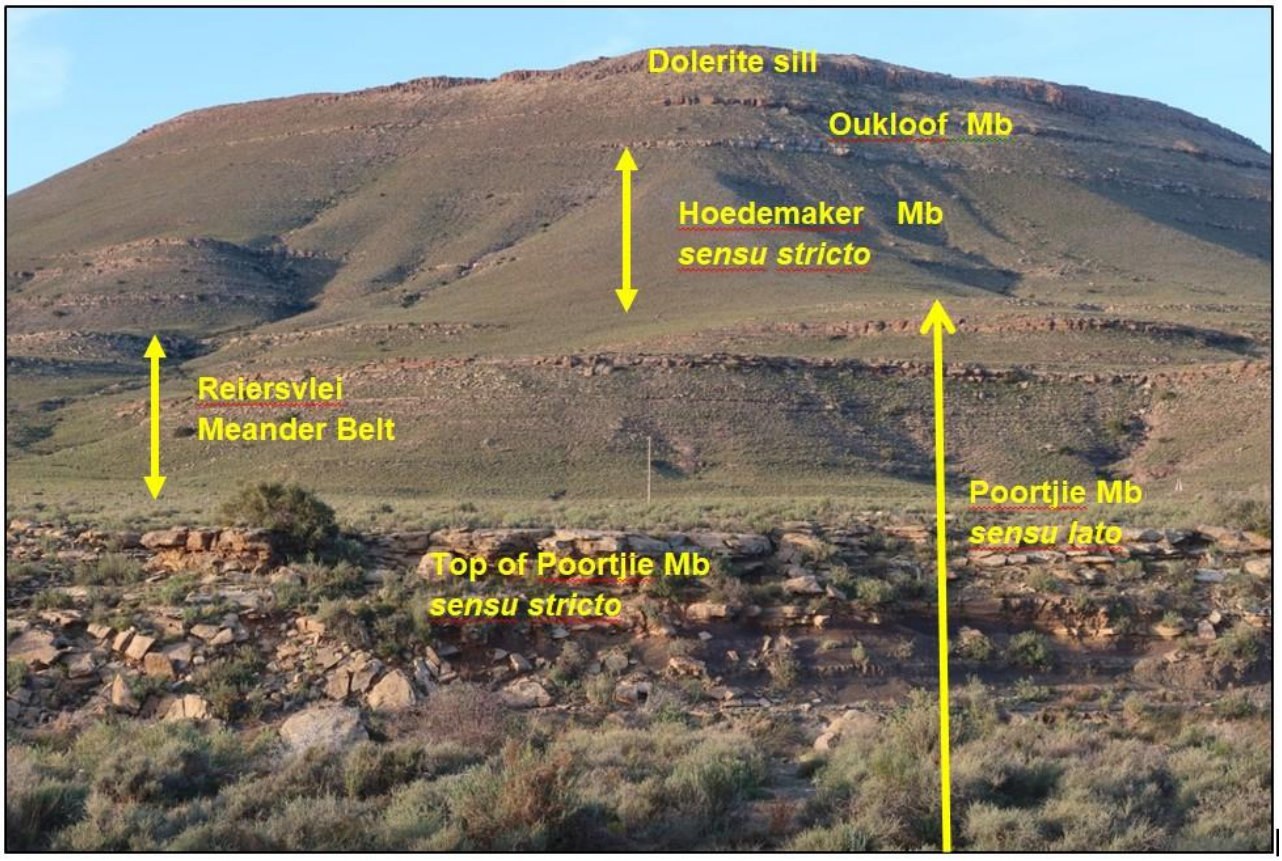


Figure 6-9 - Alternative stratigraphic subdivision of the Lower Beaufort Group succession on Perdeberg.

The Permian sediments and Jurassic intrusions within the combined project area are extensively mantled by a range of Late Caenozoic superficial deposits, limiting exposure levels of fresh (unweathered), potentially fossiliferous Permian sediments, especially in low-relief lowlands and on upland plateaux where the PV solar sites will be located. In addition to thick, consolidated (calcretised) to unconsolidated, gravelly to silty alluvial sediments along major active or defunct drainage lines (e.g. Kromrivier, Soutrivier and their various tributaries), these younger cover sediments include pan deposits (e.g. shallow brak-kolle), colluvial (slope) and eluvial (downwasted) surface gravels, pedocretes (e.g. calcrete), spring deposits and a spectrum of mainly sandy to gravelly soils. Coarse older alluvial deposits ("High Level Gravels") are not separately mapped within the project area at 1: 250 000 scale but elevated terrace gravels of Pleistocene and younger age are present along major drainage lines such as along the deeply-incised valley of the Kromrivier.

6.1.4 SURFACE WATER

The following is extracted from the Aquatic Biodiversity Assessment compiled by BlueScience (Pty) Ltd and included as ***Appendix G.4.***

The study area is mostly drained by smaller seasonal streams that feed into the larger Krom River. The rivers flow in a southeasterly direction towards the Sout River, a tributary of the Kariega River in the Groot/Gamtoos River System. The Krom River is a larger watercourse with some instream wetland habitat that tends to contain water for longer periods. The rivers are still in a natural ecological condition with little to no disturbance except for farm roads along the river.

Flow in the smaller tributaries in the upper catchment tends to be episodic (**Figure 6-10**), with very little to no flow in the rivers for much of the year. Flow typically only occurs for a short period following localised rainfall. These rainfall events tend to mostly occur in the higher rainfall months in late summer and into autumn. When flow occurs in the watercourses, it occurs as a high-flow event. This flow pattern is unlikely to change significantly due to longer-term climatic changes. The flow nature does, however, make erosion control measures in the watercourses, particularly on the slopes, essential mitigation.

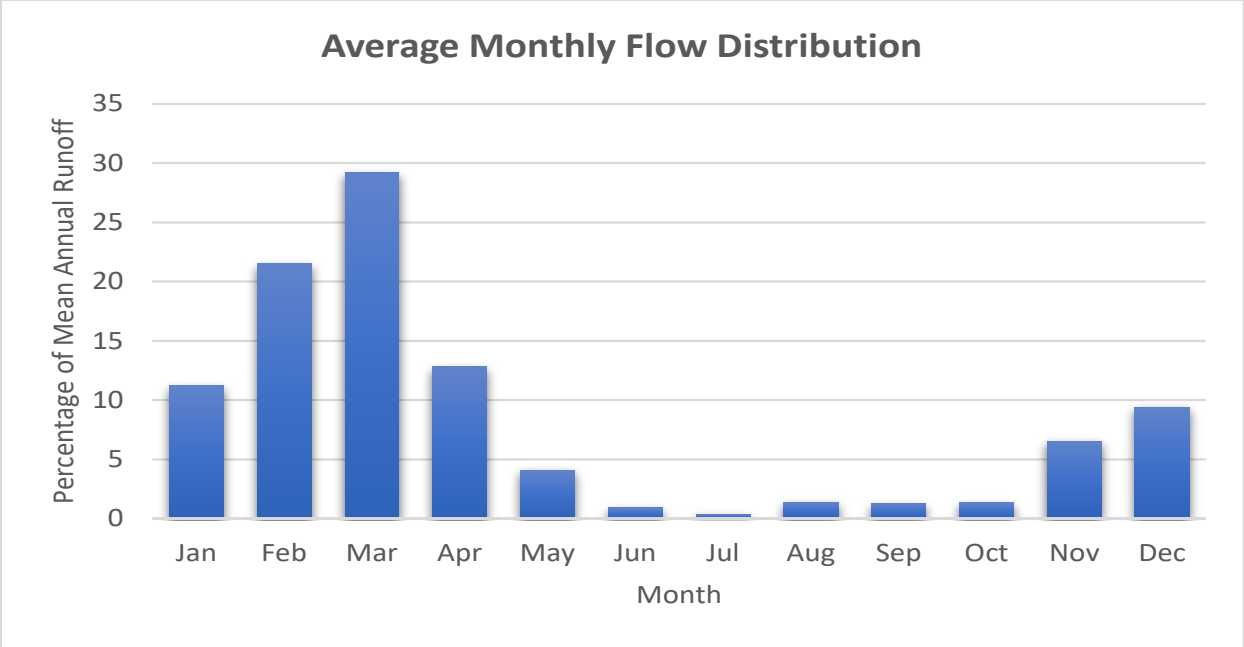


Figure 6-10 - Monthly flow distribution within the rivers in the study area, with the month flow shown as a percentage of the natural mean annual runoff (nMAR) for the catchment

6.1.5 HYDROGEOLOGY

The following is extracted from the Geohydrological Assessment compiled by GEOSS South Africa (Pty) Ltd and included as ***Appendix G.13.***

The Mura Solar Development is shown to be underlain by two aquifers. The larger of the two aquifers is classified by the Department of Water Affairs and Forestry (DWAF, 2002) as a fractured aquifer. The subordinate, more localised aquifer, is classified by DWAF as an intergranular and fractured aquifer. An intergranular aquifer describes an aquifer in which groundwater flows in openings and void space between grains or weathered rock. A fractured aquifer refers to an aquifer in which groundwater flows in joints, fissures, cracks and fractures within the rock. The larger fractured aquifer is classified as having average yield potential of 0.5 – 2.0 litres per second (L/s), whereas the smaller intergranular & fractured aquifer is classified as having an average yield potential 0.1 – 0.5 L/s. Based on the DWAF (2002) mapping of the regional groundwater quality, the electrical conductivity (EC) of the groundwater in the area generally ranges between 70 and 300 milli-Siemens per metre (mS/m). This is considered “moderate” groundwater quality, with respect to drinking water standards. The quality improves towards the east with an indicated electrical conductivity of 0 – 70 mS/m, which is considered “good” in terms of drinking water standards.

Both these classifications are based on regional datasets, and therefore, only provide an indication of the possible/likely conditions. Groundwater in the area is generally considered as being of marginal quality and boreholes have a low yield. The water requirements for each of the proposed Mura Solar Facilities are as follows:

- Construction phase: 30 000 m^3/a (1.52 L/s)
- Operational phase: 18 000 m^3/a (0.89 L/s)

The volumes of water required for the development should be readily available and could be supplied by groundwater in the region.

6.2 BIOLOGICAL ENVIRONMENT

6.2.1 TERRESTRIAL BIODIVERSITY

The following is extracted from the Terrestrial Biodiversity Compliance Statement compiled by 3Foxes Biodiversity Solutions and included as ***Appendix G.3.***

6.2.1.1 Vegetation

The Mura 1 Solar footprint falls entirely within the Eastern Upper Karoo vegetation type (**Figure 6-11**). Eastern Upper Karoo has an extent of 49 821 km^2 and is the most extensive vegetation type in South Africa and forms a large proportion of the central and eastern Nama Karoo Biome. This vegetation type is classified as Least Threatened, and about 2% of the original extent has been transformed largely for intensive agriculture. Eastern Upper Karoo is however poorly protected and less than 1% of the 21% target has been formally conserved. Mucina & Rutherford (2006) list eight endemic species for this vegetation type, which considering that it is the most extensive unit in the country, is not very high. As a result, this is not considered to represent a sensitive vegetation type. Within the study area, the vegetation is relatively homogenous, although there is some variation in which species are dominant depending on soil depth and the degree of rockiness.

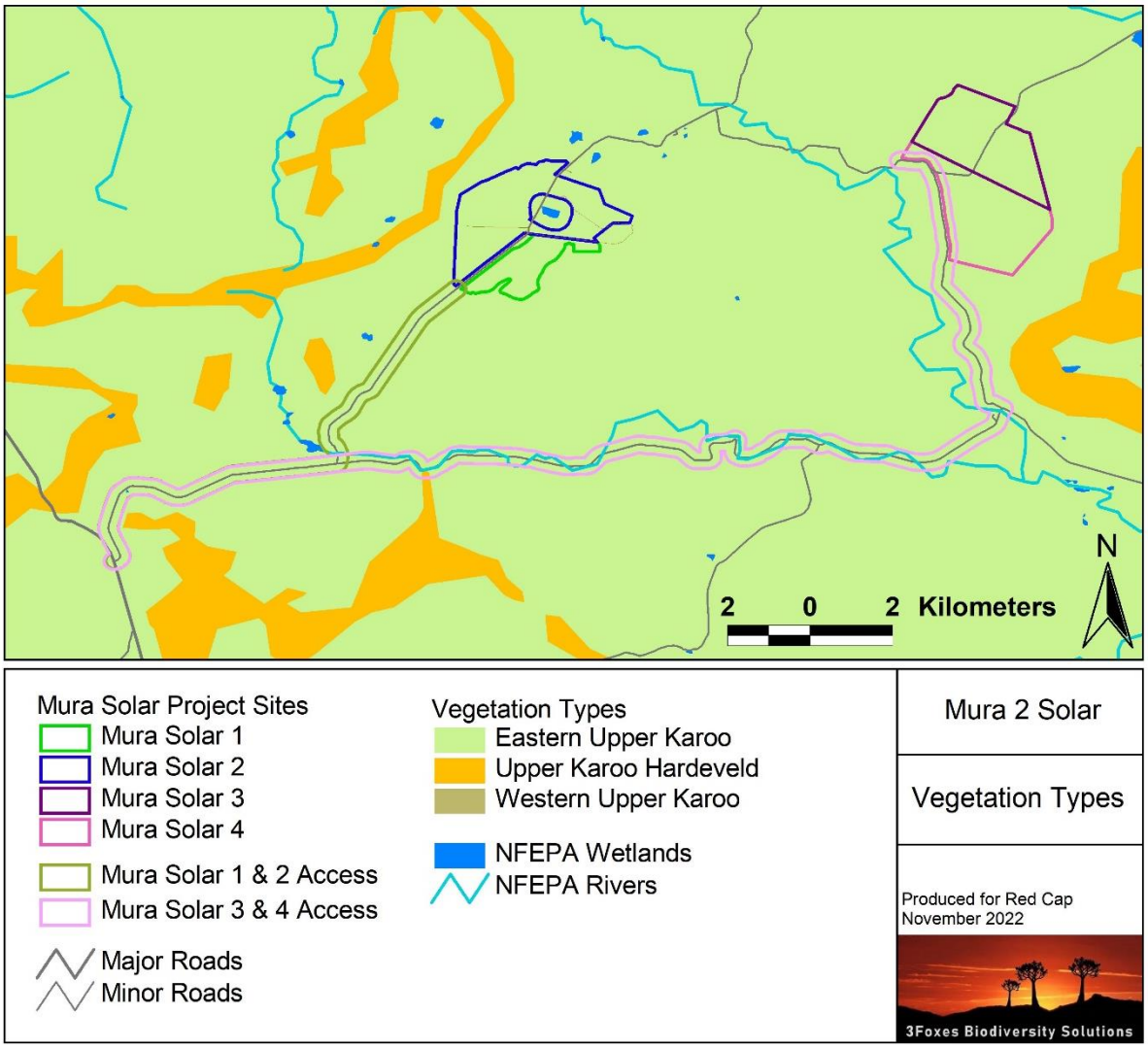


Figure 6-11 - Vegetation map of the broader Mura Solar Project Area

6.2.1.2 Critical Biodiversity Areas & Broad-Scale Processes

The CBA and ESA map for the broader project area is indicated below in **Figure 6-12** and indicates that there are no CBAs the Mura 1 footprint area. There are a few small ESAs within the site associated with the minor drainage features that occur within the site. The site does not lie within an area that appears to have a high significance in terms of faunal movement. The camera traps located within the site did not show a higher-than-average species diversity or abundance of fauna and overall diversity and abundance within the site was low compared to some other camera trapped areas in the wider vicinity. As such, the site is considered low sensitivity for ecological processes and the development of the Mura 1 site as a PV facility would not generate a significant disruption of ecological processes in the area. In addition, the site does not lie within an NPAES Focus Area or SWSA area, indicating that the site has not been identified as being of significance for conservation or water resource protection.

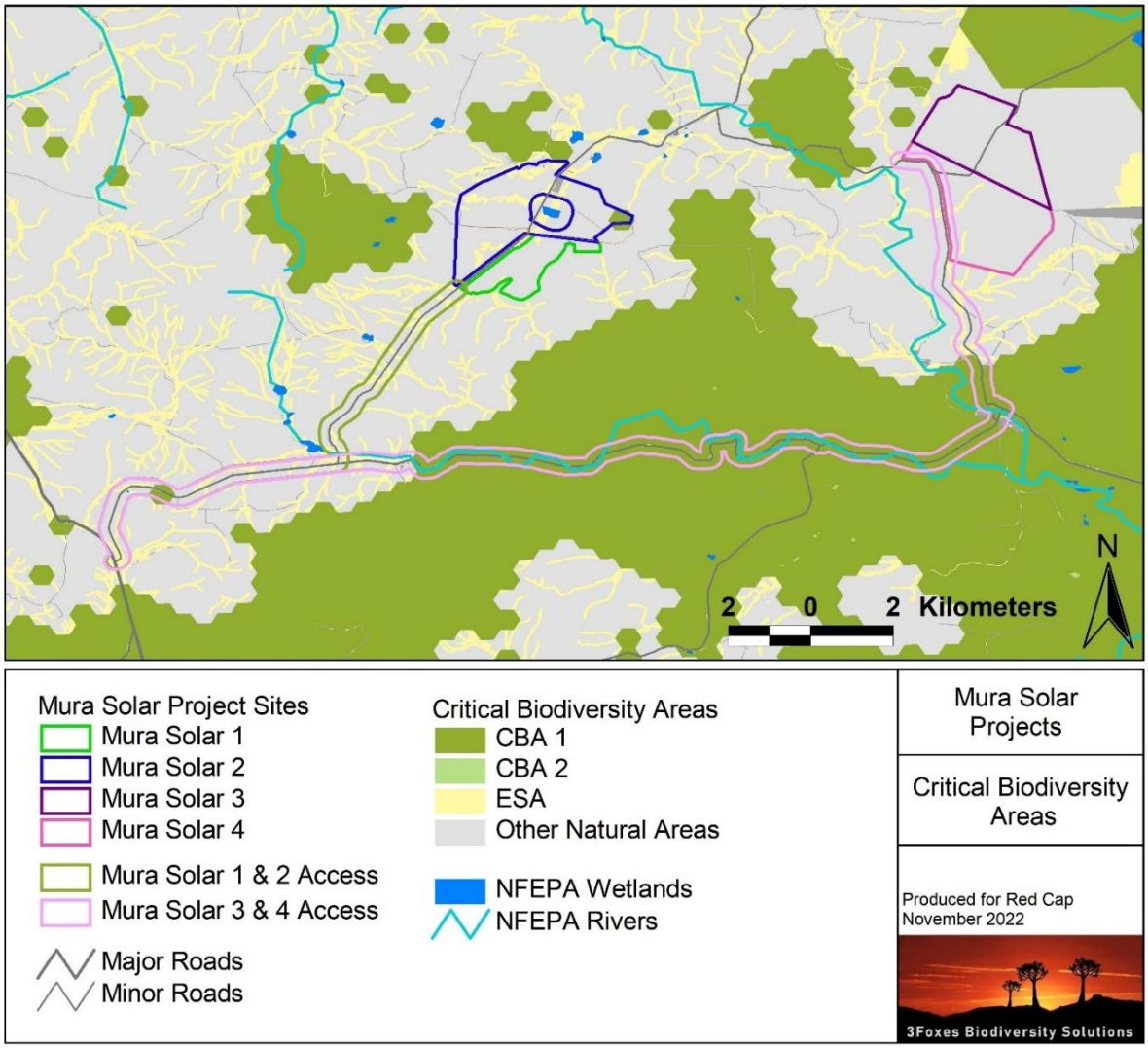


Figure 6-12 - CBAs and ESAs for the wider Mura project area, which is a combination of the Western Cape Biodiversity Spatial Plan for the Beaufort West municipality and the Northern Cape CBA map

6.2.2 AQUATIC BIODIVERSITY

The following is extracted from the Aquatic Biodiversity Assessment compiled by BlueScience (Pty) Ltd and included as ***Appendix G.4.***

The larger Krom River corridor is mapped as aquatic CBA, with the smaller tributaries mapped as aquatic ESAs (**Figure 6-13**). The only mapped natural FEPA Wetlands and National Wetland Map areas are downstream of the study area in the larger Krom River.

Figure 6-13 - Google Earth image with the mapped aquatic features shown as well as the proposed project locations

6.2.2.1 Classification of aquatic features

To assess the condition and ecological importance and sensitivity of the watercourses, it is necessary to understand how they might have appeared under unimpacted conditions. This is achieved by classifying the rivers according to their ecological characteristics, so that they can be compared to ecologically similar rivers.

River typing or classification involves the hierarchical grouping of rivers into ecologically similar units so that inter- and intra-river variation in factors that influence water chemistry, channel type, substratum composition and hydrology are best accounted for. Any comparative assessment of river conditions should only be done between rivers that share similar physical and biological characteristics under natural conditions. Thus, the classification of rivers provides the basis for assessing river conditions to allow comparison between similar river types. The primary classification of rivers is a division into Ecoregions. Rivers within an ecoregion are further divided into sub-regions.

Ecoregions: groups of rivers within South Africa which share similar physiography, climate, geology, soils and potential natural vegetation. For this study, the ecoregional classification presented in DWAF (1999), which divides the country's rivers into ecoregions, was used. The study area falls within the Great Karoo Ecoregion (**Table 6-1**).

Table 6-1 - Characteristics of the Great Karoo Ecoregion

Main Attributes	Characteristics

Terrain Morphology:	Plains: Moderate to Low Relief Lowlands; Hills and Mountains: Moderate and High Relief Open Hills, Lowlands; Mountains: Moderate to High Relief Closed Hills; Mountains: Moderate and High Relief; Table-Lands: Moderate and High Relief
Vegetation types	Valley Thicket; Spekboom Succulent Thicket (limited); Central Nama Karoo; Eastern Mixed Nama Karoo; Great Nama Karoo; Upper Nama Karoo; Bushmanland Nama Karoo (limited), Lowland Succulent Karoo; Upland Succulent Karoo; and Escarpment Mountain Renosterveld
Altitude	300-1700m; 1700-1900m (limited occurrence)
MAP	0 to 500m
Rainfall seasonality	Very late summer to winter
Mean annual temp.	10 to 20 °C
Median annual simulated runoff	<5 to 60 mm for quaternary catchment

Sub-regions: sub-regions (or geomorphological zones) are groups of rivers, or segments of rivers, within an ecoregion, which share similar geomorphological features, of which gradient is the most important. The use of geomorphological features is based on the assumption that this is a major factor in the determination of the distribution of the biota. **Table 6-2** provides the geomorphological and physical features of the rivers within the study area. From the Site Characterisation assessment, the geomorphological and physical characteristics of the channels can be classified as follows:

Table 6-2 - Geomorphological and physical features of the watercourses on site

Main Attributes	Characteristics	
River	Krom River	Minor unnamed tributaries & drainage features
Geomorph Zone	Lower Foothill Zone	
Lateral mobility	Semi-Confined by topography	
Channel form	Single to multiple channels	Simple single channel
Channel pattern	Braided channel with moderate sinuosity	Single channel, moderate to low sinuosity
Channel type	Bedrock, alluvial and gravel	
Channel modification	Channel is fairly natural with some flow and habitat modification	Natural with very small disturbances
Hydrological type	Seasonal to episodic	Episodic
Ecoregion	Great Karoo	

Main Attributes	Characteristics
DWA catchment	L11A and L11D
Vegetation type	Eastern Upper Karoo
Rainfall region	Very late summer to autumn

Wetlands can be broadly classified according to their flow and geomorphic characteristics. The wetlands are associated with the lower Krom River in the study area and are classified as channelled valley bottom wetlands. Flow into and out of the wetland areas is mostly associated with the watercourses within the study area as opposed to sub-surface flow.

Table 6-3 – Classification of wetland areas within study area

Main Attributes	Characteristics
Name	Valley bottom wetlands
System	Inland
Ecoregion	Great Karoo
Landscape setting	Channeled valley floor
Longitudinal zonation	Lower foothill
Drainage	With channel in- and outflow
Seasonality	Seasonally inundated
Modification	Largely natural to Moderately modified
Geology	Shale and siltstone of the Ecca Group; Karoo Sequence
Vegetation	Eastern Upper Karoo
Substrate	Bedrock, gravel and alluvium
Salinity	Fresh to brackish

6.2.2.2 Present Ecological Condition

Habitat Integrity of the Watercourses

The evaluation of Habitat Integrity provides a measure of the degree to which a river has been modified from its natural state. The methodology (DWAF, 1999) involves a qualitative assessment of the number and severity of anthropogenic perturbations on a river and the damage they potentially inflict upon the system. These disturbances include both abiotic and biotic factors, which are regarded as the primary causes of the degradation of a river. The severity of each impact is ranked using a six-point scale from 0 (no impact) to 25 (critical impact). The Habitat Integrity Assessment is based on an assessment of the impacts of two components of the river, the riparian zone and the

instream habitat. The total scores for the instream and riparian zone components are then used to place the habitat integrity of both in a specific habitat category (**Table 6-4**).

Table 6-4 - Instream Habitat Integrity assessment for the watercourses within the study area

Instream Criteria	Unnamed tributaries	Krom River	Riparian Category	Unnamed tributaries	Krom River
Water Abstraction	2	8	Vegetation Removal	2	6
Flow Modification	3	9	Exotic Vegetation	2	6
Bed Modification	3	8	Bank Erosion	3	5
Channel Modification	3	4	Channel Modification	2	5
Water Quality	2	5	Water Abstraction	2	6
Inundation	3	6	Inundation	3	5
Exotic Macrophytes	0	0	Flow Modification	3	7
Exotic Fauna	0	0	Water Quality	2	5
Rubbish Dumping	0	2			
Instream Integrity Class	**A**	**B/C**	**Riparian Integrity Category**	**A/B**	**B/C**

The habitat integrity assessment was divided into the smaller watercourses that have few modifications and the larger Krom River within the study area. The rivers within the study area are still in a natural ecological condition in their upper reaches with few modifications. The Krom River is more impacted by surrounding landuse activities and is in a largely natural to moderately modified ecological condition.

Table 6-5 - Habitat Integrity categories (From DWAF, 1999)

Category	Description	Score (%)
A	Unmodified, natural.	90-100
B	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.	80-90

Category	Description	Score (%)
C	Moderately modified. A loss and change of natural habitat and biota have occurred but the basic ecosystem functions are still predominantly unchanged.	60-79
D	Largely modified. Large loss of natural habitat, biota and ecosystem function has occurred.	40-59
E	The loss of natural habitat, biota and basic ecosystem functions is extensive.	20-39
F	Modifications have reached a critical level and the lotic system has been modified completely with an almost complete loss of natural habitat and biota.	0

Wetland Habitat Integrity

The Wetland PES Method (DWAF 2005) was used to establish the integrity of the wetlands in the study area and was based on the modified HI approach developed by Kleynhans (DWAF, 1999; Dickens et al, 2003). **Table 6-7** displays the criteria and results from the assessment of the habitat integrity of the wetlands within the study area. These criteria were selected based on the assumption that anthropogenic modification of the criteria and attributes listed under each selected criterion can generally be regarded as the primary causes of the ecological integrity of a wetland. The valley bottom wetlands have been slightly modified but are still in a largely natural ecological condition (Category B).

The WET-Health method was then used to determine the overall PES for the wetlands. PES scores were determined for geomorphology, hydrology, water quality and vegetation to generate the overall score and ecological category (**Table 6-8**). Modification to the indigenous vegetation being the most impacted component of the wetlands as a result of direct disturbances of adjacent land use activities (i.e. agriculture / grazing) and infrastructure (road) development.

Table 6-6 - Habitat integrity assessment and criteria for palustrine wetlands

Criteria	Relevance	Wetlands
Hydrologic		
Flow Modification	Abstraction, impoundments or increased runoff from developed areas. Change in flow regime, volume, velocity & inundation of habitats resulting in floristic changes or incorrect cues to biota.	3.4
Permanent Inundation	Consequence of impoundment resulting in destruction of natural wetland habitat and cues for wetland biota.	3.7
Water Quality		
Water Quality Modification	From point or diffuse sources such as upstream agriculture, human settlements and industry. Aggravated by volumetric decrease in flow delivered to the wetland.	3.8

Criteria	Relevance	Wetlands
Sediment Load Modification	Reduction due to entrapment by impoundments or increase due to land use practices such as overgrazing. Cause of unnatural rate of erosion, accretion, infilling of wetlands &habitat change.	3.2
Hydraulic/Geomorphic		
Canalisation	Desiccation or change to inundation of wetland and change in habitat	3.8
Topographic Alteration	Consequence of infilling, ploughing, dykes, trampling, bridges, roads, railway lines and other substrate disruptive activities that reduce or change wetland habitat	3.6
Biota		
Terrestrial Encroachment	Desiccation of wetland and encroachment of terrestrial plant species due to changes in hydrology or geomorphology. Change from wetland to terrestrial habitat	3.9
Indigenous Vegetation Removal	Direct destruction of habitat through farming activities, grazing or firewood collection affecting wildlife habitat and flow attenuation functions, organic matter inputs and increases potential for erosion.	3.8
Invasive Plants	Affects habitat characteristics through changes in community structure and water quality changes	4.5
Alien Fauna	Presence of alien fauna affecting faunal community structure.	3.5
Biota Over use	Overgrazing, over fishing, etc.	4.5
Category		**B**

Table 6-7 - Relation between scores given and ecological categories

Scoring Guidelines	Interpretation of Scores: Rating of Present Ecological Status Category (PESC)
Natural, unmodified – score=5.	CATEGORY A
	>4; Unmodified, or approximates natural condition.
Largely natural – score=4.	CATEGORY B
	>3 and <4; Largely natural with few modifications, with some loss of natural habitat.
Moderately modified- score=3.	CATEGORY C
	>2 and <3; moderately modified, but with some loss of natural habitats.
Largely modified – score=2.	CATEGORY D
	<2; largely modified. Large loss of natural habitat & basic ecosystem function
	OUTSIDE GENERALLY ACCEPTABLE RANGE

Scoring Guidelines	Interpretation of Scores: Rating of Present Ecological Status Category (PESC)
Seriously modified – rating=1.	CATEGORY E
	>0 and <2; seriously modified. Extensive loss of natural habitat & basic ecosystem function.
Critically modified – rating=0.	CLASS F
	0; critically modified. Modification reached critical levels with system completely modified.

Table 6-8 - WET-Health assessment of valley bottom wetland areas in the study area

Components	Method used for assessment	PES% Score	Ecological Category
Hydrology PES	WET-Health Hydro Module	85 %	B
Geomorphology PES	WET-Health Geomorph Module	88 %	A/B
Water quality PES	Landuse-WQ Model	91 %	A/B
Vegetation PES	WET-Health Veg Module	83 %	B
Overall Wetland PES	WET-Health default weightings	86 %	B

6.2.2.3 Ecological Importance and Sensitivity

The Ecological Importance and Ecological Sensitivity (EI&ES) assessment for both watercourses and wetlands consider several biotic and habitat determinants surmised to indicate either importance or sensitivity. The determinants are rated according to a four-point scale (**Table 6-9**).

Table 6-9 - Scale used to indicate either ecological importance or sensitivity

Scale	Definition
1	One species/taxon judged as rare or endangered at a local scale.
2	More than one species/taxon judged to be rare or endangered on a local scale.
3	One or more species/taxon judged to be rare or endangered on a Provincial/regional scale.
4	One or more species/taxon judged as rare or endangered on a National scale

The median of the resultant score is calculated to derive the EI&ES category (**Table 6-11**). The results of the EIS assessment are shown in **Table 6-12**. The EI&ES have been determined for the larger watercourses and the smaller unnamed tributaries separately.

Table 6-10 - Ecological importance and sensitivity categories (DWAF, 1999)

EISC	General description	Median

Very high	Quaternaries/delineations unique on a national and international level based on unique biodiversity. These rivers are usually very sensitive and have no or only a small capacity for use.	>3-4
High	Quaternaries/delineations unique on a national scale based on biodiversity. These rivers may be sensitive to flow modifications and may have substantial capacity for use.	>2-≤3
Moderate	Quaternaries/delineations unique on a provincial/ local scale due to biodiversity. These rivers are not very sensitive to flow modification and have substantial capacity for use.	>1-≤2
Low/ marginal	Quaternaries/delineations not unique on any scale. These rivers are generally not very sensitive to flow modifications and usually have substantial capacity for use.	≤1

Table 6-11 - Results of the EI&ES assessment of the watercourses in the study area

Biotic and Aquatic Habitat Determinants	Krom River	Smaller tributaries
Rare and endangered biota	1.5	2
Unique biota	2	1
Intolerant biota	2	2
Species/taxon richness	1.5	1.5
Diversity of aquatic habitat types or features	2.5	2
Refuge value of habitat type	2.5	2
Sensitivity of habitat to flow changes	2.5	3
Sensitivity of flow related water quality changes	2	2.5
Migration route/corridor for instream & riparian biota	2.5	1
National parks, wilderness areas, Nature Reserves & areas, PNEs	1.5	1.5
EIS CATEGORY	High	Moderate

The Krom River in the study area is deemed to be of a high ecological importance and sensitivity. This is due to the importance of larger river in providing a diversity of habitats and being important refugia for biota as well as corridors for the movement within the landscape. The smaller tributaries are of moderate ecological importance and sensitivity and tend to be more sensitive to flow and water quality changes. Indigenous fish and amphibian diversity in the rivers are likely to be relatively low. Potential fish and amphibian populations that may occur in the wetter Krom River are listed in Section 3.6 of the report (**Appendix G.4**).

The results from the wetland EIS assessment are provided in **Table 6-12**. The assessment of the ecosystem services supplied by the wetland areas (divided into Hydrological Functional Importance

and Direct Human Benefits) is included in the table and was conducted according to the guidelines as described by Kotze et al (2005).

Table 6-12 - Results of the EIS assessment for the wetland areas

Ecological Importance	Valley bottom wetlands
Biodiversity support	2.17
Presence of Red Data species	1
Populations of unique species	2
Migration/breeding/feeding sites	3.5
Landscape scale	1.40
Protection status of the wetland	1
Protection status of the vegetation type	1
Regional context of the ecological integrity	2
Size and rarity of the wetland type/s present	1
Diversity of habitat types	2
Sensitivity of the wetland	1.93
Sensitivity to changes in floods	2.8
Sensitivity to changes in low flows/dry season	2
Sensitivity to changes in water quality	1
ECOLOGICAL IMPORTANCE & SENSITIVITY	**2.17**
Flood attenuation	3
Streamflow regulation	1
Sediment trapping	2.5
Phosphate assimilation	1
Nitrate assimilation	1.5
Toxicant assimilation	1
Erosion control	2
Carbon storage	1
HYDROLOGICAL/FUNCTIONAL IMPORTANCE	**1.63**

Ecological Importance	Valley bottom wetlands
Water for human use	1.5
Harvestable resources	1.5
Cultivated foods	0
Cultural heritage	0
Tourism and recreation	2
Education and research	1
IMPORTANCE OF DIRECT HUMAN BENEFITS	**1.00**
OVERALL IMPORTANCE (highest score of ecological, hydrological and direct human benefits)	**2.17**

The wetland features within the study area are considered of moderate ecological importance and sensitivity as they are closely associated with the larger Krom River, providing habitat and ecological corridors for the movement of biota.

6.2.2.4 Recommended Ecological Condition of Aquatic Ecosystems

Considering the moderately modified to largely natural ecological condition of the aquatic ecosystems within the study area and their moderate to high ecological importance and ecological sensitivities, the recommended ecological condition (REC) of these features would be that they remain in their current condition or be improved where possible. These rivers should not be allowed to degrade further. The proposed PV Facilities are mostly located outside of the aquatic features and are unlikely to result in any significant degradation of aquatic ecosystem integrity if the recommended mitigation measures are implemented.

6.2.2.5 Aquatic Habitat and Species of Concern

The watercourses in the study area are non-perennial, however, some rock pools and dams are likely to contain water for most of the year. As a result, no indigenous fishes occur for most of the river systems, with some indigenous fish, such as smallscale redfin *Psuedobarbus asper* (vulnerable), *moggel Labeobarbus umbratus* (least concern) and *chubbyhead barb Barbus anoplus* (least concern), occurring in the larger rivers where there are deep pools that contain water through the dry season.

The amphibian diversity within the study area is also likely to be relatively low. No species of conservation concern are thus known to occur in the study area from an aquatic perspective. The amphibian species likely to be present are quite widespread and of low conservation concern. These include the Karoo Dainty Frog *Cacosternum karooicum* (Data Deficient), Poynton's River Frog *Amietia poyntoni*, the Cape Sand Frog, *Tomopterna delalandii*, Pygmy Toad *Poyntonophrynus vertebralis* and the Karoo Toad*, Vandijkophrynus gariepensis*. The latter two amphibian species are listed as "Not Threatened".

A faunal species potentially in the area and associated with the watercourses in the landscape is the Riverine Rabbit, which is listed as Critically Endangered. The habitat preference of Riverine Rabbits

is alluvial seasonal watercourses, browsing on *Pteronia erythrochaetha, Kochia pubescens, Salsola glabrescens and Mesembryanthemaceae*. They are unable to survive in heavily overgrazed or agriculturally transformed habitats (the presence of the Riverine Rabbit and suitable habitat is discussed within **Section 6.2.4** below)..

6.2.3 PLANT SPECIES

The following is extracted from the Plant Species Compliance Statement compiled by 3Foxes Biodiversity Solutions and included as ***Appendix G.5.***

The Mura 1 Solar footprint falls entirely within the Eastern Upper Karoo type (**Figure 6-11**). Eastern Upper Karoo has an extent of 49 821 km^2 and is the most extensive vegetation type in South Africa and forms a large proportion of the central and eastern Nama Karoo Biome. This vegetation type is classified as Least Threatened, and about 2% of the original extent has been transformed largely for intensive agriculture. Eastern Upper Karoo is however poorly protected and less than 1% of the 21% target has been formally conserved. Mucina & Rutherford (2006) list eight endemic species for this vegetation type, which considering that it is the most extensive unit in the country, is not very high. As a result, this is not considered to represent a sensitive vegetation type. Within the study area, the vegetation is relatively homogenous, although there is some variation in which species are dominant depending on soil depth and the degree of rockiness (**Figure 6-14** and **Figure 6-15**). Dominant and characteristic species observed at the site include low woody shrubs such *as Pentzia incana, Pentzia globosa, Plinthus karooicus, Pteronia adenocarpa, Pteronia glomerata, Ruschia spinosa, Tetragonia arbuscula, Salsola rabieana, Asparagus glaucus, Asparagus capensis, Euryops lateriflorus, Eriocephalus ericoides, Eriocephalus spinescens, Lycium cinereum; forbs such as Arctotis leiocarpa, Aptosimum indivisum, Nemesia fruticans, Heliophila suavissima* and *Chenopodium album;* grasses such as *Aristida adscensionis, Aristida diffusa, Enneapogon desvauxii, Eragrostis lehmanniana, Eragrostis obtusa, Stipagrostis obtusa* and *Tragus berteronianus*. A total of 82 plant species were recorded within the Mura 1 and Mura 2 Solar footprint area during the walk-through survey.

Figure 6-14 - Typical open plains within the Mura 1 Solar project area

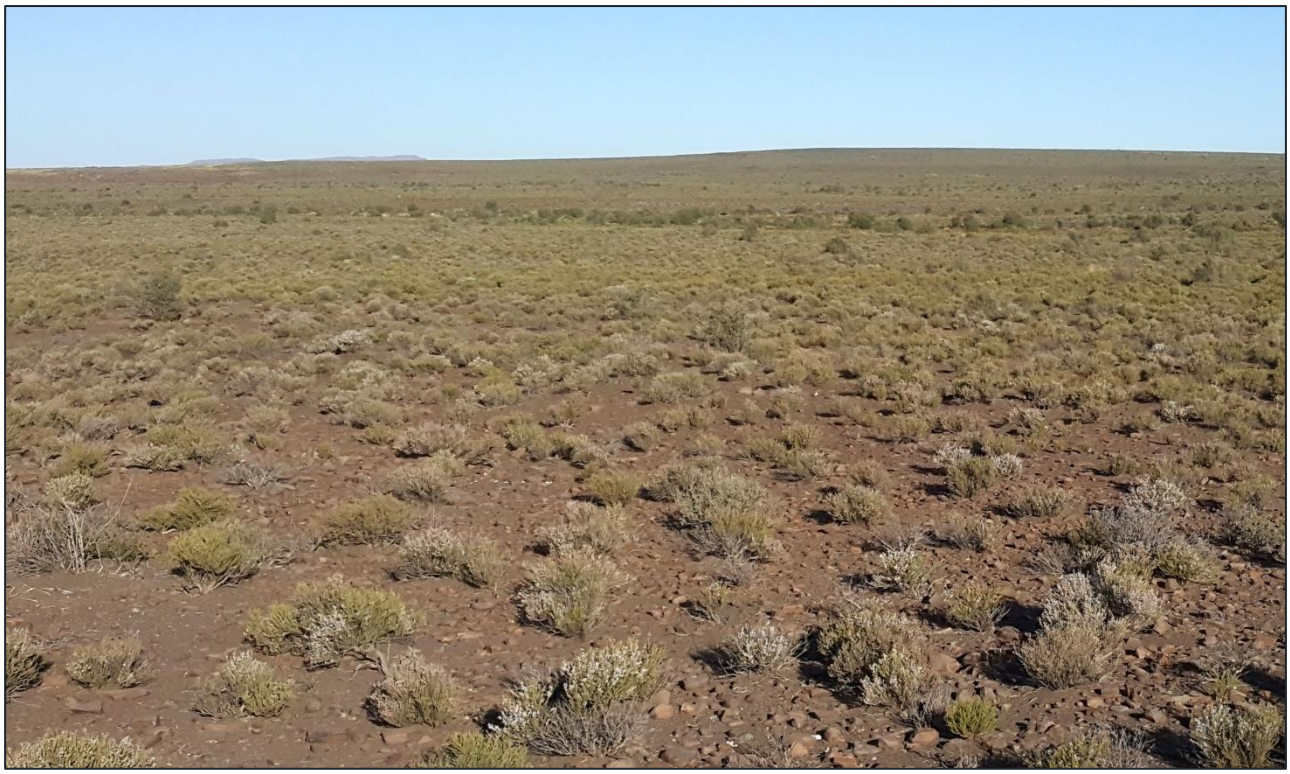


Figure 6-15 - Looking eastwards out over the southern part of the Mura 1 Solar project area

6.2.4 ANIMAL SPECIES

The following is extracted from the Animal Species Compliance Statement compiled by 3Foxes Biodiversity Solutions and included as ***Appendix G.6.***

In terms of the fauna that potentially occur at the site, the potential diversity is considered to be moderate and numbers approximately 38 mammals, 28 reptiles and about 6 frog and toads. Mammals observed at the site directly, indirectly or through the camera trapping include Springbok, Steenbok, Aardvark, Cape Hare, Cape Porcupine, Suricate, African Wildcat, African Polecat, Bat-eared Fox, Cape Fox, Cape Mongoose, Yellow Mongoose, Common Genet, Aardwolf and Black-backed Jackal as well as some introduced species such as Sable Antelope, Eland, Blesbok and Black Wildebeest. Reptiles and amphibians observed on the site or in the immediate environment include Leopard Tortoise, Southern Tent Tortoise, Karoo Girdled Lizard, Spotted Sand Lizard, Southern Rock Agama, Cape Thick-toed Gecko, Variegated Skink, Ground Agama and Karoo Toad. Although the DFFE Screening Tool identified only the Karoo Dwarf Tortoise and Riverine Rabbit as being of potential concern at the site, there are several other fauna species of concern that occur in the wider area. However, interrogation of these also suggests that none of these are likely to occur within the site as they all occur in habitats that are not represented within the PV footprint area.

In terms of the two species identified by the Screening Tool, the Karoo Dwarf Tortoise and the Riverine Rabbit, there is no suitable habitat for either species within the development footprint. The Riverine Rabbit is associated with well-vegetated alluvial floodplains of the ephemeral rivers of the central and upper Karoo and in the Upper Karoo at least, do not tend to stray far from this habitat. Since there is no alluvial floodplain habitat within the site, it can be confirmed that the site can considered low sensitivity for this species. The Karoo Dwarf Tortoise *Chersobius boul*engeri occurs in association with dolerite ridges and rocky outcrops of the southern Succulent and Nama Karoo biomes, and peripherally in the Albany Thicket biome in the southeast, at altitudes of approximately 800 to 1,500 m. The vegetation usually consists of dwarf shrubland that often contains succulent and grassy elements. The tortoises usually take shelter under rocks in vegetated areas or in rock crevices. However, these are quite specific in terms of their requirements with the result that suitable retreats for the species are not common. Due to their strong habitat association, populations are isolated on rocky outcrops with specialized vegetation (Hofmeyr et al. 2018). The typical dolerite outcrops associated with this species do not occur within the PV footprint areas and there are no other significant rocky outcrops present within the PV areas that would be likely to offer shelter for this species. As such, it is concluded that the Mura 1 Solar PV area can be considered low sensitivity for this species.

Table 6-13 - Faunal species conservation concern known from the broad area, and their likely presence within the site

Species	Wider area	PV footprint
Vaal Rhebok (NT)	Present on higher ground, especially the Nuweveld mountains.	Not observed with the camera traps on the site or on the adjacent Harpuisberg which was extensively camera trapped for the Nuweveld series of wind farms.

Species	Wider area	PV footprint
Black-footed Cat (VU)	Previously recorded from within the Karoo National Park, but no recent records.	No recent records from the area. The habitat within the site is also considered sub-optimal for this species as the cover is very low and there are very few burrow refuge sites available.
Leopard (VU)	This species is generally confined to protected areas or mountainous terrain and may be present in the wider area.	The terrain within and near the site is highly unlikely to be attractive for this species which prefers rugged terrain with more cover than the site offers.
Riverine Rabbit (CR)	There are records from the Krom River and some of the larger tributaries.	There is no habitat within the site for this species and it is not present.
Littledale's Whistling Rat (NT)	Occurs in the wider area and the arid parts of the Nama and Succulent Karoo and Namibia.	This species is associated with sandy soils and makes characteristic burrows that are easily observed. There is no habitat for this species within the site.
Karoo Dwarf Tortoise (NT)	Occasional records from the broad area. Associated with dolerite outcrops.	There is no habitat considered suitable for this species within the PV development footprint.

6.2.5 AVIFAUNA

*The following is extracted from the Avifaunal Impact Assessment compiled by WildSkies Ecological Services (Pty) Ltd and included as **Appendix G.7**. This assessment has been based on a 6 month avifaunal monitoring undertaken for the project.*

6.2.5.1 Vegetation description

Functionally in avifaunal terms, the site can be classified as Karoo shrubland. Often more important than vegetation type in determining avifaunal diversity and abundance, are the micro habitats available for birds. Micro habitats are determined by multiple factors, including but not limited to vegetation type. Anthropogenic factors such as land use, construction of dams etc. are a significant factor. At the proposed site the micro habitats available to birds are: dams, Karoo shrubland, exotic trees (mostly at homesteads), rivers, ridge/cliff lines. These micro habitats are pictured in **Figure 6-16**.

Figure 6-16 - Photographs of micro habitats on and near site

6.2.5.2 Avifaunal community on site

Southern African Bird Atlas Project data

Up to approximately 220 species were recorded in the broader area by the first and second Southern Africa Bird Atlas Projects (www.sabap2.adu.org.za). These birds were not necessarily recorded on the Mura site itself but are an indication of which species could occur on site if conditions and habitats are right. Of the 220 species approximately 71 were classified in the top 200 at risk species by Retief et al (2014). Four species are regionally Endangered (Ludwig's Bustard, Black Harrier Circus maurus, Martial Eagle Polemaetus bellicosus & Yellow-billed Stork Mycteria ibis), five are Vulnerable, and 6 are Near-threatened. Two species (Ground Woodpecker Geocolaptes olivaceus & Curlew Sandpiper Calidris ferruginea) are Least Concern regionally but Near-threatened globally (IUCN 2022).

Pre-construction bird monitoring data

Whereas the atlas data described above shows which species could occur on the site since they have been recorded in the broader area, our own monitoring data confirms those species definitely occurring on the site. The species diversity on the proposed site itself is lower, due to its smaller size and lower habitat diversity.

A total of 88 bird species were recorded on site by all our pre-construction bird monitoring methods (Appendix 1 of the Avifauna Report in **Appendix G.7**). Five of these 88 species are regionally Red Listed: Ludwig's Bustard is Endangered; Verreaux's Eagle is Vulnerable; and Karoo Korhaan

Eupodotis vigorsii, Blue Crane Grus paradisea and Sclater's Lark Spizocorys sclateri are Near-threatened (Taylor et al, 2015).

Small Passerine Bird Data (walked transects)

Table 6-14 presents a summary (full programme of 6 months) results for those species for which > 10 individuals recorded) of the bird data collected by walked transects during the monitoring period (see Appendix 2 of the Avifauna Report in **Appendix G.7** for the full dataset). A total of 37 bird species were recorded by this method. One of the 37 species is regionally Red Listed, the Sclater's Lark (Near-threatened, Taylor et al, 2015). One record of a pair of these larks was made in spring on Area 2 (Mura 1 and Mura 2). The most abundant species was Black-headed Canary Serinus alario, followed by Namaqua Sandgrouse Pterocles Namaqua and Sickle-winged Chat Cercomela sinuata. Overall, this is a rather unremarkable bird species diversity, reflecting the relatively uniform nature of the habitat on site.

Large terrestrial and raptor data (driven transects)

Table 6-15 summarises the findings from driven transects on site across the 6 months (the full dataset can be seen in Appendix 3 of the Avifauna Report in **Appendix G.7**). In total, 9 species were recorded in the period. Three regionally Red Listed species are included: Karoo Korhaan (Near-threatened), Blue Crane (Near-threatened) and Ludwig's Bustard (Endangered). The most abundant species was Karoo Korhaan, which was predominantly recorded in pairs.

Incidental observations

Incidental records of priority bird species were made during both site visits and comprised a total of 13 species (**Table 6-16)** (Appendix 4 of the Avifaunal Impact Assessment (**Appendix G.7**) shows the full dataset). Five of the recorded species are regionally Red Listed (Taylor et al, 2015): Ludwig's Bustard is Endangered; Verreaux's Eagle is Vulnerable; and Karoo Korhaan, Blue Crane and Sclater's Lark are Near-threatened. These incidental data are not used formally as they are not the product of systematic sampling. They do however assist in assessing how frequently various species are seen, and in what abundance.

Focal sites

The two most important Focal Sites monitored by this programme are a Martial Eagle nest and a Verreaux's Eagle nest (both some distance off the proposed project sites now that certain areas have been screened out). The Martial Eagle nest became irrelevant when PV Area 1 was dropped from the project design as it is too far from the proposed areas to be relevant. The Verreaux's Eagle nest also became less relevant to the study once the PV Areas 3 and 4 closest to it were excluded from the project. The nest was active in 2021 according to farm workers but does not seem to have had successful breeding in the 2022 breeding season. The results are summarised in **Table 6-17**.

Table 6-14 - Summary data from walked transects on site

Species	Birds	Records	Birds/km
Black-headed Canary	760	104	18.10

Species	Birds	Records	Birds/km
Namaqua Sandgrouse	209	46	4.98
Sickle-winged Chat	157	96	3.74
Lark-like Bunting	119	38	2.83
Spike-heeled Lark	98	27	2.33
Rufous-eared Warbler	70	43	1.67
Capped Wheatear	51	41	1.21
Karoo Eremomela	51	24	1.21
Grey-backed Sparrow-Lark	47	6	1.12
Large-billed Lark	44	28	1.05
White-necked Raven	40	16	0.95
Karoo Long-billed Lark	33	29	0.79
Bokmakierie	29	21	0.69
Karoo Chat	28	23	0.67
Speckled Pigeon	28	7	0.67
Red-capped Lark	27	11	0.64
Pied Crow	23	10	0.55
Cape Bunting	22	9	0.52
Cape Sparrow	22	7	0.52
Mountain Wheatear	20	14	0.48
South African Shelduck	18	9	0.43
African Pipit	17	12	0.40
Yellow-bellied Eremomela	17	9	0.40
Karoo Scrub Robin	16	9	0.38
White-throated Canary	16	11	0.38
Black-eared Sparrow-Lark	12	1	0.29
Cape Turtle Dove	11	8	0.26
Namaqua Dove	10	5	0.24

Table 6-15 - Summary data from driven transects on site

Transect length (km)	Birds	Records	Birds/km
Karoo Korhaan	30	12	0.61
Blue Crane	10	3	0.20
Double-banded Courser	6	3	0.12
Ludwig's Bustard	4	3	0.08
Jackal Buzzard	2	2	0.04
Pied Crow	2	2	0.04
Temminck's Courser	2	1	0.04
African Harrier-Hawk	1	1	0.02
Rock Kestrel	1	1	0.02
Transect length (km)	**49**		

Table 6-16 - Summary of incidental observations recorded on site

Species	Birds	Records
Karoo Korhaan	104	46
Grey-winged Francolin	12	6
Ludwig's Bustard	12	10
Blue Crane	10	3
Double-banded Courser	6	3
Jackal Buzzard	3	3
Sclater's Lark	3	2
Verreaux's Eagle	2	2
Rock Kestrel	2	2
Spotted Eagle-Owl	1	1
Pale Chanting Goshawk	1	1
African Harrier-Hawk	1	1

Species	Birds	Records
Temminck's Courser	1	1
# Species	**13**	

Table 6-17 - Summary of Focal Site findings

Focal site	Type	Season 1	Season 2
1	Dam	Nothing seen	n/a
2	Dam	Egyptian Goose, Blacksmith Lapwing	n/a
3	Martial Eagle nest	Nothing seen	No records
4	Medium size nests	Nothing seen	No records
5	Dam	Egyptian Goose, SA Shelduck	2 Pied Avocet
6	Dam	SA Shelduck	4 Pied Avocet, 4 SA Shelduck
7	Dam	Egyptian Goose, Blacksmith Lapwing, SA Shelduck	Cape Teal x 2
8	Dam	Nothing seen	Nothing, dam dry
9	Cliff	Verreaux's Eagle occupied nest, Hamerkop nest	Inactive
10	Cliff & river	SA Shelduck, African Spoonbill, Blacksmith Lapwing, Egyptian Goose, African Black Duck	Jackal Buzzard nest active
11	Cliff	Nothing seen	No records
12	Cliff	Nothing seen	No records

Important Bird & Biodiversity Area (IBA) data

The closest Important Bird and Biodiversity Area (IBA - Marnewick et al, 2015) is approximately 35 kilometres south of the study area at its closest point, the Karoo National Park IBA. Although this is geographically quite distant, the avifaunal community is believed to be fairly similar and is discussed further below.

The Karoo National Park is in the semi-arid central Karoo and is approximately 90 000 hectares in size. The IBA contains the Nuweveld escarpment with peaks over 1900 metres above sea level and plains at 900m.a.s.l. The climate is one of extremes, with very hot summers and very cold winters, particularly on top of the escarpment. Average annual rainfall is 260mm p.a. Up to 231 bird species

have been recorded in the IBA, which is extremely important for Namib-Karoo biome restricted species such as Black-headed Canary, Swee Waxbill *Coccopygia melanotis*, Cape Rockjumper *Chaetops frenatus*, Protea Seedeater *Crithagra leucoptera*, Cape Siskin *Crithagra totta*, Victorin's Warbler *Cryptillas victorini* and Hottentot Buttonquail *Turnix hottentottus*. The plains are particularly good for Ludwig's Bustard, Karoo Korhaan, Spike-heeled Lark, Karoo Lark *Calendulauda albescens*, Grey-backed Sparrow-lark *Eremopterix verticalis*, Tractrac Chat *Emarginata tractrac*, Karoo Chat *Emarginata schlegelii*, Karoo *Eremomela Eremomela gregalis*, Rufous-eared Warbler *Malcorus pectoralis*, and Black-headed Canary. The riverine woodland along drainage lines holds Namaqua Warbler *Phragmacia substriata* and other species. The cliffs hold Verreaux's Eagle, Booted Eagle *Hieraaetus pennatus* and Black Stork Ciconia nigra.

IBA trigger species include: Martial Eagle, Blue Crane, Black Harrier, Secretarybird Sagittarius serpentarius, Kori Bustard Ardeotis kori and Ludwig's Bustard. Regionally threatened species are Verreaux's Eagle, Lanner Falcon Falco biarmicus, Black Stork, Karoo Korhaan and African Rock Pipit Anthus crenatus. Biome-restricted species that are common in the IBA include Karoo Long-billed Lark Certhilauda semitorquata, Karoo Chat, Namaqua Warbler, Pale-winged Starling Onychognathus nabouroup, Black-headed Canary, Layard's Tit-Babbler Curruca layardi and the locally common Karoo Korhaan. Uncommon species in this category include Ludwig's Bustard, Karoo Lark, Sclater's Lark, Black-eared Sparrow-lark Eremopterix australis, Tractrac Chat, Sickle-winged Chat, Karoo Eremomela and Cinnamon-breasted Warbler Curruca subcoerulea. The Beaufort West sewage works (within this IBA) is important for water birds particularly in dry times when little other surface water is present in the landscape. Greater Flamingo, Lesser Flamingo, South African Shelduck Tadorna cana, and Cape Shoveler Spatula smithii are regularly recorded here. Interestingly the town of Beaufort West itself is included in the IBA because there is a Lesser Kestrel Falco naumanii roost in trees in town.

Coordinated Avifaunal Roadcount (CAR) project

CAR counts are a census of birds (focussed on large terrestrial species) performed twice annually (in winter and summer) by volunteer birdwatchers driving set routes. The purpose is to provide population data for use in science, especially conservation biology, by determining findings about the natural habitats and the birds that use them. The closest CAR routes to the proposed site are approximately 51km south, below the escarpment. These data are too far from site to be of use.

Coordinated Waterbird Count (CWAC) project

There is one Coordinated Waterbird Count (CWAC) site approximately 16km north of the site (Slangfontein Dam) (Taylor et al, 1999). Bird species counted at this dam include all the usual waterfowl species such as Yellow-billed Duck *Anas undulata*, Egyptian Goose *Alopochen aegyptiaca*, South African Shelduck *Tadorna cana*, Cape Shoveler *Anas smithii*, and Red-billed Teal *Anas erythrorhyncha* (**Table 6-18**). None of these species were recorded in remarkable numbers. No flamingos were recorded at this dam to date, which is positive as flamingos would be susceptible to power line collision. **Table 6-18** summarises these data.

Table 6-18 - CWAC data from Slangfontein Dam

Common name	Taxonomic name	Min	Avg	Max
Duck, Yellow-billed	*Anas undulata*	44	44	44

Common name	Taxonomic name	Min	Avg	Max
Goose, Egyptian	*Alopochen aegyptiacus*	10	10	10
Greenshank, Common	*Tringa nebularia*	8	8	8
Heron, Black-headed	*Ardea melanocephala*	1	1	1
Heron, Grey	*Ardea cinerea*	1	1	1
Ibis, African Sacred	*Threskiornis aethiopicus*	10	10	10
Ibis, Hadeda	*Bostrychia hagedash*	1	1	1
Lapwing, Blacksmith	*Vanellus armatus*	9	9	9
Plover, Kittlitz's	*Charadrius pecuarius*	15	15	15
Plover, Three-banded	*Charadrius tricollaris*	3	3	3
Ruff, Ruff	*Philomachus pugnax*	8	8	8
Sandpiper, Curlew	*Calidris ferruginea*	14	14	14
Shelduck, South African	*Tadorna cana*	11	11	11
Shoveler, Cape	*Anas smithii*	2	2	2
Teal, Red-billed	*Anas erythrorhyncha*	55	55	55
Wagtail, Cape	*Motacilla capensis*	18	18	18

6.2.5.3 Description of Species of Conservation Concern for this site

Given the large number of species within the broader study area, it is necessary to prioritise the species most relevant to the proposed development to streamline the impact assessment process. Relevant to this study, Species of Conservation Concern (SCC) include regionally and globally Red Listed species (Taylor, 2015; IUCN, 2022) and endemic species, especially those that may be susceptible to solar energy impacts.

Taking the above data sources described in Section 4.2 into account, the SCC species were identified and are presented in **Table 6-19**. **Table 6-19** provides an annotated list of the identified species. The likelihood of each of these species occurring on the proposed site, the likely importance of the site for each species, and potential impacts of the proposed facility were also rated in the table. The ratings are all the same for all four PV sites, since the species involved were recorded in the broader area and are mobile, so are considered to occur on all the sites.

Table 6-19 - Identified SCC for the proposed projects

Common name	Taxonomic name	Taylor et al 2015, IUCN 2022	Endemic /near	Likelihood of occurring on site	Relative importance of the site for species	Possible impacts	Overall risk
Ludwig's Bustard	Neotis ludwigii	EN, EN		Confirmed, likely forages on site frequently when conditions are right	Medium	Habitat destruction, Disturbance	High
Verreaux's Eagle	Aquila verreauxii	VU, LC		Confirmed, resident several kilometres off site and likely forages on site occasionally	High	Habitat destruction, Disturbance	Medium
Karoo Korhaan	Eupodotis vigorsii	NT, LC		Confirmed, multiple pairs resident on site	Medium	Habitat destruction, Disturbance	High
Sclater's Lark	Spizocorys sclateri	NT, NT	1	Confirmed, one pair seen on site, likely occasional visitor	Medium	Habitat destruction, Disturbance	Medium
Sclater's Lark	Spizocorys sclateri	NT, NT	1	Confirmed, one pair seen on site, likely occasional visitor	Medium	Habitat destruction, Disturbance	Medium
Blue Crane	Grus paradisea	NT, VU	1	Confirmed, likely resident in broader area	Low	Habitat destruction, Disturbance	Low

'1' denotes presence, not abundance; EN – Endangered; VU – Vulnerable; NT – Near-threatened; LC - Least Concern; RD (Regional, Global) – Regional Red List – Taylor et al, 2015; Global Red List – IUCN 2022.

Ludwig's Bustard (High risk)

The Ludwig's Bustard is classified as regionally Endangered by Taylor et al (2015). This physically large species is highly vulnerable to collision with overhead power (although not the scope of this report, still relevant as the proposed PV projects will give rise to new overhead power lines) and is also likely to be affected by disturbance and habitat destruction. This species was listed as globally Endangered in 2010 because of potentially unsustainable power line collision mortality, exacerbated

by the current lack of proven mitigation and the rapidly expanding power grid (Jenkins et al. 2011). Ludwig's Bustard is a wide-ranging bird endemic to the south-western region of Africa (Hockey et al. 2005). Ludwig's Bustards are both partially nomadic and migratory (Allan 1994, Shaw 2013, Shaw et al, 2015), with a large proportion of the population moving west in the winter months to the Succulent Karoo. In the arid and semi-arid Karoo environment, bustards are also thought to move in response to rainfall, so the presence and abundance of bustards in any one area are not predictable.

Ludwig's Bustard is likely to be susceptible to two possible impacts associated with a solar PV facility: habitat destruction, and disturbance. We recorded Ludwig's Bustard on the proposed sites in both seasons. Most records were of 1 or 2 individual birds. We believe that small influxes of Ludwig's Bustards onto site could occur at times when conditions are right on site. Based on the species' conservation status, we consider this species to be at High risk at this site.

Verreaux's Eagle (Medium risk)

The Verreaux's Eagle has recently been up-listed in regional conservation status to Vulnerable (Taylor et al. 2015) in recognition of the threats it is facing. This species tends to occupy remote mountainous areas largely unaffected by development (until the advent of wind energy in SA). A pair can typically use several alternate nests in different seasons, varying from a few metres to 2.5km apart (in Steyn, 1989). Approximately 400 – 2 000 pairs exist in the Western and Northern Cape (Hockey et al. 2005). These eagles can exist at quite high density compared to other eagle species, with some territories as small as 10km² in the Karoo (Davies, 2010 – www.africanraptors.org – work done on Nuweveld Escarpment) and 10.3km² in the Matopos in Zimbabwe (Steyn, 1989). Davies found a range of territory size from 10 to 50km², with an average size of 24km² in the Karoo of South Africa, and nests were approximately 2 kilometres apart on average.

At the proposed sites we have recorded a Verreaux's Eagle nest within the broader area (5.2km south-west of Mura 4). We categorised a 2km radius around this nest as No-Go for new development. This resulted in the impact avoidance measures taken by the developer in excluding the closest PV area from development.

This species is likely to be susceptible to two possible impacts at a solar PV facility: habitat destruction, and disturbance. Based on our data collected on site to date, we conclude that this species is at Medium risk. This risk would have been High if avoidance had not already been applied through the application of the no-go buffers around the nest.

Karoo Korhaan (High risk)

Karoo Korhaan is classified as Near-threatened regionally (Taylor et al, 2015). This species is suspected to have undergone a reduction in population and range (Taylor et al, 2015). Karoo Korhaan could be susceptible to two possible impacts at a solar PV facility: habitat destruction, and disturbance. We have recorded this species consistently on the proposed sites through all site visits, mostly in pairs and small family units. Based on these data we judge the species to be at High risk at the proposed site, primarily through habitat destruction and disturbance.

Sclater's Lark (Medium risk)

The Sclater's Lark is Near Threatened regionally and globally (Taylor et al, 2015, IUCN, 2022). This is an uncommon, localised, species that is found in the Karoo. There is currently no population estimate for the species', mostly due to incomplete survey data due to its remote habitats and

inconspicuous nature. We recorded a single pair of Sclater's Lark once on Mura PV 3 and 4 in spring through walked transects. Two incidental records of the species were also made on Mura PV 3 and 4 in spring, a single bird, and a pair. This species could be susceptible to habitat destruction, disturbance, and possibly direct mortality at solar PV facilities. Given our current understanding of direct mortality at PV facilities (and information from Visser et al, 2019) and the Sclater's Lark we believe that direct mortality is not likely to be significant.

Blue Crane (Low risk)

The Blue Crane is classed as Near-threatened regionally by Taylor et al (2015) and Vulnerable globally (IUCN, 2021). It is almost endemic to South Africa (a small population exists in Namibia) and is the South African national bird. It has the most restricted range of any of the 15 crane species worldwide. The population is estimated at a minimum of 25 000 birds (Taylor et al, 2015). The 2015 Red Data book on birds downgraded the species conservation status from Vulnerable (Barnes, 2000) to Near-threatened (Taylor et al, 2015). Globally the status remained the same at Vulnerable (IUCN, 2022). The species population is divided into three sub-populations: the eastern grasslands (2600 cranes), the Karoo (10 800 cranes) (within which the site is located); and the Western Cape (12 100 cranes). Of these the Western Cape population appears to have shown growth in recent decades, whilst the eastern grasslands population has declined or at best been stable, and the Karoo population has been stable.

At the proposed sites we have recorded the species several times, in pairs or small family units. Overall, we conclude that Blue Crane is at Low risk at the site, since no large flocks or congregation areas were recorded.

6.3 SOCIAL AND ECONOMIC ENVIRONMENT

6.3.1 ARCHAEOLOGICAL AND CULTURAL HERITAGE

The following is extracted from the Heritage Impact Assessment compiled by ASHA Consulting (Pty) Ltd and included as ***Appendix G.8****.*

The broader Karoo region generally contains sparse archaeological traces from the Early (ESA), Middle (MSA) and Later Stone Ages (LSA). The vast majority of material tends to be what is referred to as background scatter. This can be defined as "widespread isolated artefacts whose distribution results from either primary or secondary causes" (Orton 2016:121).

ESA and MSA materials were found to be very rare in this mountain environment, but not absent (Orton 2022a). In this dry landscape, LSA archaeological sites are well-known to be focused most strongly on water sources. Where dolerite outcrops are close to water sources then these are strongly favoured for occupation. This pattern was well demonstrated locally by Orton (2021a, 2021b, 2021c, 2021d, 2022a, 2022b), but the density of sites found was quite low. These sites are usually scatters of stone artefacts (strongly dominated by hornfels with other materials being rare), often accompanied by ostrich eggshell fragments and sometimes pottery, but may also include fragments of bone and even archaeological deposits (the latter are unknown from the Nuweveld area though). Ostrich eggshell beads and lower grindstone are also rarely seen. Occasionally, the scatters were very dense and those sites must have either been occupied for a long period of time, or on many occasions. The flat plains that lack landscape features tend to also lack significant archaeological heritage resources. Webley and Hart (2010) examined a site to the east of Loxton and located just two flakes that they considered to be of MSA origin. Two WEF projects have been

assessed to the north and northeast of the Mura study areas, but these projects do not appear on SAHRIS and their reports could thus not be consulted.

An interesting aspect of Karoo archaeology is rock gongs. These are (usually) dolerite rocks that are naturally perched in such a way that when struck they release a ringing musical note. The gongs are identified by heavily worn patches where they have been repeatedly struck. Parkington et al. (2008) have studied a number of gongs from Nelspoort and Vosburg, some 55 km to the southeast and 140 km to the north-northeast of the present study area respectively, but Orton (2021b) recorded two further examples in the Nuweveld within about 15 km to the west of the Mura study area, both of which were surrounded by extensive stone artefact scatters indicating occupation of the area.

Rock art sites occur in low density through the wider area, with three painted 'geometric tradition' sites and several engraved 'fine line' tradition sites on record from the Nuweveld (Orton 2021a, 2021b, 2021c, 2021d, 2022a, 2022b). Geometric tradition art is thought to have been produced by the Khoekhoen and the new records expand the known distribution of this tradition in the area (Figure 6-17). Parkington et al. (2008) have documented many engravings in the Karoo region. They do not map their work but do provide a historical map of engraving distribution which shows the densest concentration being to the northeast around the Kimberley region.

Figure 6-17 - Extract from a map showing the distribution of geometric tradition rock art. Source: Smith & Ouzman (2004: fig. 9)

Until Orton's (2021a, 2021b, 2021c, 2021d) recent surveys in the area, historical archaeological resources, too, were little known from the Nuweveld area. These surveys showed that 19th century occupation of the area was widespread with many small abandoned and ruined stone-walled farmsteads scattered along the water courses of the area. The structures included houses (both formal rectangular flat roofed houses and lobed dwellings that might have had temporary roofs), kraals, and various small outbuildings of unknown function but likely including storage spaces and chicken coops. At the southern end of the Nuweveld Mountains, in the Karoo National Park (KNP), Kaplan (2005, 2006) recorded several small, ruined stone structures which were said to be kraals, a homestead and shepherd's huts. One of them had a small scatter of late 19th to early 20th century historical artefacts associated with it. A stone-built lime kiln and some animal traps are also on

record there (SANParks 2017). Other stone walled ruins are known from the KNP and, according to Anonymous (2016) some were demolished in order to reuse the stone to build the Klipspringer Pass. This pass was built from 1986 to 1992 (Goetze 1993).

These early packed stone structures are invariably collapsed reducing them to archaeological sites in terms of the NHRA definitions. While some with taller walls may have had a formal or informal and/or temporary roof over them, others may have been hartebeeshuise with A-frame-type roofs made of branches and reeds placed above low stone or mud walls. Governor van Plettenberg, during his travels east to inspect the Colony, noted near the Sneeuwberg Mountains that the houses of the colonists consisted only of one room structures with low walls and straw roofs (Theal 1896-1911 cited in Böeseken 1975). In 1811 William Burchell illustrated a trekboer farmhouse (Van Zyl 1975), while Schoeman (2013) shows an image of such a historical stone dwelling still in use in the early 20th century (**Figure 6-18** and **Figure 6-19**).

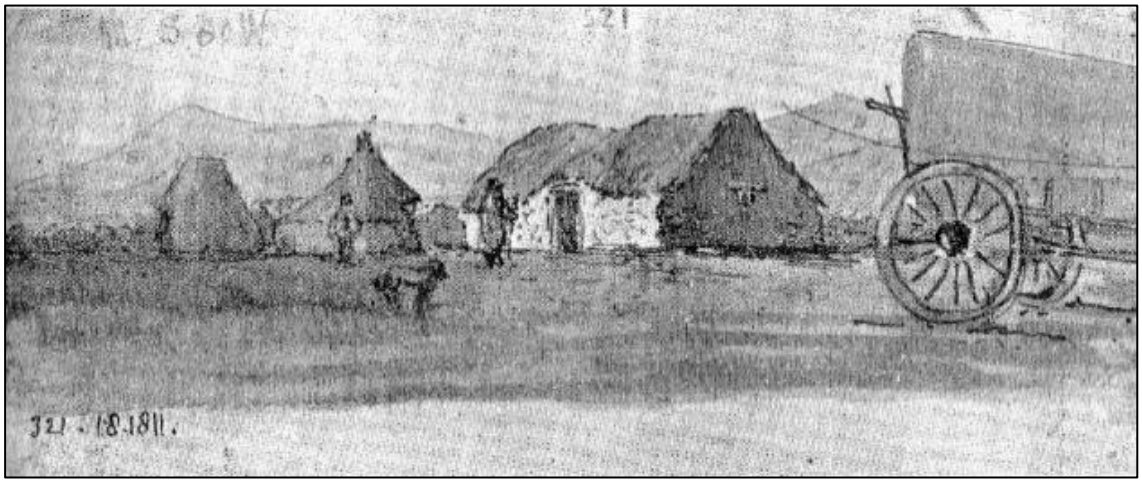


Figure 6-18 - Drawing of an early 19th century trekboer farmhouse by William Burchell. Source: Van Zyl (1975:103)

Figure 6-19 - A shepherd's hut photographed near Beaufort West in the early 20th century. Note the low, narrow doorway and informal roof structure. Source: Schoeman (2013:48)

The engraving tradition in the Karoo continued beyond the Stone Age as testified to by the many recent 'scratched' engravings that are known to occur. Horses are an extremely common subject in these recent engravings. Morris (1988) has reviewed the engravings of the Karoo and notes that they have been attributed by Battiss (1948) to Europeans and Griquas and by Fock (1979) to 'Hottentots'. Morris (1988) suggests that some were almost certainly made by early Baster and Trekboer immigrants and that the tradition continued into the 20th century. He also notes the inclusion of wagons and human figures in western clothing. Recent work in the Nuweveld has revealed a scattering of such images but with a very dense concentration located 43 km west-southwest of the Mura study area (Orton 2022a, 2022b). Notably, subject matter in the latter area included many Nine Men's Morris boards, a Morris Minor car and dates of 1924 and 1934 (the latter written as 30.7.34 but assumed to be 20th century). While some of these engravings are clearly less than 100 years old and not legally archaeological, they demonstrate a continuity of the engraving tradition, and the sites can thus be considered as places associated with living heritage.

The Karoo has been a highly contested landscape at various times in the past. The Khoekhoen first migrated into South Africa about 2000 years ago. That they lived in the Karoo in precolonial times is testified to by the presence of geometric tradition rock art and precolonial kraals, while many historical records of their presence also exist. The only study to attempt to date the Khoekhoe occupation was by Sampson (2010) in an area about 160 km northeast of the Mura study area. Through dating potsherds associated with kraals he determined that the kraals – and by implication herding – dated to between about AD 1000 and AD 1750, shortly before the arrival of the Trekboers. Sampson (2010:847) suggests that there would have been tension between the indigenous San and the incoming Khoekhoen but considers that their interactions resulted in "a millennium of (probably uneasy) space-sharing with the locals."

Stone Age materials were generally found to be rare. The only finds made were ephemeral scatters of artefacts. In one area to the south of the Mura 1 footprint there was a very light scattering of artefacts that were only lightly patinated and may be from the LSA (**Figure 6-20** and **Figure 6-21**). There was nothing else associated with them. Elsewhere, Stone Age finds were limited to a few isolated background scatter artefacts of Pleistocene and/or Holocene age.

Figure 6-20 - Stone artefacts from waypoint 1321 within the Mura 1 study area (Scale = 20 cm)

Figure 6-21 - Stone artefacts from waypoint 1322 within the Mura 1 study area (Scale = 20 cm)

The Nuweveld surveys revealed a number of archaeological sites along the access roads. These were mostly historical ruins and associated features. The majority are unlikely to be affected by any upgrades of the road since the road is generally already wide enough to accommodate the required vehicles.

6.3.1.1 Graves

No graves were seen in any of the study areas and given the often hard substrate and general lack of occupation debris, none are expected to occur.

6.3.1.2 Historical aspects and the Built environment

Historical buildings occur widely across the Karoo with most dating to the 19th century. Orton et al. (2016:15-8) noted the following:

"In the harsh, resource-scarce Karoo environment with its restricted range of materials, necessity often was the mother of invention when it came to constructing shelter, resulting in a unique regional vernacular building tradition that displays the creative and technical achievement required to fashion an existence there. This relied on both traditional and conventional artisanal skills since buildings were hand-crafted from sun-baked bricks, locally occurring timber and quarried or collected stone. The result was a variety of local styles that we refer to collectively as Karoo vernacular."

This varied architecture is evident not only in the towns but also in remote areas. Two building traditions are unique to the Karoo. Corbelled buildings, which mainly occur to the north and west of the present study area and date between about 1813 and 1870, evolved from the need to build roofs without wooden beams (Kramer 2012). Isolated examples are mapped to the west and southwest of the present study area. The second tradition is known as Karoostyle and has been described by Marincowitz (2006). These buildings are typically simple rectangular structures with flat roofs and parapets. Flat roofs were often of the type referred to as 'brakdak' which consists of beams overlaid by sticks, reeds and then mud mixed with other materials such as manure or vegetation (Fagan 2008).

In rural areas buildings tend to be clustered into farm complexes with relatively few isolated structures. The complexes can include a variety of styles, while isolated structures are often small Karoostyle labourer's cottages. Due to the consolidation of farms into larger holdings in order to increase commercial viability, there are far fewer occupied farmsteads today than would have been the case in the past. Archaeological farm complexes generally outnumber historical ones showing that further back in time there were many more farming units.

Some farmsteads occur in the area but all are more than 1.5 km the Mura PV footprints. None were studied in detail as they will not be affected but it is noted that they include various historical structures, kraals, arable lands and clusters or lines of trees. Two farmsteads lie along the access roads and should be mentioned, although, again, impacts should not occur. These are the Leeukloof farmstead in the south and Booiskraal in the southeast. **Figure 6-22** to **Figure 6-24** show examples of some of the structures at these complexes.

Figure 6-22 - Structure in the Leeukloof Farm complex at Waypoint 1850

Figure 6-23 - Structure in the Leeukloof Farm complex at Waypoint 1850

Figure 6-24 - A structure built of stone, sun-dried mud bricks and fired clay bricks at Waypoint 1993

The only historical feature close to the PV footprints is the large dam in the centre of – but excluded from – the Mura 2 area. It is an earthen-walled dam but stones have been packed around the ends of the walls to prevent erosion when the dam overflows (**Figure 6-25**).

Figure 6-25 - One end of the large earthen dam with stone-packed ends at waypoint 1324. This site is enclosed by, but excluded from, the development area

6.3.1.3 Cultural landscapes and scenic routes

Cultural landscapes are the product of the interactions between humans and nature in a particular area. Sauer (1925) defined them thus: “The cultural landscape is fashioned from a natural landscape by a cultural group. Culture is the agent, the natural area is the medium, the cultural landscape the result”. The present PV study area is a largely natural landscape with minimal anthropogenic input. It is very remote and isolated with access only by the landowners. The earliest layers to the cultural landscape are the archaeological traces of pre-colonial occupation and early farming, but these are very light. Modern farming has only resulted in the addition of some jeep tracks and fences to the PV study area but these are not noticeable from a distance. Farm complexes are widely spaced with none located closer than 1.5 km from the PV footprints. The string of earthen dams in the Mura 1 and Mura 2 area are older than 60 years and also a part of the cultural landscape. With the exception of the dams, the landscape in the vicinity of the PV facilities is currently a largely natural one with its cultural significance being due to its scenic qualities. There are no public roads anywhere close to the PV study area and the footprints will not be visible from any public roads. The same applies to the proposed access roads, except that the roads pass through two farm complexes as noted above. This not an issue for this project because there will be no lasting changes to the landscape around these complexes.

6.3.2 PALAEONTOLOGY

*The following is extracted from the Palaeontological Study compiled by Natura Viva cc and included as **Appendix G.9**.*

The continental (fluvial / lacustrine) sediments of the Poortjie Member and Hoedemaker Member of the Teekloof Formation that are mapped within the Mura PV Solar and EGI project areas are associated with important fossil assemblages of latest Middle Permian to earliest Late Permian age.

According the latest biostratigraphic zonation of the Main Karoo Basin by Smith et al. (2020) these assemblages are assigned to the *Endothiodon* Assemblage Zone (AZ) within the upper part of the Poortjie Member as well as most, if not all, of the Hoedemaker Member (Day & Smith 2020) (See biostratigraphic chart in Figure 28. N.B. It remains uncertain whether or not older fossil assemblages of the *Tapinocephalus* Assemblage Zone are represented here within the lower part of the Poortjie Member - see discussion below). The *Endothiodon* AZ fossil assemblages include a wide range of vertebrates (bony fish, temnospondyl amphibians, true reptiles, several therapsid subgroups – especially dicynodonts), non-marine molluscs, invertebrate and vertebrate trace fossils (including tetrapod trackways and burrows) as well as petrified wood, palynomorphs and other plant remains of the Glossopteris Flora. The fossils are variously associated with channel sandstones (including basal breccio-conglomerates) as well as crevasse splay sandstones (e.g. rippled palaeosurfaces) and - especially - overbank mudrock facies with calcretised palaeosol horizons. They have been reviewed in the publications listed above as well as by Smith et al. (2012), supplemented by recent PIA reports by the present author for the Red Cap Nuweveld and Hoogland WEFs and grid connections (See References).

Lower *Endothiodon* AZ (*Lycosuchus – Eunotosaurus* Subzone) assemblages are associated with the upper Poortjie Member beds while the *Tropidostoma – Gorgonops* Subzone is represented within the overlying Hoedemaker Member. The Reiersvlei Meanderbelt transition zone has yielded good material of Endothiodon low down (Maharaj et al. 2019) and probably belongs, at least in part, within the lower part of the *Endothiodon* AZ where this genus of sizeable dicynodont tends to be most abundant.

Mapping of Beaufort Group vertebrate fossil sites by Nicolas (2007) (**Figure 6-27**) shows a high concentration of fossil sites to the SE of Loxton reflecting, in part, fieldwork by the Council for Geoscience in the Booiskraal – Perdeberg area (Dr Colin MacRae, late 1900s) as well as the long history of palaeontological recording by Professor R. Smith from the Hoedemaker Member at sites like Dunedin (Quaggafontein 82) and Leeukloof 43 (cf Smith 1993). Historical fossil sites are not indicated within the present project area on the 1: 250 000 Victoria West geology sheet, apart from a single Pristerognathus AZ site (now Endothiodon AZ) from the Poortjie Member to the SW of Perdeberg.

A key skull specimen of the large therocephalian *Pristerognathus* studied by J. van den Heever (1987) was collected from the Poortjie Member on the lower slopes of Perdeberg (R. Smith, pers, comm., 2022). Rich assemblages of small dicynodonts (especially *Diictodon*) within the Hoedemaker Member on the Farm Leeukloof 43, within the Nuweveld East Wind Farm project area just west of the present project area, are the subject of on-going benchmark taphonomic studies on Beaufort Group tetrapods by Dr Smith of Wits University (e.g. Smith 1993). A few additional sites with skulls and postcrania of small- to large-bodied dicynodonts, including *Diictodon* and probable *Endothiodon*, tetrapod burrow casts, plant stem casts and invertebrate trace fossil assemblages have been recorded from the Hoedmaker Member beds close to or within the western end of the Gamma Gridline Corridor during recent PIAs for the Red Cap Nuweveld East Wind Farm and Grid Connection (Almond 2020a, 2020b, 2022c).

Fossil material recorded during the recent site visit to the combined Mura PV Solar and EGI project areas is tabulated in Appendix 1 of the Paleontological Study (**Appendix G.9**), together with GPS locality data, a provisional Field Rating and any recommended mitigation.

The main fossil groups recorded from the upper Poortjie Member – lower Hoedemaker Member beds within the Mura project areas include:

- Several skulls and partially-articulated postcrania of small-bodied dicynodonts, most or all of which are probably Diictodon (by far the commonest taxon within the stratigraphic units represented here);
- Highly fragmentary, and mostly unidentifiable, reworked bones within channel breccia lenses;
- Rare isolated bones (mostly fragmentary) of medium- to large tetrapods whose identity is currently equivocal; options include dinocephalian or therocephalian therapsids, pareiasaur parareptiles or large-bodied dicynodonts such as Endothiodon (see further discussion below);
- Straight, inclined to helical (or combined) tetrapod burrow casts;
- Low-diversity invertebrate trace fossil assemblages (Scoyenia Ichnofacies), often associated with wave-rippled surfaces and microbial mat textures (microbially-induced sedimentary structures or MISS) associated with damp or wet depositional settings. These may occasionally occur with possible (but unconfirmed) temnospondyl amphibian finger probes.
- Rare occurrences of carbonaceous plant stem or leaf compressions within both mudrock and sandstone facies as well as reedy plant stem casts in sandstones.

In general, fossils are very sparsely distributed within both the Poortjie Member and Hoedemaker Member outcrops within the present project areas and the great majority of the material is of modest scientific or conservation value. No fossils have been recorded within the Late Caenozoic superficial sediments here. Recorded Lower Beaufort Group fossil sites are mainly concentrated in scattered areas of good mudrock exposure which are mostly found along major drainage lines and on gullied hillslopes. The PV solar project areas are generally flat with very low levels of bedrock exposure due to the pervasive blanket of superficial deposits (eluvial gravels, soils) found here. No fossil sites are recorded within the Mura project areas.

Tapinocephalid dinocephalians are an essentially Middle Permian group of therapsid megaherbivores that have only been recorded hitherto as high up as the lower Poortjie Member within the Lower Beaufort succession (Day et al. 2015a, 2015b, Day & Rubidge 2020). The fragmentary new Abrams Kraal 206 fossil material is recorded at an elevation of c.1440 m amsl. which probably corresponds to the upper part of the Poortjie Member (at least as mapped by the Council for Geoscience) on the western and southern slopes of Perdeberg. This assumes that the Teekloof Formation beds around Perdeberg are more-or-less flat-lying, as appears to be the case in the field, and there are no intervening major dolerite intrusions or faults influencing bedrock elevation. The Poortjie Member sensu lato succession on the western slopes of Perdeberg near Booiskraal homestead is at least 130 m thick (c.1360-1390m amsl.) (cf Le Roux & Keyser 1988 who record Poortjie Member thicknesses on sheet 3122 Victoria West of 130 m in the west thinning to c. 80m in the east). The upper Poortjie Member elsewhere is characterised by faunas of the lower *Endothiodon* Assemblage Zone (*Lycosuchus* – *Eunotosaurus* Subzone) which extends into the earliest Late Permian and is not known to include dinocephalians (Day & Smith 2020).

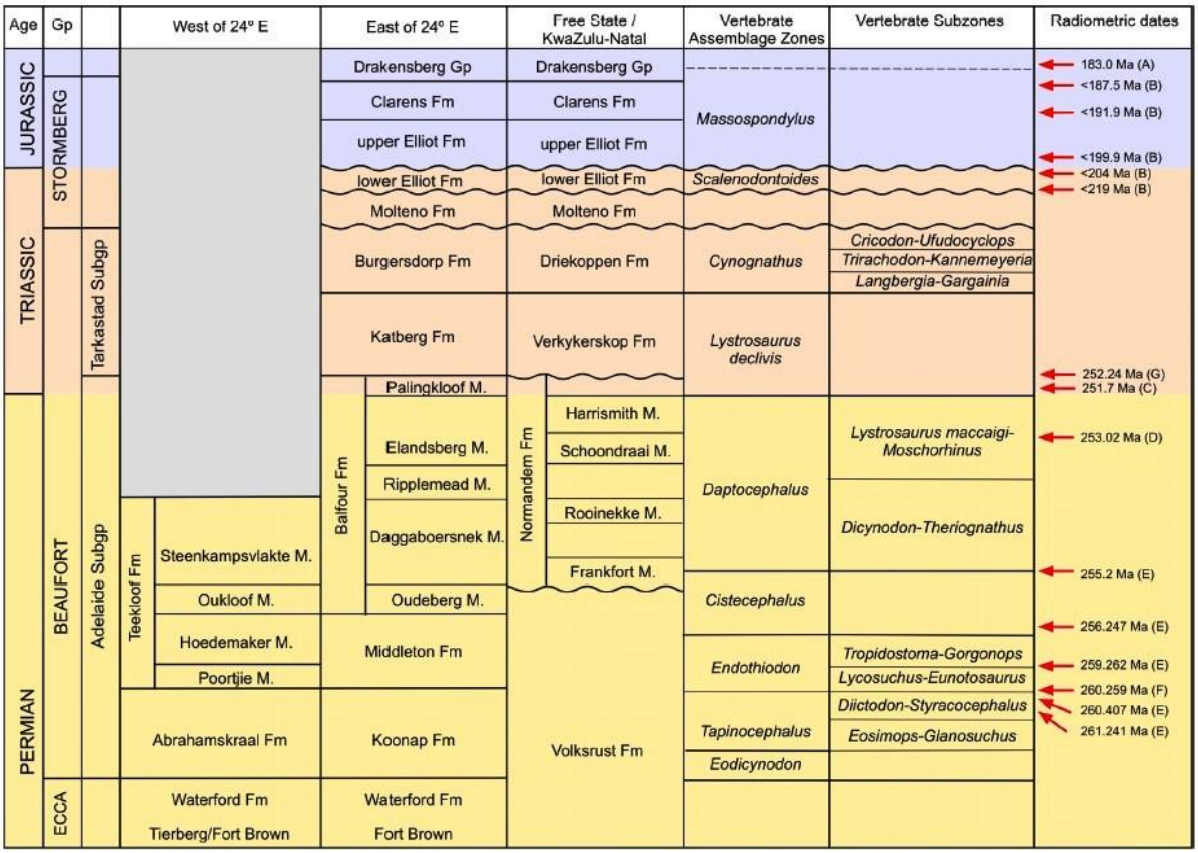


Figure 6-26 - Chart showing the latest, revised fossil biozonation of the Lower Beaufort Group of the Main Karoo Basin (abstracted from Smith et al. 2020).

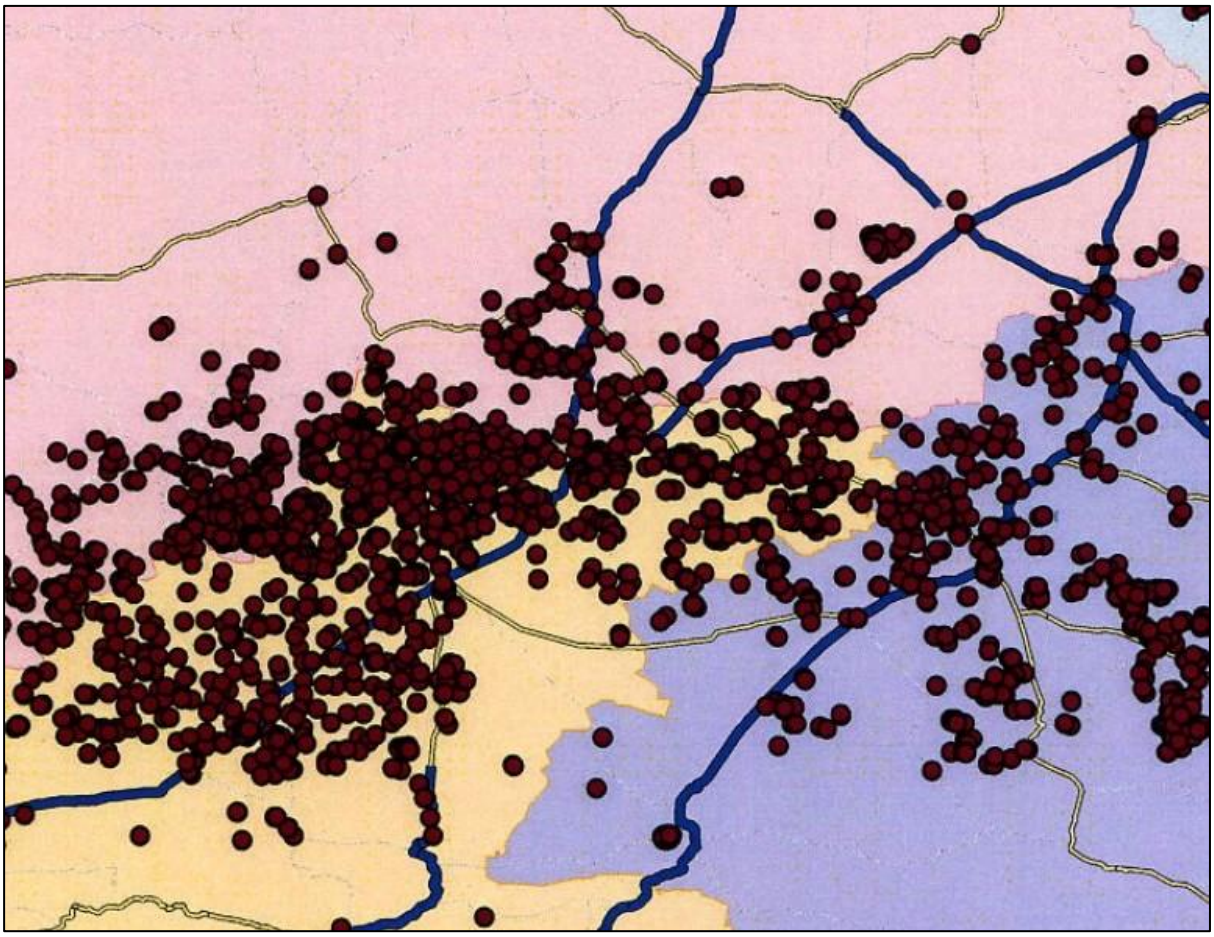


Figure 6-27 - Distribution map of recorded vertebrate fossil sites within the Lower Beaufort Group of the Great Karoo between Loxton (LOX), Victoria West (VIC W) and Beaufort West (BW)

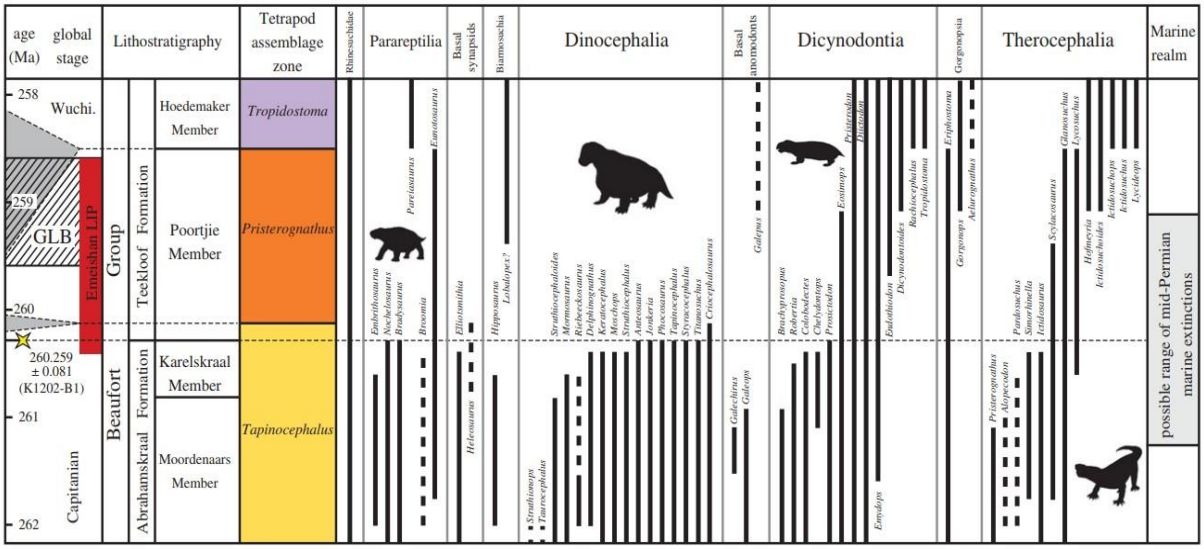


Figure 6-28 - Chart showing the ranges of known terrestrial tetrapod genera from the Middle to Late Permian of the Main Karoo Basin (From Day et al. 2015b)

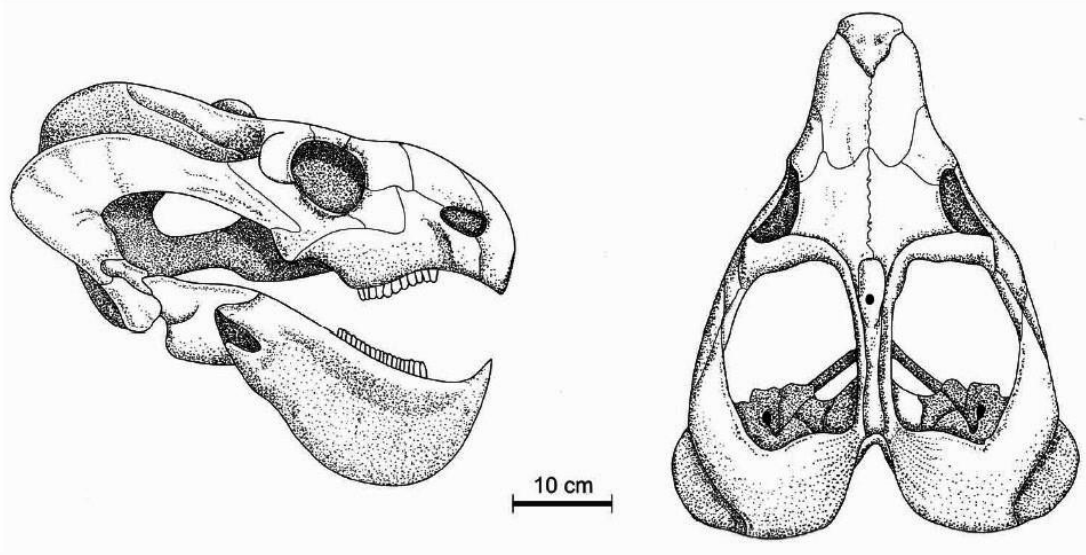


Figure 6-29 - Skull of the medium-sized dicynodont therapsid Endothiodon which occurs especially abundantly within the lower part of the Endothiodon Assemblage Zone

6.3.3 TRAFFIC

The following is extracted from the Traffic Impact Assessment compiled by Athol Schwarz and included as ***Appendix G.10****.*

6.3.3.1 Road Network

The existing road network adjacent to the proposed developments is well established. Consisting predominantly of the lower order gravel roads, which provides access to the local towns and the major commercial centres within South Africa.

The most relevant roads within the study area, which provide access to the proposed developments from the surrounding towns, are shown in **Figure 6-30** are delineated below.

The main roads utilised to access the site are summarised below.

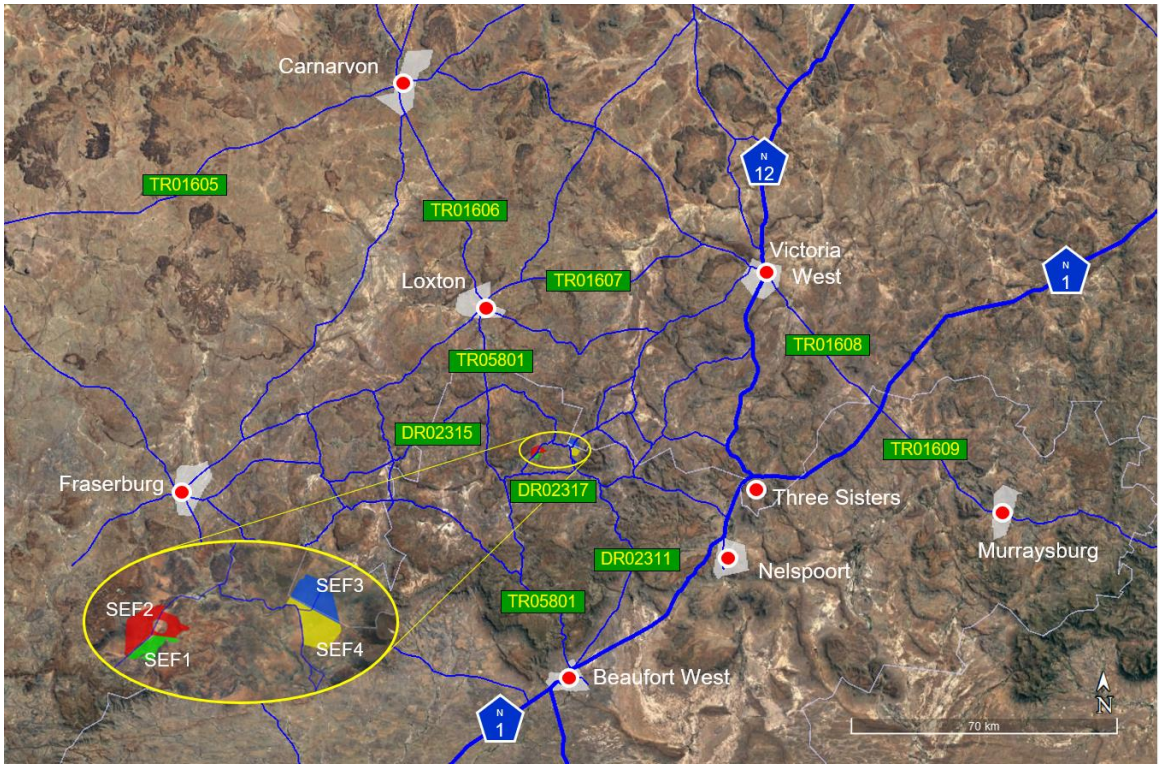


Figure 6-30 – Road Network

TR 05801 (R381)

The TR 05801 starts at the N1, north of Beaufort West (Western Cape) and ends at TR 01607 in Loxton (Northern Cape).

According to the Western Cape Road Information System, the Functional Classification of this road is a Class 2. The road is situated in a 20 m wide servitude, sections of the road are paved, the surfacing and width details of this road are provided in **Table 6-20**.

Table 6-20 - TR05801 - Road Details

Start km	End km	Surface Type	Width	Shoulder Width	Shoulder Type
0	10.07	Surfaced	7.20	2.00	Unsurfaced
10.07	13.28	Surfaced	8.60	2.00	Unsurfaced
13.28	23.80	Gravel	7.00		
23.80	32.96	Surfaced	7.20	0.9	Unsurfaced
32.96	38.20	Surfaced	6.80	0.9	Unsurfaced
38.20	95.75	Gravel	8.50		
95.75	111.00	Gravel			

Road A

This is a private road that is to be used as the main access route to Nuweveld WEF East, Nuweveld Collector Substation, Mura 1 and Mura 2. This road was not included in the site inspection. Thus, the author cannot comment on the condition or the viability of using this route.

6.3.3.2 Transportation Routes

Commuter Routes

The towns in this part of the country are few and far between. There are several towns within a 200 km radius of the proposed development from which the workforce is to be drawn. These include Beaufort West, Carnarvon, Fraserburg, Hutchinson, Loxton, Murraysburg, Nelspoort and Victoria West. The anticipated commuting routes to the proposed development from the surrounding towns are highlighted in magenta, as shown in **Figure 6-31**.

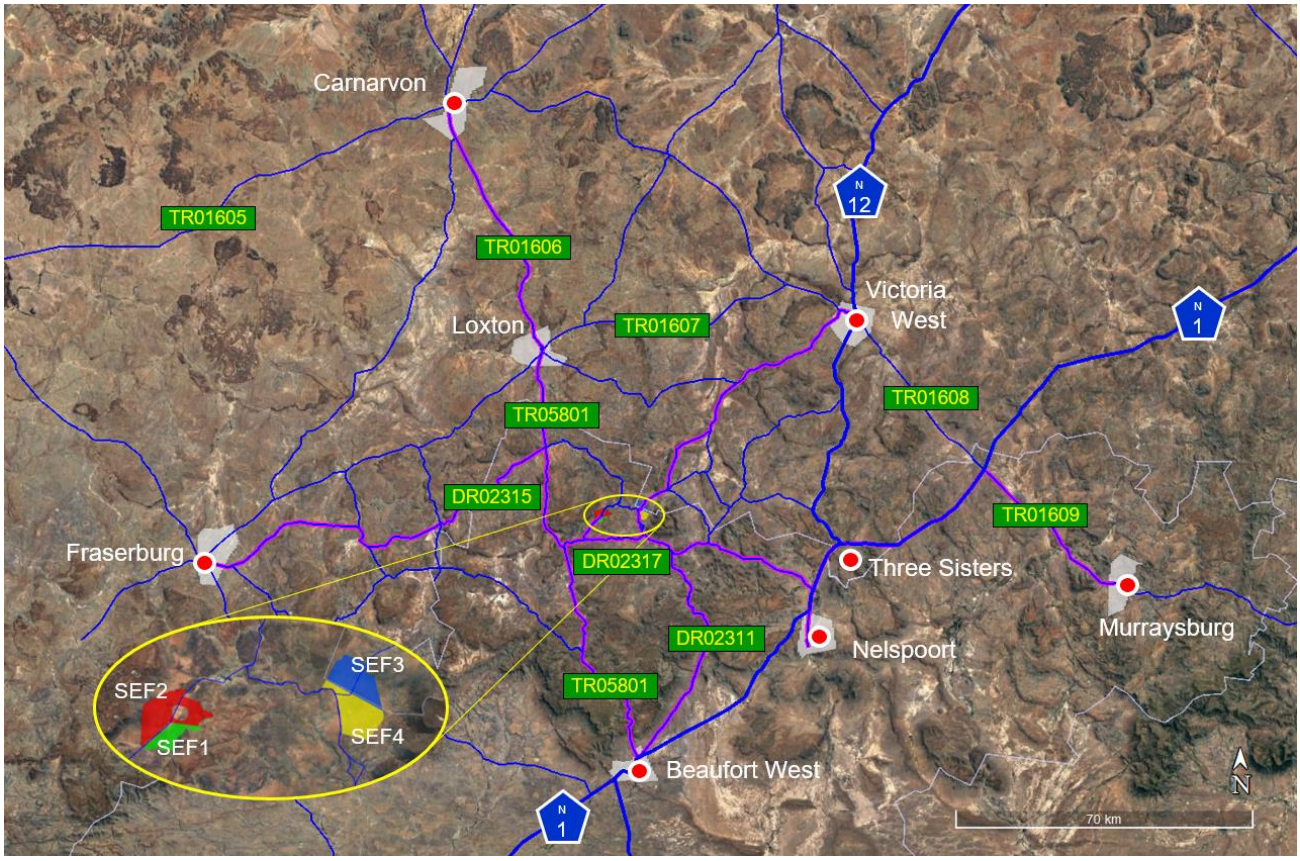


Figure 6-31 - Surrounding Towns

The proportionality of the workforce on the proposed developments from the surrounding towns, are based on the 'working-age' population in the town, modified by a 'weighting factor' which is calculated based on the distance travelled to the proposed development from the relevant town. The expected proportion of the workforce from the surrounding communities is depicted in **Table 6-21**.

Table 6-21 - Distribution of the Workforce

Town	Population	Travel Distance	Proportion (%)
Beaufort West	21376	78 km	67%
Carnarvon	4107	128 km	8%
Fraserburg	1854	139 km	3%
Loxton	604	65 km	2%
Murraysburg	2814	165 km	4%
Nelspoort	1212	83 km	4%
Victoria West	4978	106 km	11%

It should be noted that the town of Hutchinson, was excluded from the table as the proportionality was extremely low, less than 0.25%.

Freight Routes

Container Terminals

Transnet Port Terminals operates container terminals at Durban, Ngqura, Gqeberha and Cape Town. Thus, all the imported solar panels entering South Africa will be via one of these terminals. The container terminal and the most likely routes to the proposed developments will be via Victoria West and Loxton, as shown in **Figure 6-32**.

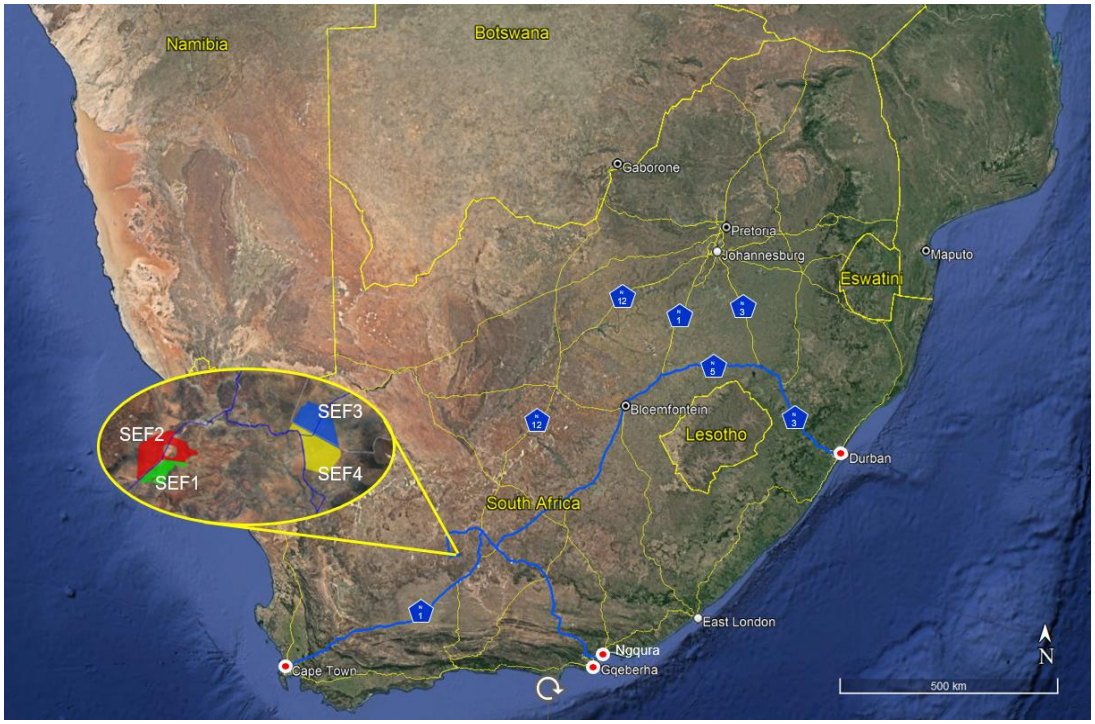


Figure 6-32 - Freight Routes from Container Terminals

The potential transportation routes from the various Container Terminals in South Africa to the proposed developments, are detailed in **Table 6-22**.

Table 6-22 – Distance – Port Terminals

Container Terminals	Distance
Cape Town	742 km
Durban	1265 km
Gqeberha	581 km
Ngqura	592 km

The closest container terminal to the proposed developments are the Ports at Gqeberha and Ngqura.

However, the preferred transportation route would ultimately be identified by the logistic company appointed to transport the components from the port of entry to the proposed development.

Commercial Centres

The most likely transportation routes for domestically supplied and manufactured components from the major commercial centres to the proposed developments are either Cape Town or Johannesburg (or any supplier along these routes), as shown in **Figure 6-33**.

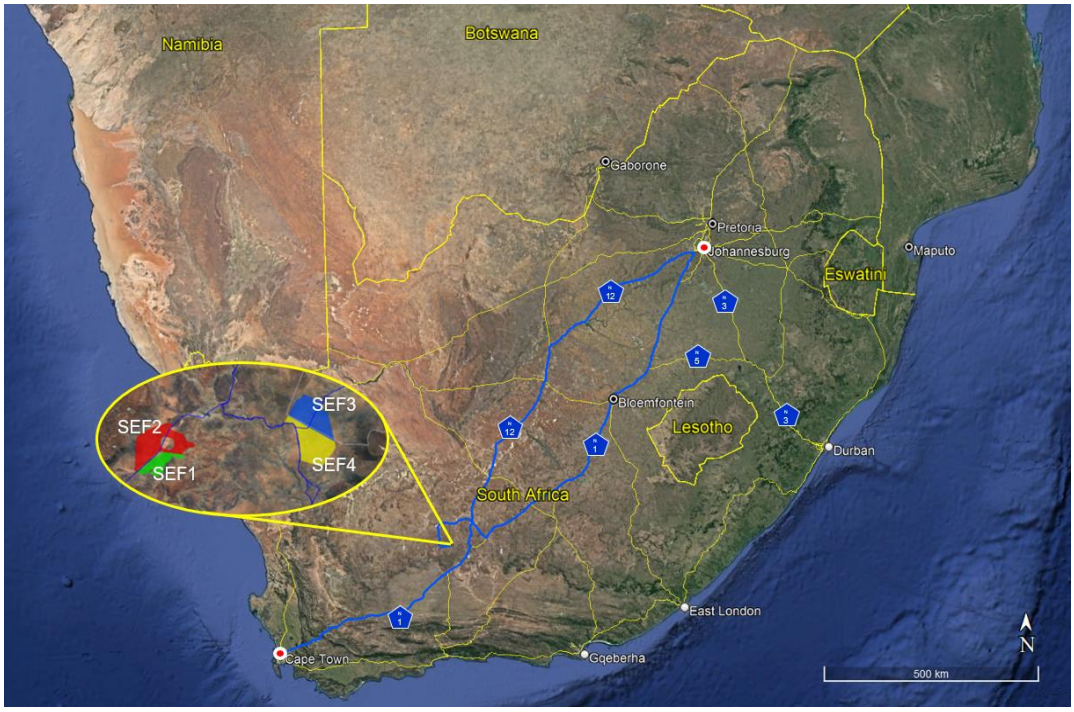


Figure 6-33 - Freight Routes from Commercial Centres

The distances from the proposed developments to selected commercial centres in South Africa are shown in **Table 6-23.**

Table 6-23 – Distance – Major Commercial Centres

Commercial Centres	Distance
Cape Town	742 km
Johannesburg (via N1)	1006 km
Johannesburg (via N12)	964 km

Although the closest major commercial centre to the proposed developments is located in the Cape Town area, many components will be fabricated in Johannesburg and transported to the proposed development.

6.3.4 VISUAL

The following is extracted from the Visual Impact Assessment compiled by Quinton Lawson and Bernard Oberholzer and included as ***Appendix G.11****.*

6.3.4.1 Landscape setting

The landscape and scenic features of the study area are similar to those for the Nuweveld wind farms. The 4 solar project areas lie within an expansive semi-arid landscape, with widely scattered farmsteads usually nestled among tree copses. The large farms mainly support merino sheep, and occasionally dorper sheep, goats and horses, as well as game, such as small antelope.

6.3.4.2 Geology and landforms

The landscape in this part of the Great Karoo has been eroded over time, the once deeply buried Beaufort Group mudstones and sandstones and the dolerite intrusions having been exposed to form the present-day Karoo landscape.

The regional plateau is characterised by horizontal sills and dykes of erosion-resistant dolerite forming steep slopes in places, boulder-strewn mesas and flat-topped koppies that are the main scenic features of the study area. The gentler, lower hillslopes and plains consist of more easily weathered mudstone, with occasional narrow ledges of harder sandstone. The flattish plains, where the solar projects are located, are at around 1400-1500m elevation, and the surrounding dolerite ridges and mesas around 1600-1700m elevation (**Figure 6-34**).

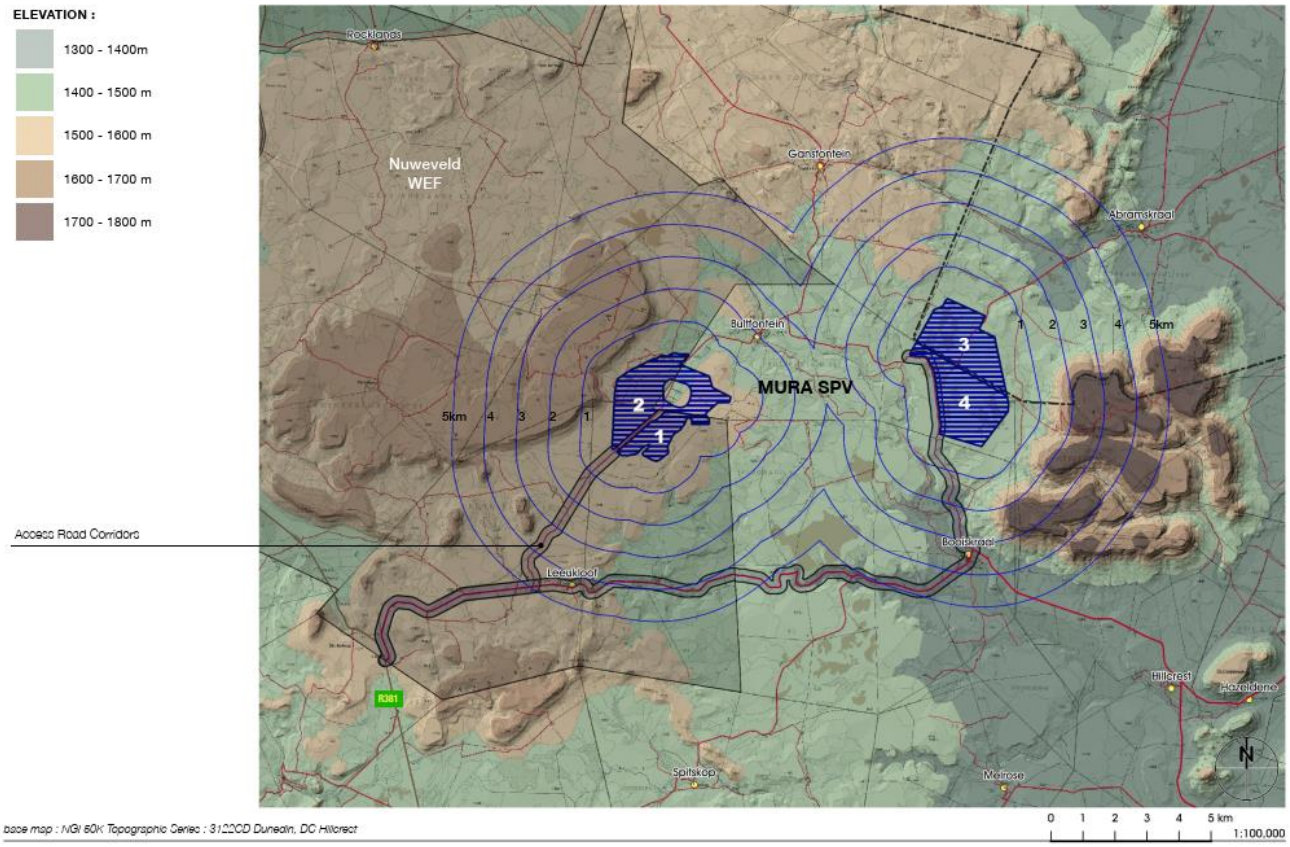


Figure 6-34 – Layout and Physiography

6.3.4.3 Land use

There are a few scattered farmsteads in the surroundings, within the viewshed, which form green oases in the semi-arid landscape. The farmsteads are on average 5 to 10km+ apart, linked by narrow gravel roads. The farms are generally extensive in area and support mainly sheep farming and game.

6.3.4.4 Sense of place

The flat-topped hills and dolerite ridges are a characteristic feature of the Great Karoo in an otherwise fairly featureless, parched landscape, an area noted mainly for its empty, uncluttered landscapes, stillness, red sunsets, dark nights and starry skies.

The most scenic areas tend to be the dolerite koppies and the river courses, particularly in the vicinity of Leeukloof and Booiskraal (**Figure 6-35** and **Figure 6-36**).

Figure 6-35 - Typical mesas and plains with succulent shrub vegetation of the study area

Figure 6-36 - Existing access road between Leeukloof and Booiskraal

6.3.5 SOCIAL

The following is extracted from the Socio-Economic Impact Assessment compiled by Independent Economic Researchers and included as ***Appendix G.12****.*

Most of the overall area proposed for the development of solar energy facilities is within Ward 7 of the BWLM, in the CKDM of the Western Cape Province. Note however that Ward 7 covers a particularly large area of 8,175 square kilometres and extends as far as the town of Merweville which is over 100km from the proposed Solar Facilities. The nearest major towns include Beaufort West in the Western Cape (50km) and Victoria West in the Northern Cape (65km). Smaller towns nearby include Loxton (27km) and Nelspoort (46km). Towns and settlements in the wider area include Carnarvon, Hutchinson, Fraserberg, Leeu-Gamka, Merweville, Murraysburg and Riebton, all located between 60–130km from the project site. Some of these towns are relatively less accessible given the condition of minor provincial roads.

6.3.5.1 Current land uses

Current land uses in the wider rural area, where the solar facilities would be located, are focused on extensive agriculture with small stock primarily in the form of sheep, game farming, some tourism and conservation primarily in the form of the Karoo National Park. The farms are large and homesteads are few and far between to maintain economically viable farm units. Small communities are housed on the farms and work as farm labourers or in associated tourism ventures. Away from the towns there are few other sources of enterprise or employment.

Drought has been experienced to varying degrees in different parts of the study area, with many of the farms surrounding Loxton and Beaufort West are currently in the initial stages of recovery from a severe drought. During the drought, farming became unviable for those without access to a permanent source of groundwater. Consequently, many farmers sold their livestock or moved them to other parts of the region or country. This reduction in agricultural activity resulted in retrenchments which have been particularly disruptive to affected communities given that farm labourers typically reside on-farm in this area. This resulted in an influx of job seeker, particularly in Beaufort West. In 2021, many farmers experienced their first rainfall in several years. This has resulted in increased agricultural activity and renewed demand for farm labour in the area.

6.3.5.2 Demographics

BWLM had a population of 51 177 in 2021, up from 49 586 in 2011, which translates to a population growth rate of around 0.3% per annum over the ten-year period (**Figure 6-37).** This is lower than the annual growth rate for the CKDM, which was 0.6% over the same period. BWLM had an average household size of 3.9 in 2021.

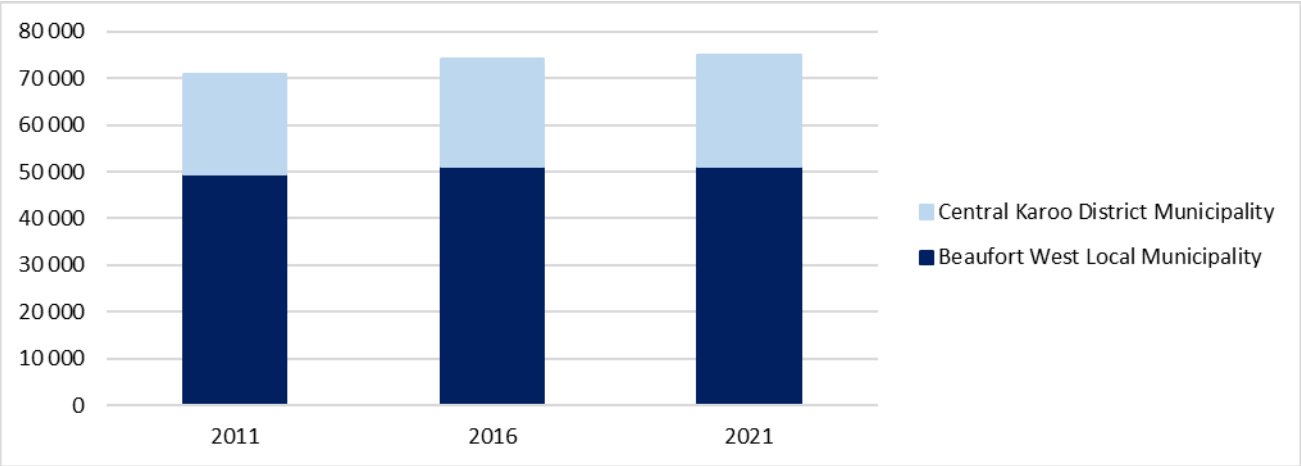


Figure 6-37 - Population trends in the CKDM and BWLM

Around 53.1% of BWLM's population are female. According to statistics published by the Western Cape Government, this proportion is similar to that of the CKDM's population – 52.8%.

Recent population estimates are not available at the settlement level, but the 2011 census gives some indication of the towns nearby the study site, as outlined in **Table 6-24**. Beaufort West had a population of 20,053 in 2011, while Loxton had a population of 1,044, Fraserburg 3,029 and Nelspoort 1,696.

Table 6-24 - Population groups in the towns surrounding the study site, 2011

Population Group	Beaufort West	Loxton	Fraserburg	Nelspoort
Black African	1 452	28	145	288
Coloured	15 624	895	2 569	1 375
Indian or Asian	107	3	18	14
White	2 741	113	288	13
Other	129	5	9	6
Total	20 053	1 044	3 029	1 696

Between 2011 and 2016, BWLM's dependency ratio showed a decreasing trend over time as an ever-larger proportion of the population was falling into the working age group (**Figure 6-38**). The dependency ratio decreased from 59.7 in 2011 to 56.7 in 2019. The Western Cape Provincial Government had previously projected that it would continue to reduce to 55.1 by 2024. However, more recent information suggests that this trend reversed between 2016 and 2019, with an increase in the dependency ratio to a high of 64.4% in 2021. Interviews with municipal representatives indicate that this could be due to higher than anticipated rates of in-migration over the period. As the net change in population has been negligible in recent years this would imply out-migration as well.

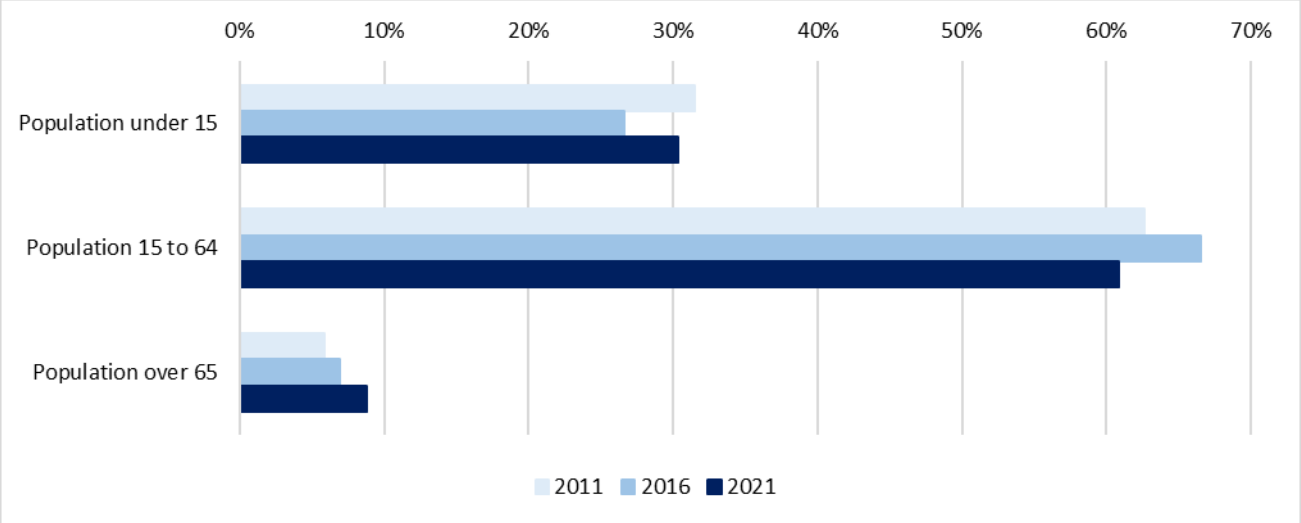


Figure 6-38 - Age cohorts over time in the BWLM

6.3.5.3 Employment and sectors

BWLM's unemployment rate was around 24.2% in 2019, which is the highest unemployment rate in the CKD. The local municipality's trend has for the most part been consistent with that of the district municipality as well as that of the province at least since 2008 (**Figure 6-39**). Western Cape Treasury estimates that unemployment will fall to 22.4% in 2020 (WCPG, 2021a). Reducing unemployment in a year like 2020 seems challenging however, given that Quantec Research estimates that 725 jobs were lost in BWLM in 2020 (1,066 in the wider CKDM) (WCPG, 2021b).

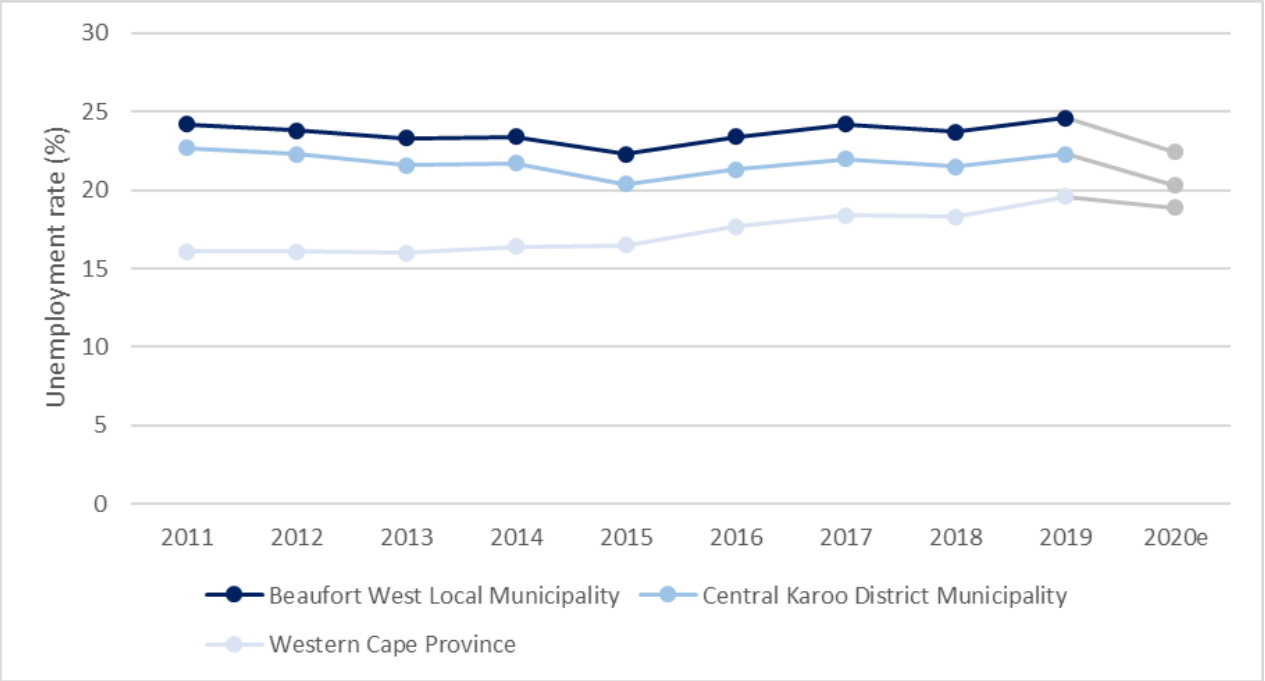


Figure 6-39 - The unemployment rate in BWLM and CKDM over time

The sector which contributes most to employment in BWLM is wholesale and retail trade, catering and accommodation. This sector contributed 3,165 of the total of the area's 12,552 jobs in 2019, and 31 more jobs than in 2018. The second highest number of jobs was in agriculture, forestry and fisheries which employed 2,421 people in that year (the same number estimated in 2018). **Table 6-25** outlines each sector's employment numbers in 2019 and shows the change in job numbers between 2014 and 2018.

Table 6-25 - Sectoral contribution to employment and net employment growth per sector in BWLM

	GDPR			Employment		
	R Million value 2019	Trend 2015 –2019	Real GDPR growth 2020e	Number of jobs 2019	Ave ann. change 2015 - 2019	Net change 2020e
Primary Sector	225.3	-2.8	10.7	2 423	77	-73

Agriculture, forestry & fishing	223.7	-2.9	10.8	2 421	77	-73
Mining & quarrying	1.6	0.5	-17.6	2	0	0
Secondary sector	278.6	-0.3	-12.8	787	-11	-94
Manufacturing	67.4	0.4	-10.3	249	-2	-16
Electricity, gas & water	120.3	0.2	-6.2	65	0	-3
Construction	90.9	-1.3	-22.0	473	-9	-75
Tertiary sector	1 727.3	0.5	-6.3	9 342	70	-558
Wholesale & retail trade, catering & accommodation	346.4	-0.2	-11.3	3 165	41	-280
Transport, storage & communication	382.2	-1.2	-16.9	649	-1	-38
Finance, insurance, real estate & business services	287.9	2.2	-3.6	1 277	2	-86
General government	500.3	1.0	1.0	2 319	7	26
Community, social & personal services	210.5	0.7	-2.9	1 932	21	-180
Beaufort West	2 231.2	-0.1	-4.8	12 552	136	-725

Most jobs in BWLM fall into the semi-skilled (42.7%) and low-skilled (36.6%) categories with skilled jobs making up only 20.7% of jobs in the area (**Figure 6-40**). Higher-skill positions are concentrated in the electricity, gas and water sector, as well as in general government, finance and community services-related sectors.

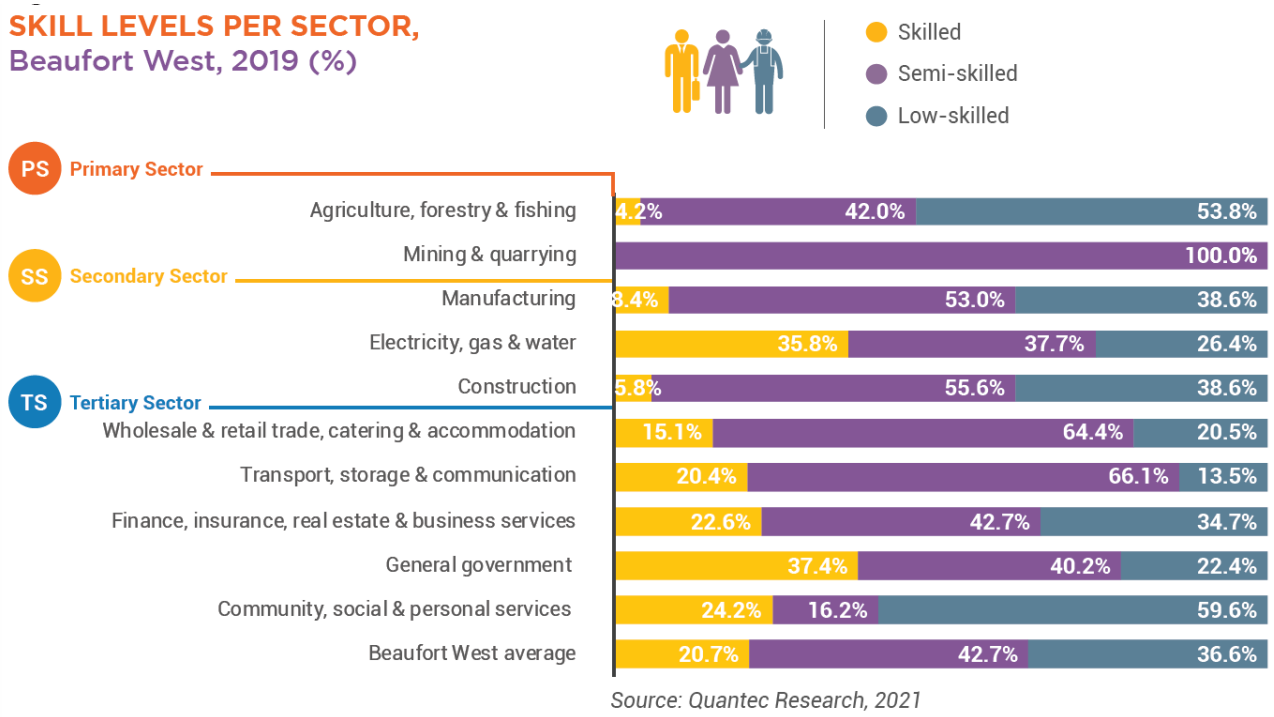
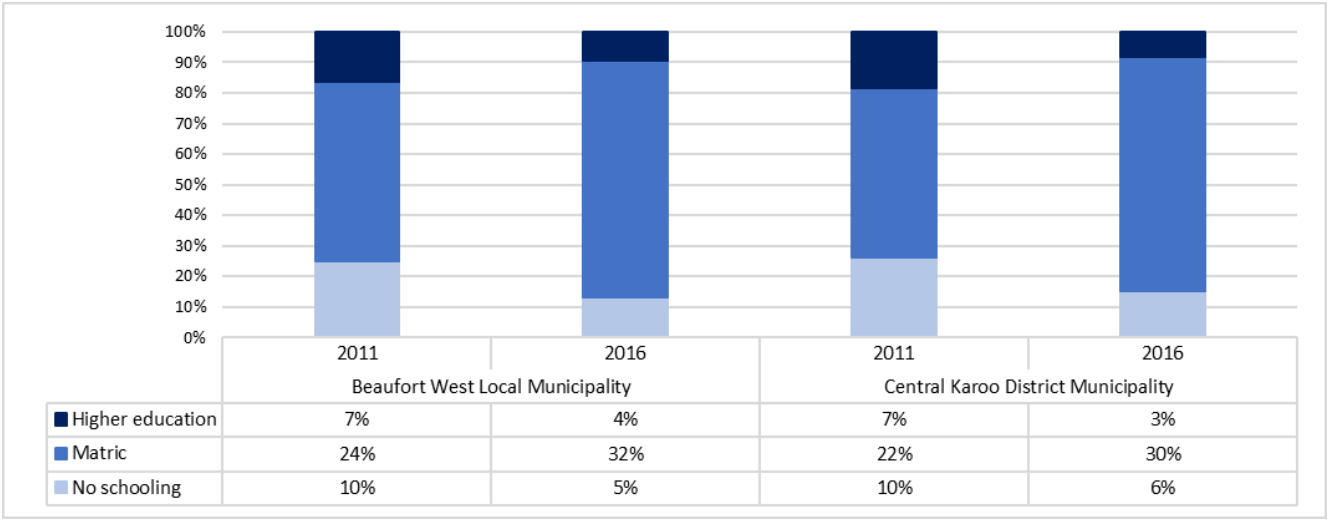


Figure 6-40 - Sectoral contribution to employment and net employment growth per sector in BWLM

6.3.5.4 Education levels

The proportion of people over the age of 20 years who have obtained a matric certificate increased in the 2011 to 2016 period at both the local and district municipality scales (**Figure 6-41**). This indicates that basic education levels have improved in the study area during this time. The proportion of people who have obtained some form of higher education has however decreased over the same period, at both the local and district municipality scales.



	2011	2016	2011	2016
	Beaufort West Local Municipality		Central Karoo District Municipality	
Higher education	7%	4%	7%	3%
Matric	24%	32%	22%	30%
No schooling	10%	5%	10%	6%

Figure 6-41 - Education levels in those over 20 years old in BWLM and CKDM, 2011 and 2016

Statistics published by the Western Cape Government indicate that both learner enrolment and learner retention have been increasing gradually in recent years (WCPG, 2021a). This is a promising trend. However, while the demand for education has risen, supply has decreased according to the measure of the number of public ordinary schools, which decreased by one per year over the 2018–2019 period. This combination of trends has resulted in higher learner-teacher ratios in the municipality, at 1:33.2 in 2019 (higher than the provincial average of 1:30.5 and the national average of 29.3). In 2020 the ratio reduced slightly to 1:31.

6.3.5.5 Availability of municipal services

Access to basic services has fluctuated over time both at the local and district municipality levels, except in the case of water. The data in **Figure 6-42** was assembled based on statistics generated by StatsSA for 2011 and 2016, as well as 2019–2020 statistics generated by Quantec and reported in the Western Cape Treasury's 2020 and 2021 socio-economic profiles for Beaufort West. According to this data, a greater proportion of households had access to a flush toilet connected to sewerage, weekly refuse removal and electricity and lighting in 2016 as compared to 2011 throughout the local and district municipalities. This improvement was somewhat reversed in the 2016–2019 period, with relatively more households not having access to electricity for lighting, flush toilets and weekly refuse removal in recent years.

The proportion of households with piped water inside their dwelling fell from 81% to 78% in BWLM and from 77% to 74% in CKDM between 2011 and 2016, but then saw an increased to 98% in 2019 for both BWLM and CKDM. Interviews with municipal representatives suggest that in-migration of poor families has led to the expansion of informal settlements where the provision of service delivery remains relatively low.

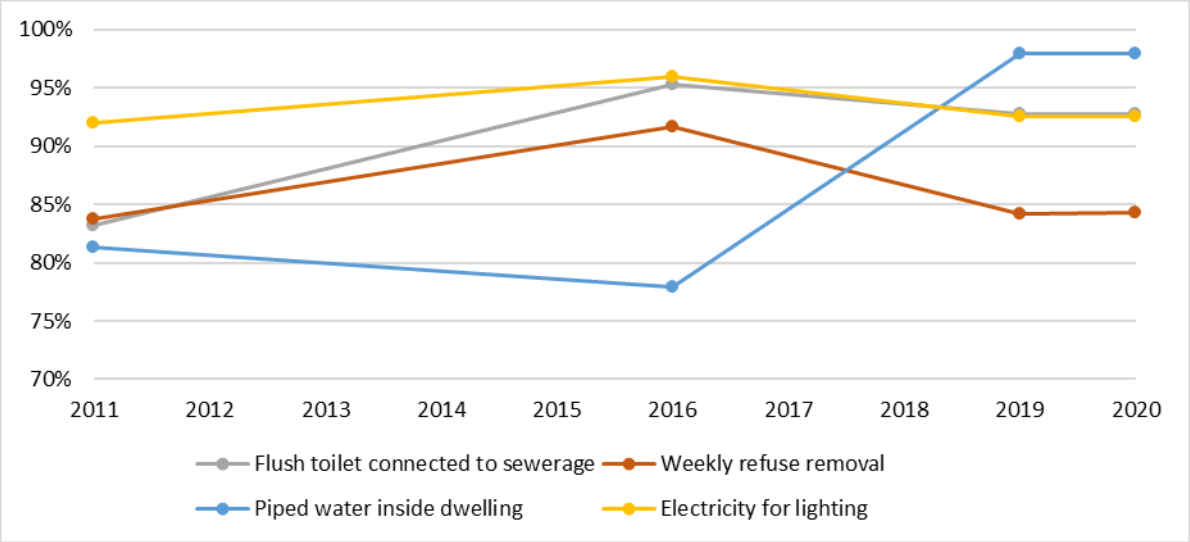


Figure 6-42 - Access to key municipal services in BWLM and CKDM, 2011, 2016 and 2019

According to the Western Cape Government, there are relatively few informal houses in either the BWLM or in the CKDM. In the BWLM, 97.9% of households live in formal dwellings, which is a slightly higher proportion of households than the CKDM with 97.0% (WCPG, 2021a).

6.3.5.6 Health

Assessing access to health services is key to understanding well-being and poverty. Chronic lower respiratory disease is the leading cause of death in the Central Karoo District (9.5% of deaths in 2018), followed by Tuberculosis (TB) (8.8%), Cerebrovascular disease (6.9%), Hyperintensive diseases (5.5%) and Diabetes melitus (5.5%) (WCPG, 2021b).

According to StatsSA, 75% of South Africans rely on public health services, while the remaining 25% make use of private facilities. The number and types of public healthcare facilities available in BWLM and CKDM are outlined in **Figure 6-43**.

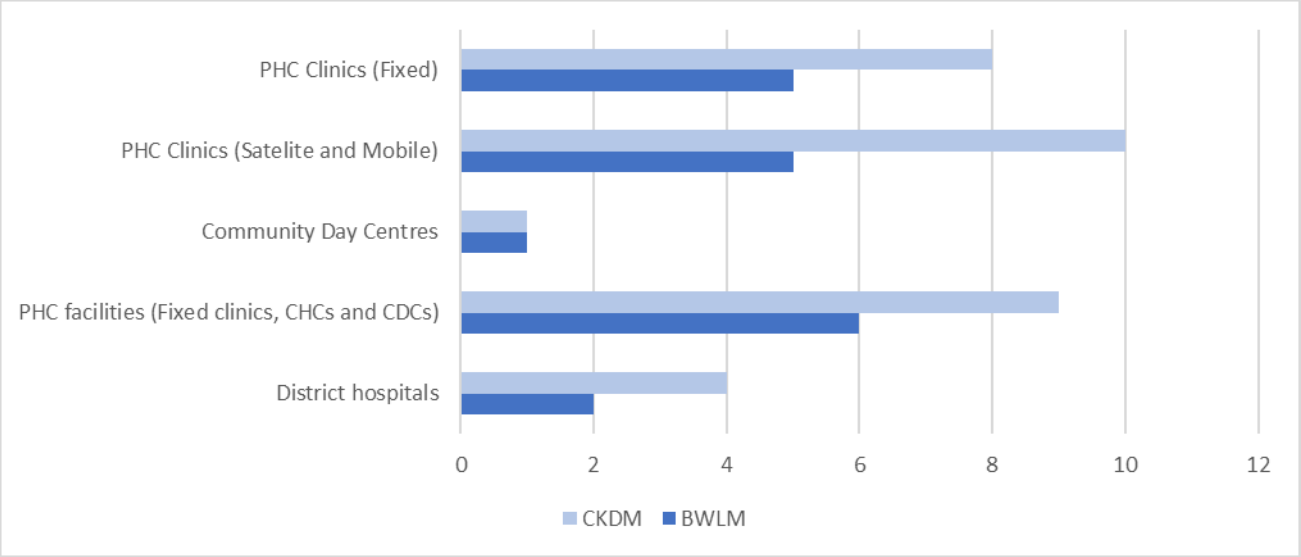


Figure 6-43 - Public healthcare facilities in the study area

BWLM's latest IDP revision notes the importance of providing preventative care for HIV/AIDS and Tuberculosis (TB) to vulnerable communities. This preventative care is provided by government and consists primarily of condom distributions and campaigns to encourage the practice of safe sex. In terms of providing treatment, government provides antiretroviral therapy (ART) to people living with HIV. There were a total of 1,558 people receiving ART in BWLM in 2020/21, up from 1,524 in 2019/20. The total number in the CKDM was 2,037 in 2020/21, down from 2,050 in 2019/20. The CKDM socio-economic profile, published by the Western Cape Treasury, notes that the number of newly registered ART patients remained relatively stable at 142 in 2019/20 and 147 in 2020/21.

The following healthcare facilities provide treatment in the BWLM:

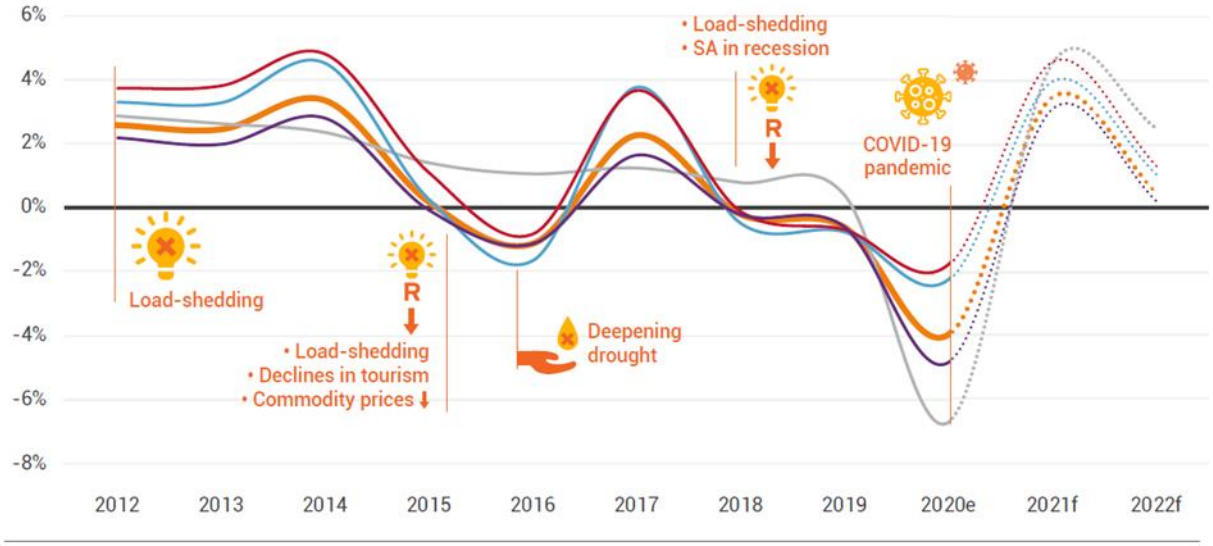
- Murraysburg Primary Healthcare Centre (PHC)
- Nelspoort PHC
- Nieuveldpark PHC
- Kwa Mandlenkosi PHC
- Hillside Clinic PHC (constructed in 2016/17)
- Merweville Satellite Clinic
- Beaufort West CDC
- Murraysburg Mobile Clinic
- Nelspoort Mobile Clinic
- Beaufort West Mobile Clinic

- Merweville Mobile Clinic
- Beaufort West District Hospital
- Murraysburg District Hospital
- Nelspoort Specialised Hospital

Municipalities continue to address health issues facing communities through the provision of health services and through the continued training of Community Health Workers. In addition to treating HIV/AIDS, facilities provide immunisation for children (CKDM's immunisation rate was 74.9% in 2016). Other challenges faced by communities include a higher than anticipated neo-natal mortality rate – 13.4 neonatal deaths per 1000 live births for CKDM in 2019, up from 14 in 2016 (the target had been set at 6 or less). The neonatal death rate for BWLM is lower, at 8.4 deaths per live birth.

6.3.5.7 Local and regional socio-economic growth and development plans/priorities

The Central Karoo District has experienced low levels of economic growth in recent years, with fluctuating GDPR growth patterns seen since 2014 in the district economy and all local economies within. Quantec Research estimates that the BWLM experienced 4.8% decline in 2020, in line with the 4% decline in CKDM's GDPR growth rate and a 6.7% decline in that of the Western Cape. Several reasons for this low and erratic growth are outlined in **Figure 6-44**. They include the COVID-19 pandemic, drought and load shedding.



	2012	2013	2014	2015	2016	2017	2018	2019	2020e	2021f	2022f
Western Cape	2.9%	2.6%	2.4%	1.4%	1.1%	1.2%	0.8%	0.4%	-6.7%	4.6%	2.5%
Central Karoo District	2.6%	2.4%	3.3%	0.2%	-1.1%	2.3%	-0.2%	-0.6%	-4.0%	3.5%	0.5%
Laingsburg	3.3%	3.3%	4.5%	0.3%	-1.6%	3.8%	-0.5%	-0.7%	-2.2%	4.0%	1.0%
Prince Albert	3.7%	3.8%	4.8%	1.1%	-0.8%	3.7%	-0.1%	-0.7%	-1.8%	4.6%	1.3%
Beaufort West	2.2%	2.0%	2.8%	-0.1%	-1.1%	1.7%	-0.2%	-0.6%	-4.8%	3.2%	0.2%

Source: Quantec Research, 2021; Urban-Econ based on Quantec, SARB, Stats SA and BFAP, 2021 (e denotes estimate, f denotes forecast)

Figure 6-44 - GDPR growth in the local economies of the Central Karoo District

In terms of future economic development goals, the 2021-2022 review of the 2017-2022 IDP of the BWLM is most instructive. According to this plan, the Municipal Strategic Programme is aligned to 5 Key Performance Areas:

- KPA 1: Basic service delivery and infrastructure development
- KPA 2: Economic development
- KPA 3: Institutional development and municipal transformation
- KPA 4: Financial viability and management
- KPA 5: Good governance and community participation

KPA 2 above (economic development) is linked to the following strategies:

- To use municipal and government funded projects as means to create jobs and reduce poverty
- To facilitate development and growth of SMME's
- To establish and strengthen LED Structures
- To facilitate Education and Skills Development for Cooperatives & SMME's
- To provide SMME Support and Capacity building
- To manage and enhance the performance of the municipality

At the district level, the CKDM IDP 2017-2022, 2nd Review 2021–2022, highlights the following projects, identified in the District LED Strategy:

- Infrastructure development to increase access for businesses and households;
- Business support programmes to retain existing businesses and encourage start-up or relocating businesses to enter the area;
- Spatial planning to promote land acquisition and property development for businesses and households;
- Skills programmes to respond to business and government for greater productivity and efficiency; and
- Social development programmes to increase participation in the local economy and build better lifestyles for the community.

The CKDM IDP goes on to mention the importance of establishing an LED unit to coordinate activities, as well as the Economic Recovery Plan being drafted to respond to the economic impact of the COVID-19 pandemic.

7 SITE SENSITIVITY VERIFICATION

Specialist assessments were conducted in accordance with the Procedures for the Assessment and Minimum Criteria for Reporting on identified Environmental Themes, which were promulgated in Government Notice No. 320 of 20 March 2020 and in Government Notice No. 1150 of 30 October 2020 (i.e. “the Protocols”), or Appendix 6 of the EIA Regulations, depending on which legislation apply to the assessment under consideration. A summary of the DFFE screening tool, the applicable legislation as well as the specialist sensitivity verification are detailed in **Table 7-1** below. The site verification process is discussed in the section below.

Table 7-1 - Assessment Protocols and Site Sensitivity Verifications

Specialist Assessment	Assessment Protocol	DFFE Screening Tool Sensitivity	Specialist Sensitivity Verification
Agricultural Compliance Statement	*Protocol for the specialist assessment and minimum report content requirements of environmental impacts on agricultural resources by onshore wind and/or solar photovoltaic energy generation facilities where the electricity output is 20 megawatts or more*	Medium Sensitivity	Low Sensitivity
Terrestrial Biodiversity Impact Assessment	*Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Biodiversity*	Low Sensitivity	Low Sensitivity
Aquatic Biodiversity Impact Assessment	*Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity*	Low Sensitivity	Low Sensitivity
Plant Species	*Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Plant Species*	Low Sensitivity	Low Sensitivity
Animal Species	*Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Animal Species*	High Sensitivity	Low Sensitivity
Avifauna Impact Assessment	*Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Animal Species*	Low Sensitivity	Medium Sensitivity
Archaeological and Cultural Heritage Impact Assessment	*Site Sensitivity Verification Requirements where a specialist Assessment is required but no Specific Assessment Protocol has been prescribed*	Low Sensitivity	Medium Sensitivity

Specialist Assessment	Assessment Protocol	DFFE Screening Tool Sensitivity	Specialist Sensitivity Verification
Palaeontology Impact Assessment	*Site Sensitivity Verification Requirements where a specialist Assessment is required but no Specific Assessment Protocol has been prescribed*	Very High Sensitivity	Low Sensitivity
Visual (Landscape) Impact Assessment	*Site Sensitivity Verification Requirements where a specialist Assessment is required but no Specific Assessment Protocol has been prescribed*	Very High Sensitivity	Medium Sensitivity
Social Impact Assessment	*Site Sensitivity Verification Requirements where a specialist Assessment is required but no Specific Assessment Protocol has been prescribed*	No Sensitivity Identified	Low to Medium Sensitivity
RFI Theme	*Site Sensitivity Verification Requirements where a specialist Assessment is required but no Specific Assessment Protocol has been prescribed*	High Sensitivity	N/A

7.1 AGRICULTURAL POTENTIAL

The purpose of including an agricultural component in the environmental assessment process is to ensure that South Africa balances the need for development against the need to ensure the conservation of the natural agricultural resources, including land, required for agricultural production and national food security. The different categories of agricultural sensitivity, used in the national web-based environmental screening tool, indicate the priority by which land should be conserved as agricultural production land.

Agricultural sensitivity is a direct function of the capability of the land for agricultural production. All arable land that can support viable crop production, is classified as high (or very high) sensitivity. This is because there is a scarcity of arable production land in South Africa and its conservation for agricultural use is therefore a priority. Land which cannot support viable crop production is much less of a priority to conserve for agricultural use and is rated as medium or low agricultural sensitivity.

The screening tool classifies agricultural sensitivity according to only two independent criteria – the land capability rating and whether the land is used for cropland or not. All cropland is classified as at least high sensitivity, based on the logic that if it is under crop production, it is indeed suitable for it, irrespective of its land capability rating.

The screening tool sensitivity categories in terms of land capability are based upon the Department of Agriculture's updated and refined, country-wide land capability mapping, released in 2016. The data is generated by GIS modelling. Land capability is defined as the combination of soil, climate, and terrain suitability factors for supporting rain fed agricultural production. It is an indication of what level and type of agricultural production can sustainably be achieved on any land, based on its soil,

climate, and terrain. The higher land capability values (≥8 to 15) are likely to be suitable as arable land for crop production, while lower values are only likely to be suitable as non-arable grazing land.

A map of the proposed Mura 1 development area overlaid on the screening tool sensitivity is given in **Figure 7-1**. The classification of the site as high agricultural sensitivity is because that land is classified as cropland in the data set used by the screening tool. However, that data set is outdated. That land is no longer used as cropland and has not been cropped in the last sixteen years according to the historical imagery available on Google Earth. Therefore, it should not still be classified as high agricultural sensitivity.

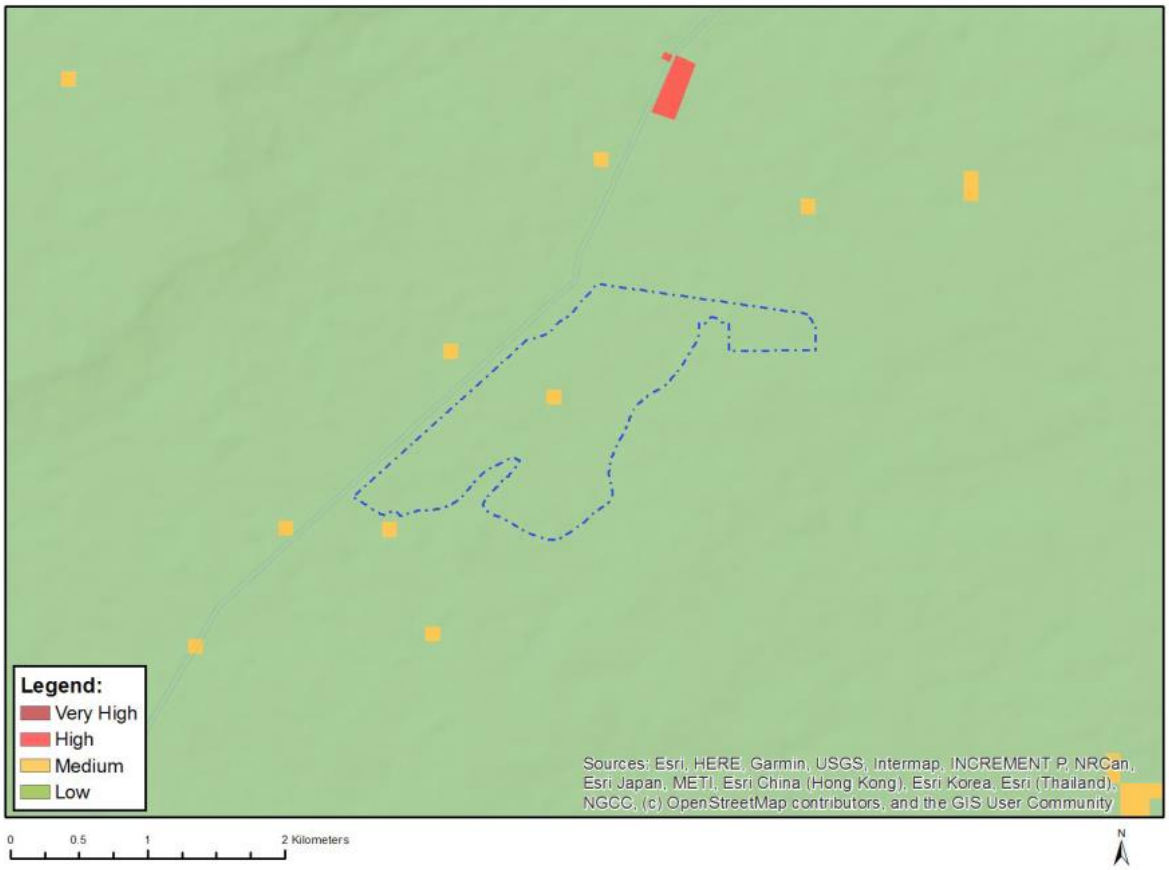


Figure 7-1 - Map of Agriculture Sensitivity

Source: DFFE Screening Report

The fact that previously cropped lands are no longer viable for cropping is because the suitability for cropping changes with a changing agricultural economy. Poorer soils or marginal climates that may have been cropped with economic viability in the past, are abandoned as cropland because they become too marginal for viable crop production in a more challenging agricultural economy with higher input costs. Climate change and changes in rainfall patterns have also led to poorer soils becoming more marginal.

The classified land capability of the sites is predominantly 4 and 5, but does range from 4 to 8. The small-scale differences in the modelled land capability across the project area are not very accurate or significant at this scale and are more a function of how the data is generated by modelling, than actual meaningful differences in agricultural potential on the ground.

The DFFE screening tool identifies the agricultural sensitivity as high, however, the verified agricultural site sensitivity was low. The motivation for confirming the sensitivity is predominantly that the climate data (low rainfall of between 171 and 212 mm per annum and high evaporation of between 1,274 and 1,312 mm per annum) proves the area to be arid and therefore of limited land capability. Moisture availability is completely insufficient for viable rainfed crop production. In addition, the land type data shows the dominant soils to be shallow on underlying rock and hardpan carbonate. A low agricultural sensitivity is entirely appropriate for the site, which is unsuitable for crop production.

A land capability value of greater than or equal to 8 should indicate viability for crop production. However, moisture availability of the sites is totally insufficient for crop production without irrigation and therefore a land capability value of higher than 7 is not justified for the site.

This site sensitivity verification verifies the Mura 1 site as being of low agricultural sensitivity. With a land capability of 4 to 5. The required level of agricultural assessment is therefore confirmed as an Agricultural Compliance Statement.

7.2 TERRESTRIAL BIODIVERSITY

The output of the DFFE Screening Tool for the Terrestrial Biodiversity Theme is illustrated in **Figure 7-2** and indicates that the whole of the Mura 1 site falls within areas classified as Low Sensitivity. There are no areas within the development footprint that have been classified as High sensitivity and it is restricted to low sensitivity areas with some restricted areas of habitat considered to represent medium sensitivity areas which are considered vulnerable to disturbance and should preferably be left free from PV development.

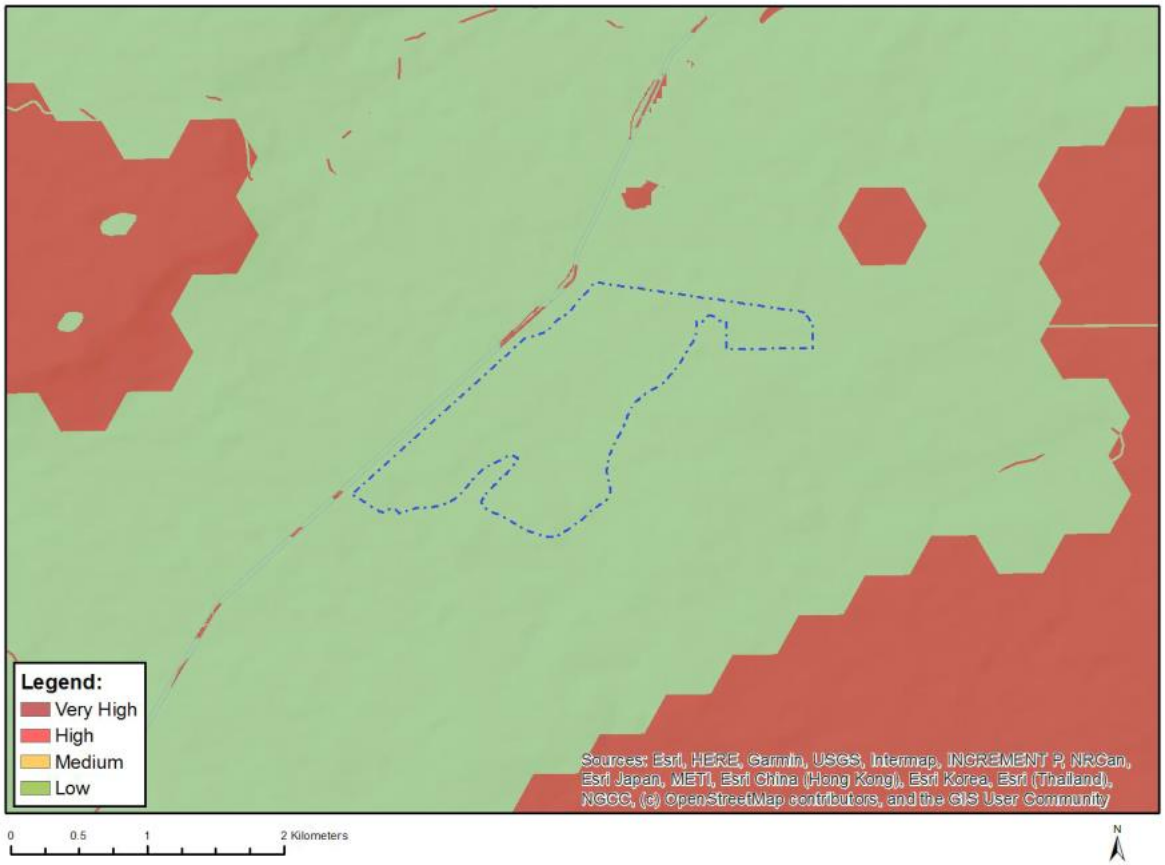


Figure 7-2 - Map of Terrestrial Biodiversity Sensitivity

Source: DFFE Screening Report

The site was visited on 9th of June 2022 for the Site Verification. During the field assessment, the full site was investigated on foot and a full plant species checklist for the site was developed. Specific points of interest across the site were checked and included any rocky outcrops, drainage features, wetlands and any areas of quartz pebbles or gravel patches where present. The total track within the Mura 1 Solar project area was in excess of 8km long. In order to check the larger fauna of the site, three camera traps were also put out on the site and the adjacent Mura 2 Solar site, during the site verification and recovered in October 2022.

Given the extent of the site and the relatively favourable conditions at the time of the site visit, there are few limitations and assumptions required with regards to the vegetation of the site. In terms of fauna, the habitats present within the site were well-investigated and it is unlikely that there are any features of concern present that have not been observed. **Figure 7-3** shows the terrestrial biodiversity sensitivity determined for the site

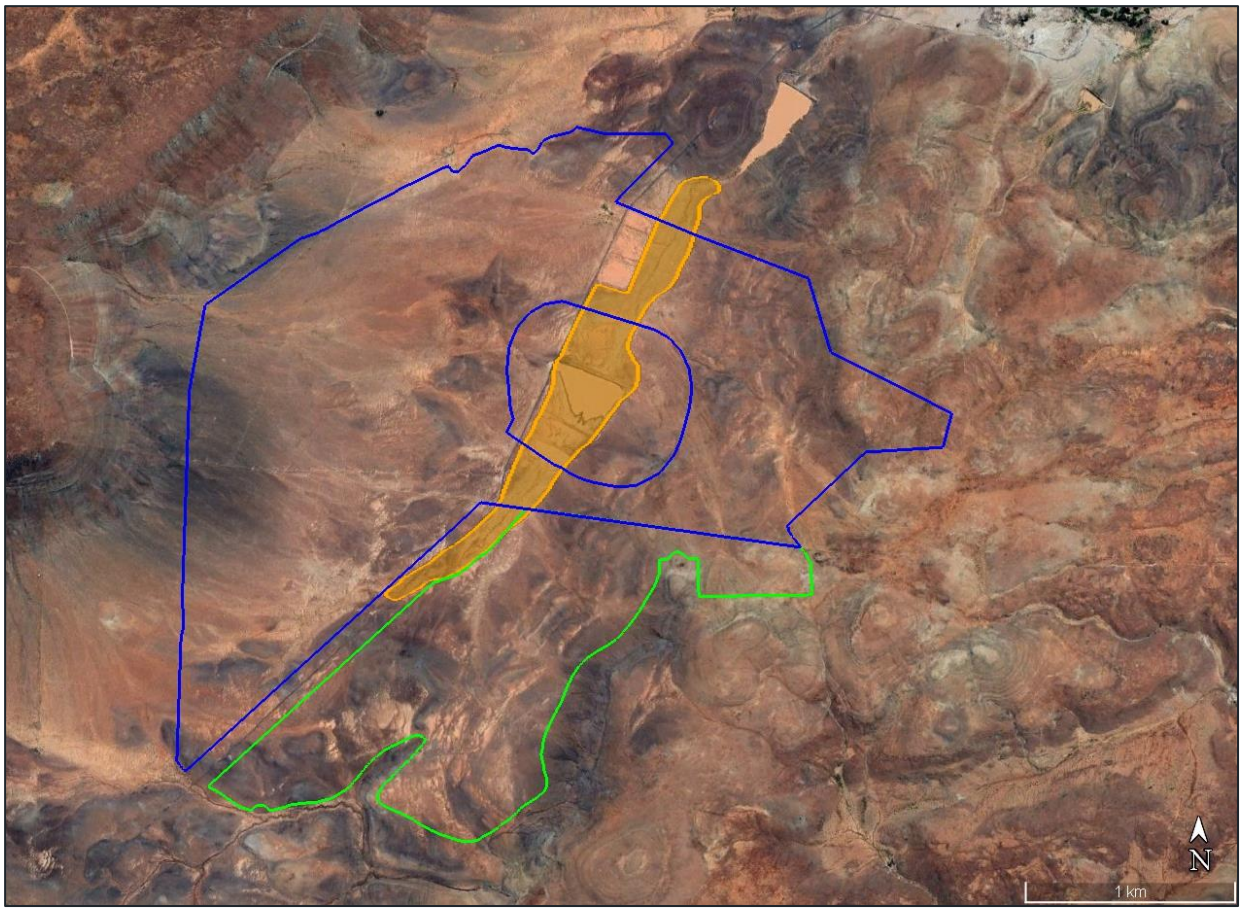


Figure 7-3 - Sensitivity map for the Mura 1 and Mura 2 project areas, illustrating areas with habitats of higher sensitivity that should be avoided as much as possible by the development

7.3 AQUATIC BIODIVERSITY

The DFFE Screening Tool map for the Aquatic Biodiversity at the Mura 1 PV Solar Facility (**Figure 7-4**) indicates the area to be of low sensitivity. The aquatic ecosystem assessment concurs with the Aquatic Biodiversity Sensitivity mapping, that the area is of low sensitivity.

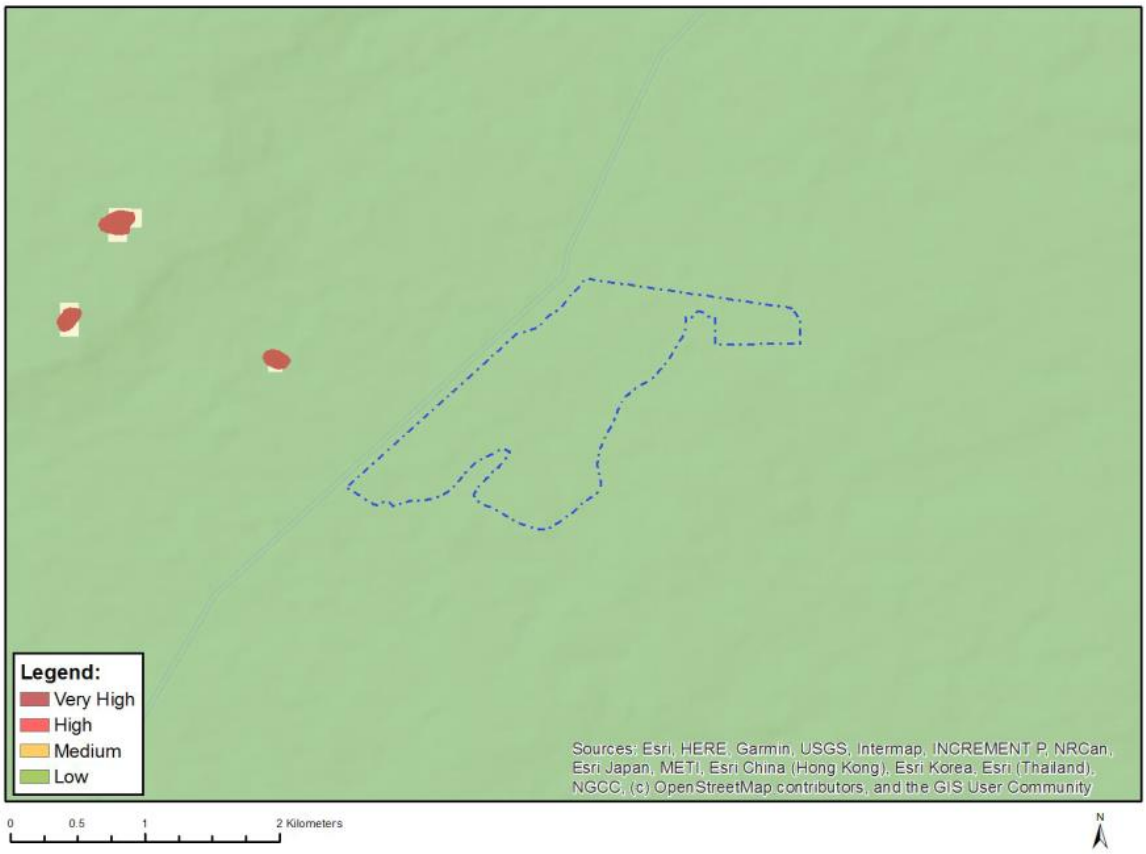


Figure 7-4 - Map of Aquatic Biodiversity Sensitivity

Source: DFFE Screening Report

Table 7-2 contains a summary of the aquatic ecological condition, ecological importance and sensitivity and recommended ecological category as well as the sensitivity and associated buffers for the aquatic features, based on the field assessment.

Table 7-2 - Summary of condition, ecological importance and sensitivity of aquatic features together with recommended buffers

Aquatic feature	PES	EIS	REC	Sensitivity	Recommended buffer
Krom River	B/C	High	B/C	High	35m and surrounding valley bottom and floodplain wetland and buffer
Small tributaries	A/B	Moderate	A/B	Medium	35
Valley bottom wetlands	B	Moderate	B	Medium	35

Based on the PES, EI&ES and REC above, aquatic sensitivity and recommended buffers have been mapped to protect these ecosystems. The recommended buffer area between the aquatic features and the project components is 35m from the centre of these streams or along the delineated edge of the wide associated floodplain area. The buffer areas are areas of protection recommended as a development setback for the PV Facilities that is intended to reduce the edge effect and direct impacts on the integrity and functionality of the aquatic ecosystems. The projects sites have generally avoided the high sensitivity areas, following the input received as part of the screening assessment undertaken.

In terms of the proposed layout there are some minor watercourses that occur within each of the proposed PV Facilities. These watercourses are deemed of moderate sensitivity and the potential impact of the proposed activities is likely to be of low significance that they would not pose a constraint to the proposed development if mitigated. No infrastructure or panels may be placed within these watercourses but the underground cables and limited-service tracks may be constructed through these features. Similarly, the proposed widening of the access roads are along existing roads and the watercourse crossings can be adequately mitigated so that these aquatic ecosystems would not be a constraint to the required upgrade to the existing roads. Therefore, the proposed associated widening of existing roads, construction of underground cables and limited-service tracks can be undertaken within the aquatic features and buffers if adequately mitigated.

Figure 7-5 indicates the aquatic sensitivity layers and their associated recommended buffers for the proposed projects. The no-go areas (red lines) are areas of high aquatic sensitivity that should be avoided for the PV facilities. The existing access roads that intersecting with the high sensitivity areas will be upgraded and is acceptable. The medium sensitivity (yellow areas) should be avoided where possible, or in the case of the new service tracks and underground cables, adequately mitigated.

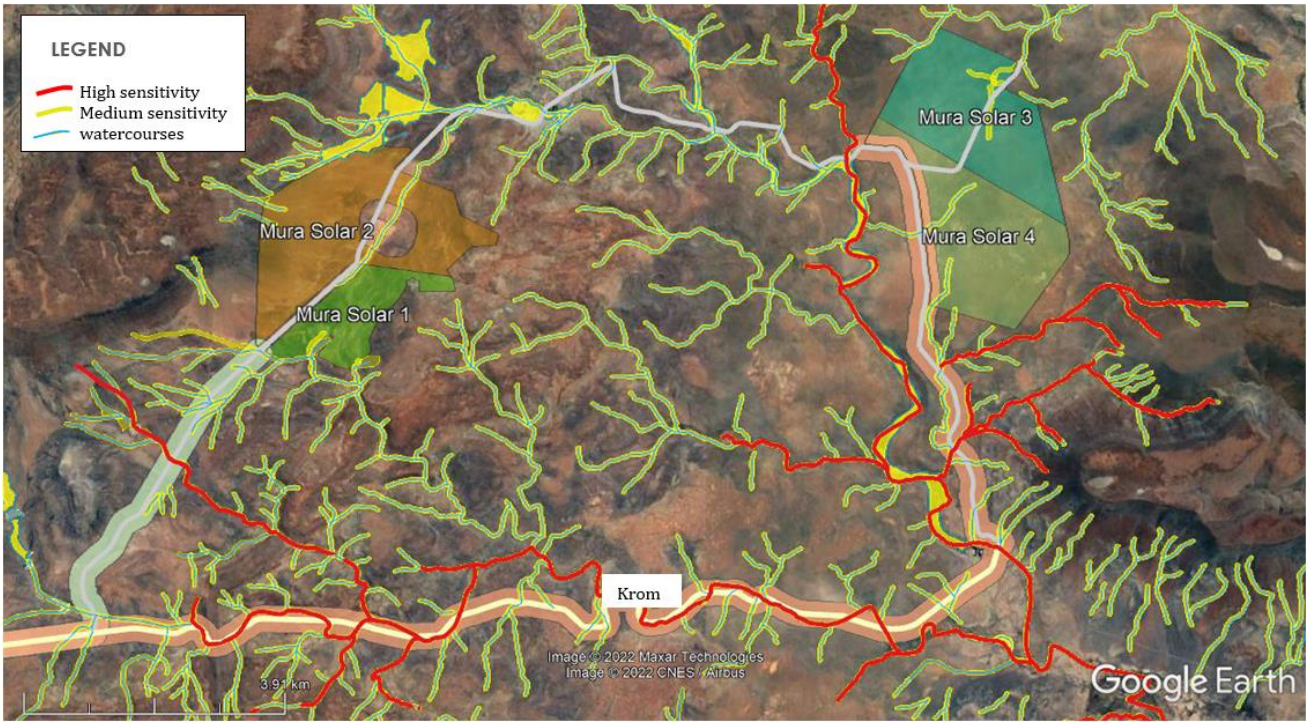


Figure 7-5 - Recommended aquatic buffer/setback areas and associated aquatic ecosystem sensitivity mapping

7.4 PLANT SPECIES

The DFFE Screening Tool indicates that the site falls within an area with Low Sensitivity under the Plant Species Theme (**Figure 7-6**). The site verification was able to confirm this low sensitivity and no plant SCC were observed on the site.

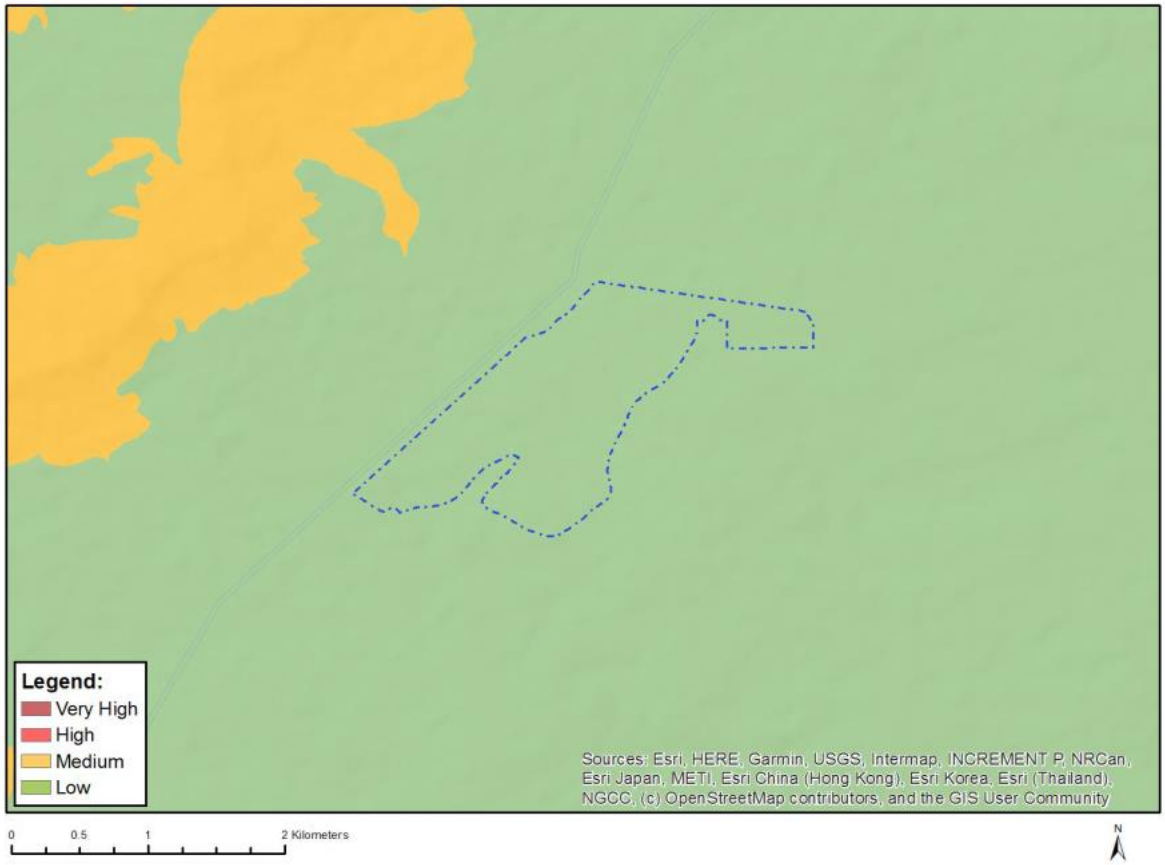


Figure 7-6 - Map of Plant Species Sensitivity

Source: DFFE Screening Report

The site was visited twice for the current project. An initial field assessment took place on the 9th of June 2022 and a follow-up field assessment on the 19th of October 2022. During the initial field assessment, a broad area covering the Mura 1 and the Mura 2 PV areas was investigated in the field and the primary aim was to survey the ecological features of the site to inform a sensitivity map of the whole project area that can be used to guide the final development footprint for the PV areas and grid connection. A full species list for the site was developed during the field sampling and attention was paid to the possible presence of any flora of concern within the development footprint. Sensitive species and habitats within the footprint were recorded where present and mapped with a GPS if necessary. The track that was walked through the Mura 1 Solar PV footprint areas has a total length in excess of 3km. This included some areas that are outside of the final development footprint as the initial area provided for assessment included areas that were later excluded on the grounds of being unsuitable for PV development based on the results of the initial field assessment.

During the follow-up field assessment, the vegetation had dried significantly from the initial site visit and no additional species were observed.

7.5 ANIMAL SPECIES

The DFFE Screening Tool indicates that the site has a high sensitivity (**Figure 7-7**) due to the potential presence of the Karoo Dwarf Tortoise *Tortoise Chersobius boulengeri* (EN) and Riverine Rabbit *Bunolagus monticularis* (CR) within the project site. However, the site verification indicates that there is no suitable habitat for either species within the PV development footprint indicating that the site can be considered low sensitivity in terms of this species.

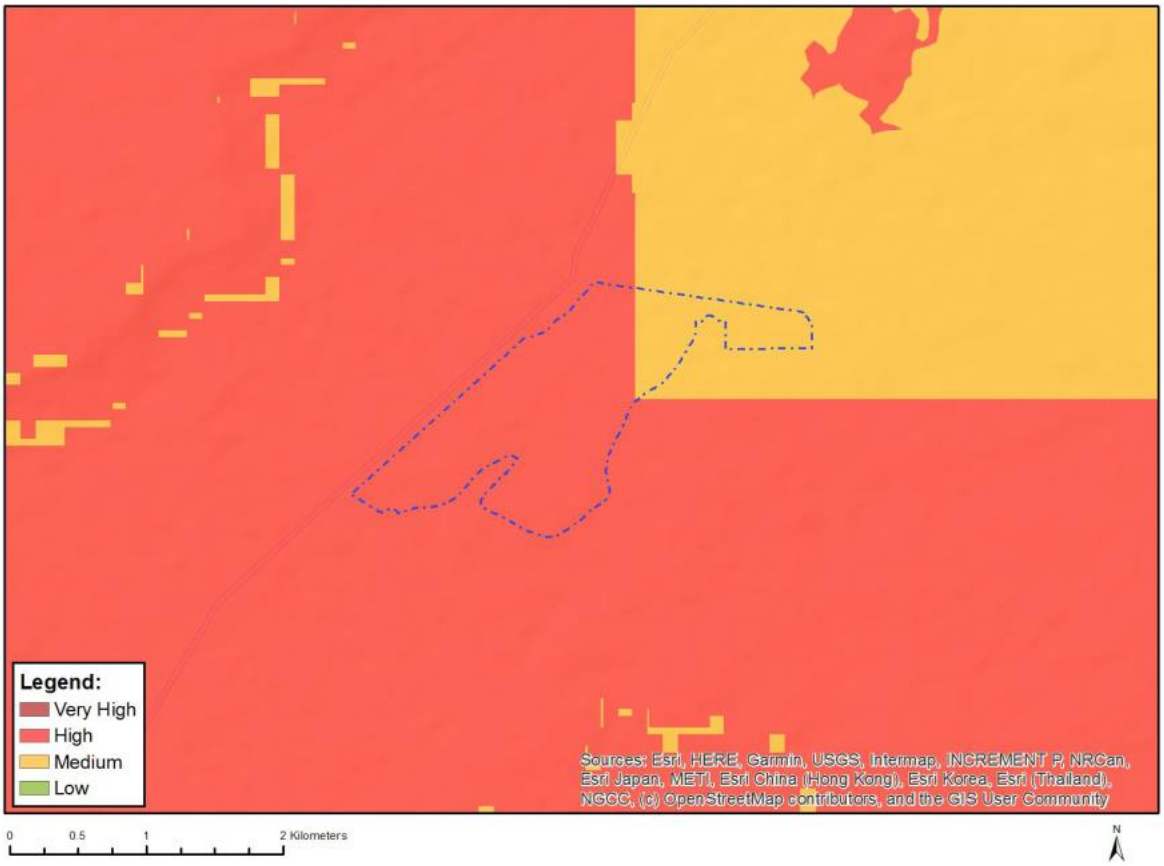


Figure 7-7 - Map of Animal Species Sensitivity

Source: DFFE Screening Report

An initial field assessment took place on the 9th of June 2022 and a follow-up field assessment on the 19th of October 2022. During the initial field assessment, a broad area was investigated in the field and the primary aim was to survey the ecological features of the site to inform a sensitivity map of the whole project area that has been used to guide the final development footprint for the PV areas and grid connection. During the initial field assessment, three camera traps were located across the Mura 1 and Mura 2 site and recovered during the second field assessment, giving rise to four months of camera trapping at the site. During the walked transects conducted across the site, all animal species directly or indirectly observed were recorded. Within habitats likely to harbour species of concern, active searches were conducted which included looking under rocks, within dense bushes and other shelter sites. In addition, specific attention to the presence of dead tortoise

carapaces was paid as this is frequently the only sign of less common species that can readily be observed. If present, sensitive species locations and habitats within the footprint were recorded and mapped with a GPS. The track that was walked through the different PV footprint areas has a total length in excess of 8km.

7.6 AVIFAUNA

A map of the proposed Mura 1 development area overlaid on the screening tool sensitivity is given in **Figure 7-8**. The DFFE Screening Tool rates the Avian Theme as Low Sensitivity.

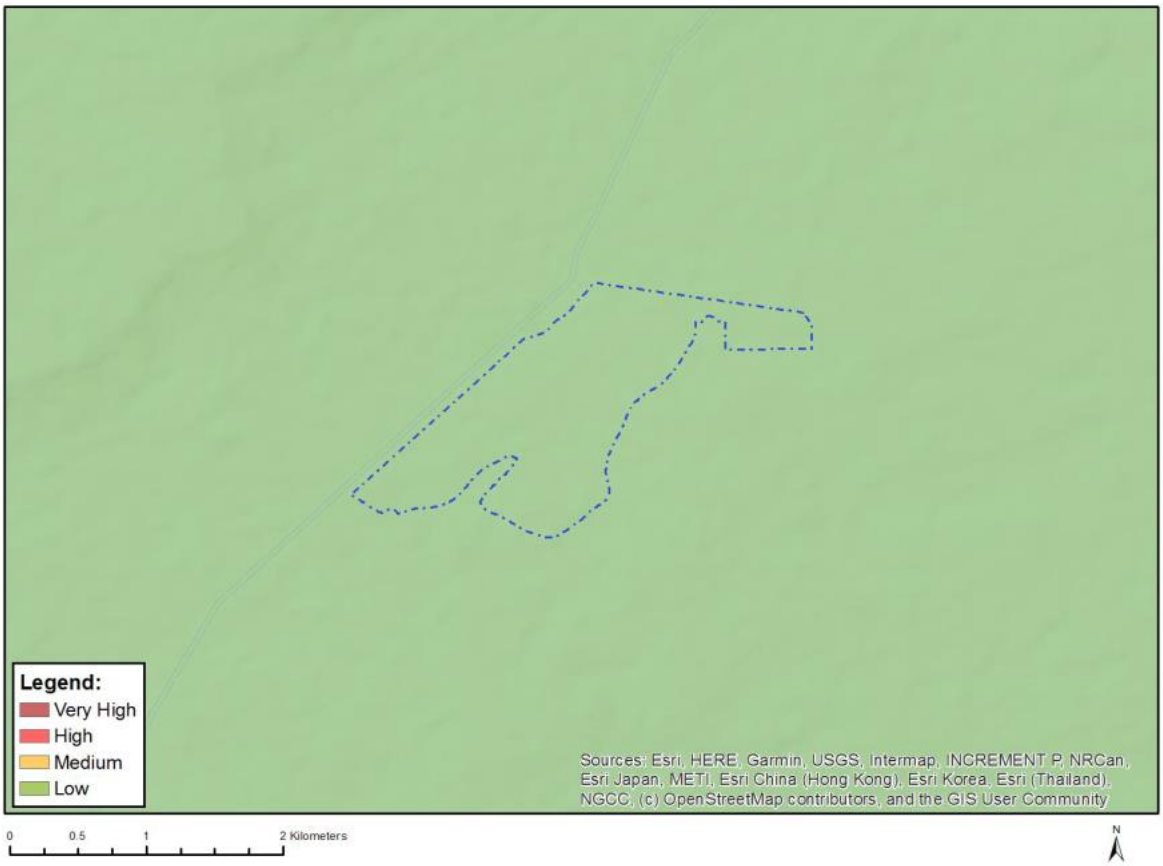


Figure 7-8 - Map of Avian Sensitivity

Source: DFFE Screening Report

Based on a site verification survey, two seasons of pre-construction bird monitoring (in accordance with best practice), and extensive previous work in the area for the Nuweveld Wind Farms, WildSkies draw the following conclusions:

- The two listed species: Ludwig's Bustard; and Verreaux's Eagle do occur on the proposed site:
  - Ludwig's Bustard has been recorded as follows on site: twice on drive transects in spring (1 and 3 birds); four times as incidental records of single birds and pairs. The species can be expected to forage on site at times. However, no evidence of breeding was recorded.
  - Verreaux's Eagle has been recorded twice (both single birds) incidentally and has a nest approximately 5.2km south-west of south of Mura 3 and 4, which has been protected by a 2km No-Go buffer.

Based on the on-site work Wildskies confirms that the site is of Medium sensitivity for avifauna.

During the screening phase, the following sensitive areas on site for avifauna were identified. Two sensitive avifaunal feature categories were identified on the site:

- **Dams:** Dams provide an open source of surface water and attract birds to drink, wash, feed and roost. These areas should be avoided by the proposed infrastructure. We used the SANFEPA and NBA2018 shape files to identify dams on site, of which there are relatively few. A buffer of 250m was applied to these dams and the resulting areas are classified as No-Go for new PV or overhead line infrastructure and roads (**Table 7-3**). Use may be made of existing roads within these areas.
- **Bird nests:** Most of the sensitive nests in the broader area are sufficiently far from the proposed areas to be irrelevant to this phase of study. However, one Verreaux's Eagle nest was previously considered close enough to be relevant. An alternate nest for this pair of eagles also exists to the east. Wildskies have assigned a No-Go buffer for new infrastructure of 2km to these two nests (**Table 7-3**). This buffer size is determined by Wildskies own judgement and is intended to provide protection against disturbance of the birds' breeding during construction and operations; and destruction of foraging habitat for the birds. This buffer size is less than half that required for wind farms, because direct mortality of eagles (through collision) is not likely on the PV facilities. This buffer area is considered a No-Go area for new PV infrastructure and new roads. Use may be made of existing roads (which may be widened) within this area.

Table 7-3 – Avifaunal sensitivity features for solar areas

Category	Feature
No Go	▪ Dams plus 250m buffer ▪ Verreaux's Eagle nest x 2 (1 alternate) plus 2 000m buffer

Avifaunal constraints are presented in **Figure 7-9** for the full site. There are no conflicts between the planned infrastructure and the No-Go areas.

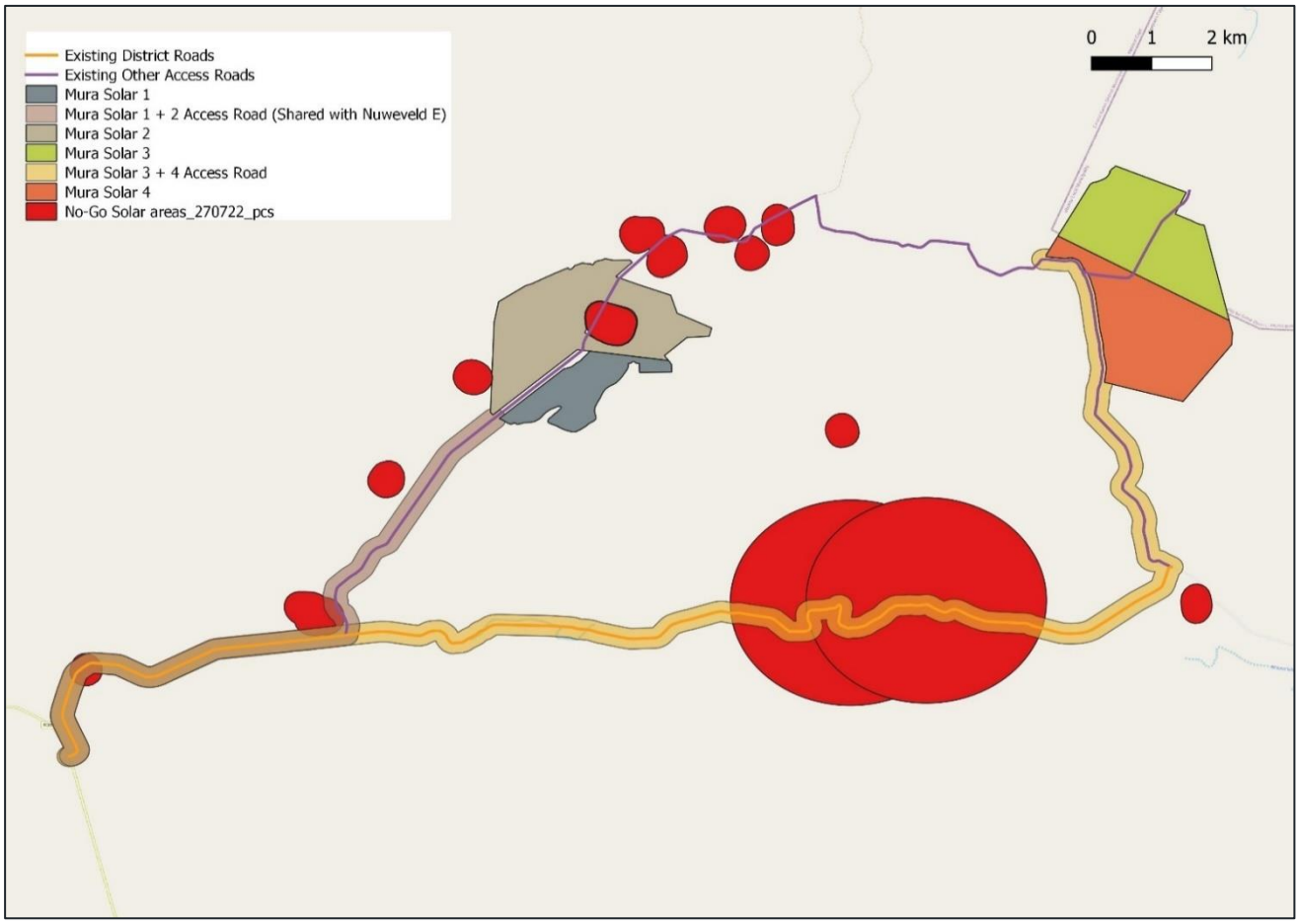


Figure 7-9 - Avifaunal sensitivity of the overall PV site

7.7 ARCHAEOLOGICAL AND CULTURAL HERITAGE

The output of the DFFE Screening Tool for the Archaeological and Heritage Theme is illustrated in **Figure 7-10** and indicates that Mura 2 site is classified as low. The heritage specialist disputes the uniform low sensitivity of the broader study area noting that several areas of medium to high sensitivity are present. Also, the wider landscape can be considered as at least medium sensitivity. In sum, the overall sensitivity is best considered to be medium.

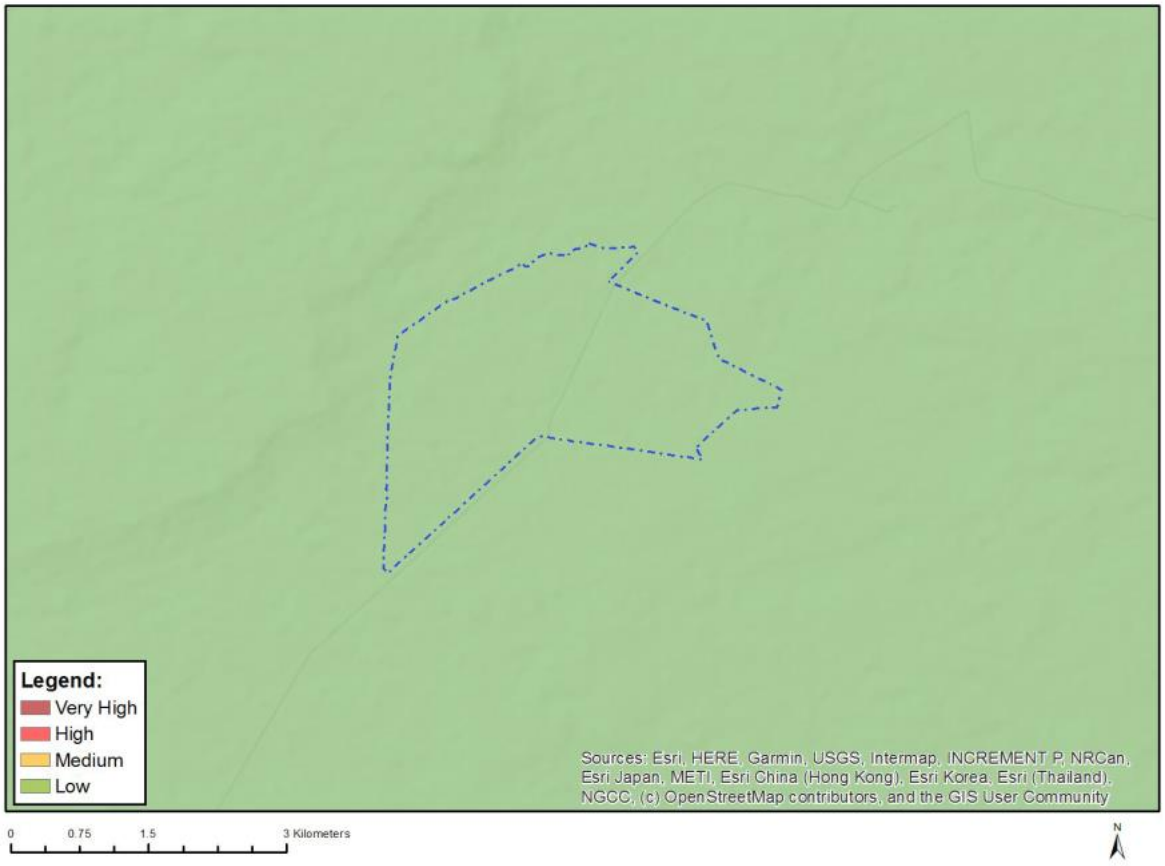


Figure 7-10 - Map of Archaeological and Heritage Sensitivity

Source: DFFE Screening Report

Section 38(3)(b) of the NHRA requires an assessment of the significance of all heritage resources. In terms of Section 2(vi), ‘‘cultural significance’’ means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance. The reasons that a place may have cultural significance are outlined in Section 3(3) of the NHRA.

Although archaeological resources of up to grade IIIA occur close to the access road corridors, none are close enough to be of further concern. Within the PV footprint there are sites of up to grade IIIC, but sites graded up to IIIB occur nearby in areas excluded from development. These resources have variable cultural significance at the local level for their historical, social and scientific values.

Graves are deemed to have high cultural significance at the local level for their social value but are unlikely to occur. If found, they would be allocated a grade of IIIA.

The cultural landscape is largely a natural landscape with aesthetic value and is rated as having medium cultural significance at the local level. It can be graded IIIB.

Known heritage resources are mapped with 50 m buffers in **Figure 7-11** and **Figure 7-12**.

The maps show the following heritage grading requirements:

- Grade IIIA (red) is regarded as No-Go;
- Grade IIIB (orange) is high sensitivity; and

Grade IIIC/GPA/GPB (yellow) are medium.

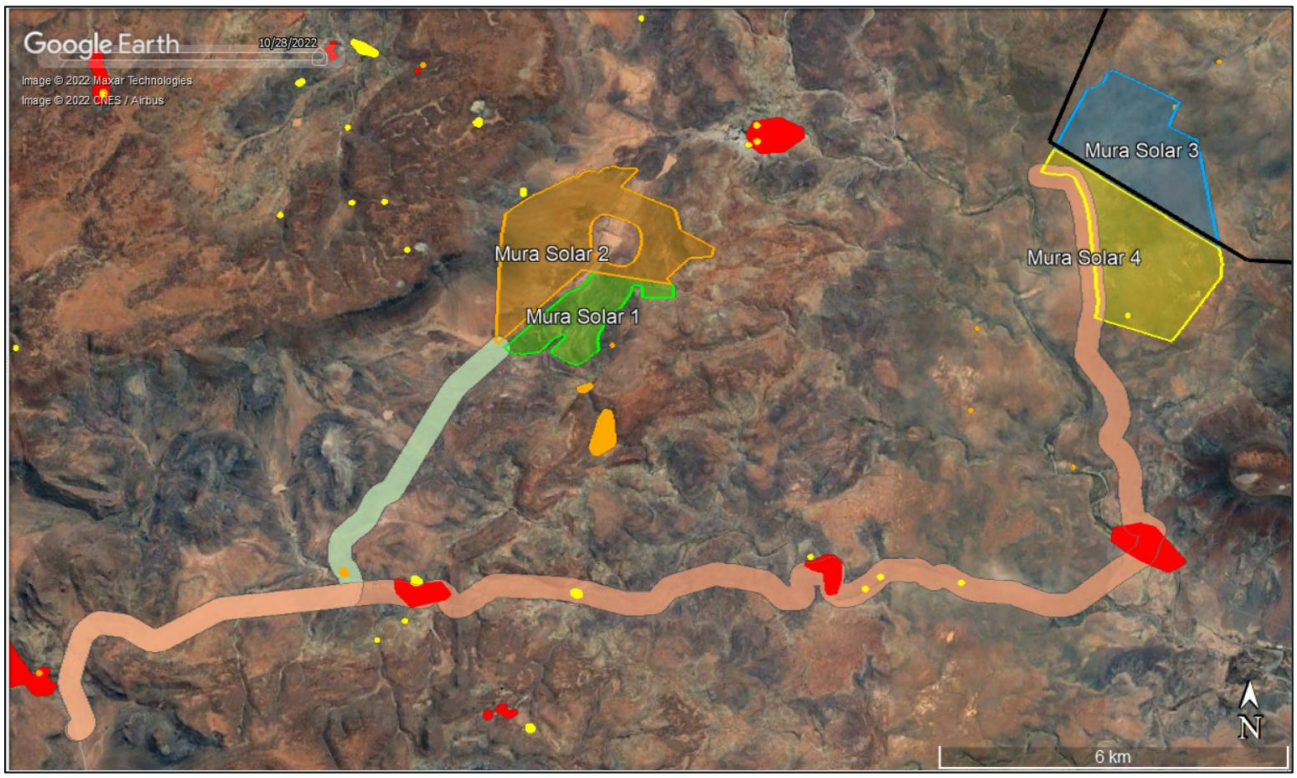


Figure 7-11 - Grade map of the study area. Note that it is constructed using data from several projects but that only those sites directly relevant to this project appear in the report

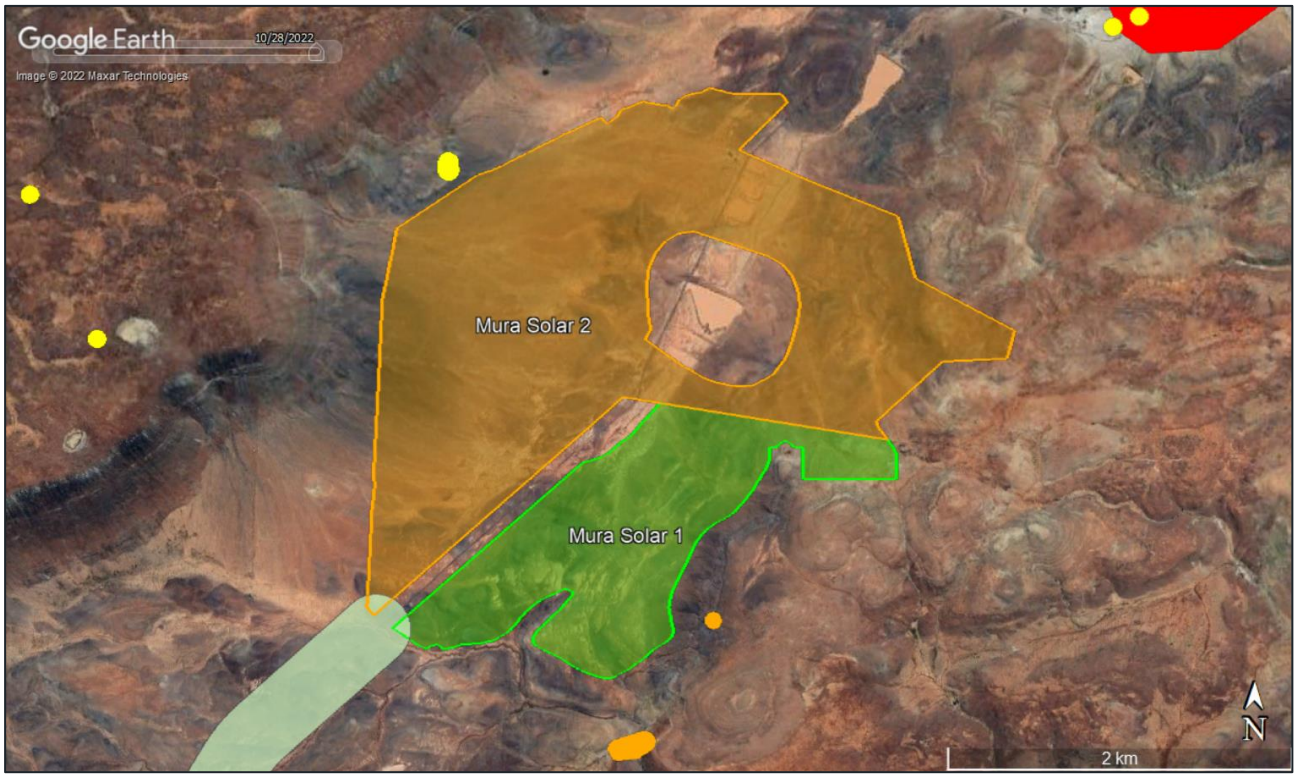


Figure 7-12 - Smaller scale map showing heritage resource grading in the vicinity of the Mura 1 and Mura 2 footprints

The landscape on site is very flat and guidelines for the placement of infrastructure within the footprint areas are not deemed necessary.

7.8 PALAEONTOLOGY

Provisional site sensitivity mapping for palaeontology using the DFFE National Web-Based Environmental Screening Tool (as well as the SAHRIS Palaeosensitivity Map) suggests that Mura 1 falls within a Very High Sensitivity (**Figure 7-13**). Small sectors of the project areas that are underlain by substantial alluvial deposits along major drainage lines are assigned a Medium Palaeosensitivity while areas underlain by dolerite intrusions are palaeontologically Insensitive.

A Low Palaeosensitivity for Mura Solar 1 is inferred in this report on the basis of:

- Desktop analysis of relevant geological maps and palaeontological databases, including previous PIA studies in the region by the author (e.g. Nuweveld WEF cluster and Grid Connection);
- A six-day palaeontological heritage site visit to the combined Mura project area which yielded only a very sparse scatter of fossil sites (mostly of low scientific / conservation value) within the Lower Beaufort Group bedrocks and no Late Caenozoic sites;
- Generally low to very low levels of bedrock exposure, especially within the low-relief Mura Solar 1-4 project areas. Most fossil sites occur in gullied hillslopes and along major drainage lines which form only a very minor part of the combined project area;
- Dolerite intrusions which have compromised fossil preservation in some sectors of the combined project area.

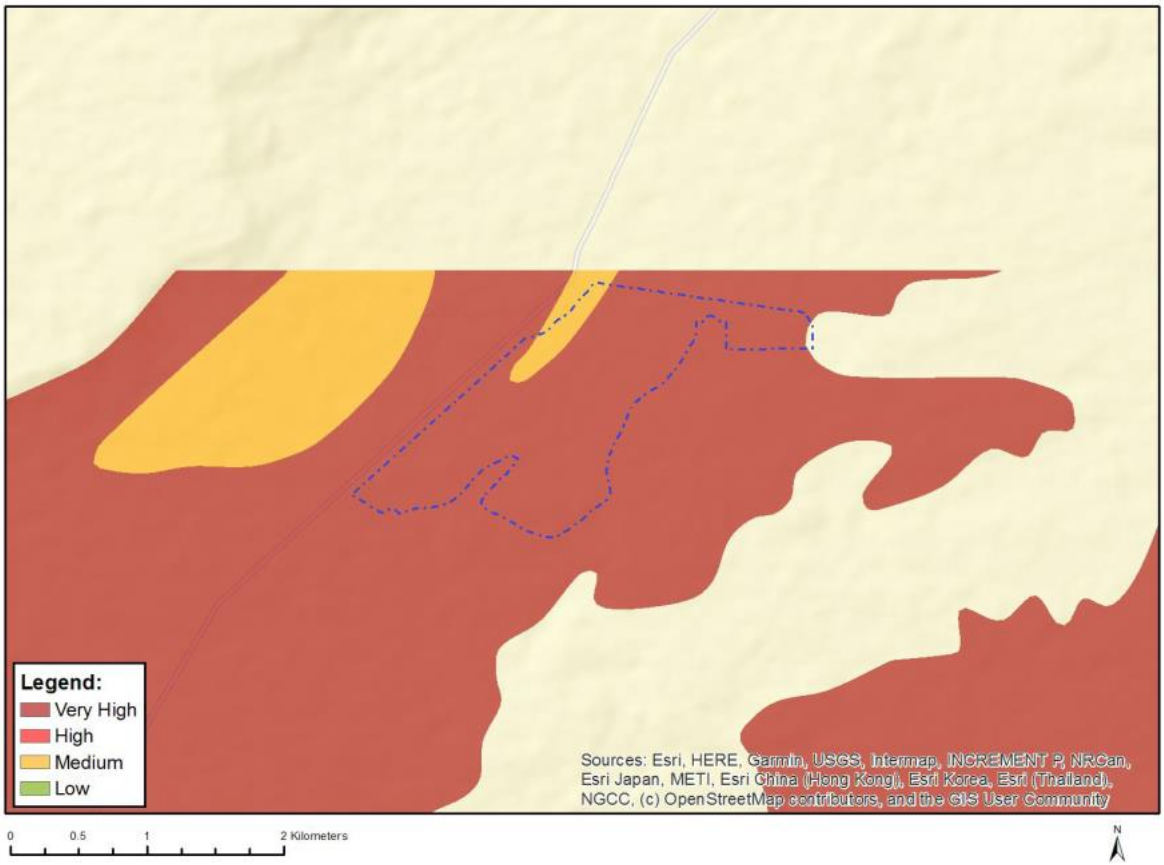


Figure 7-13 - Map of Palaeontology Sensitivity

Source: DFFE Screening Report

7.9 VISUAL

A map of the proposed Mura 1 development area overlaid on the screening tool sensitivity is given in **Figure 7-14**. The classification of the site as high sensitivity is because of the mountain tops and high ridges identified by the screening tool.

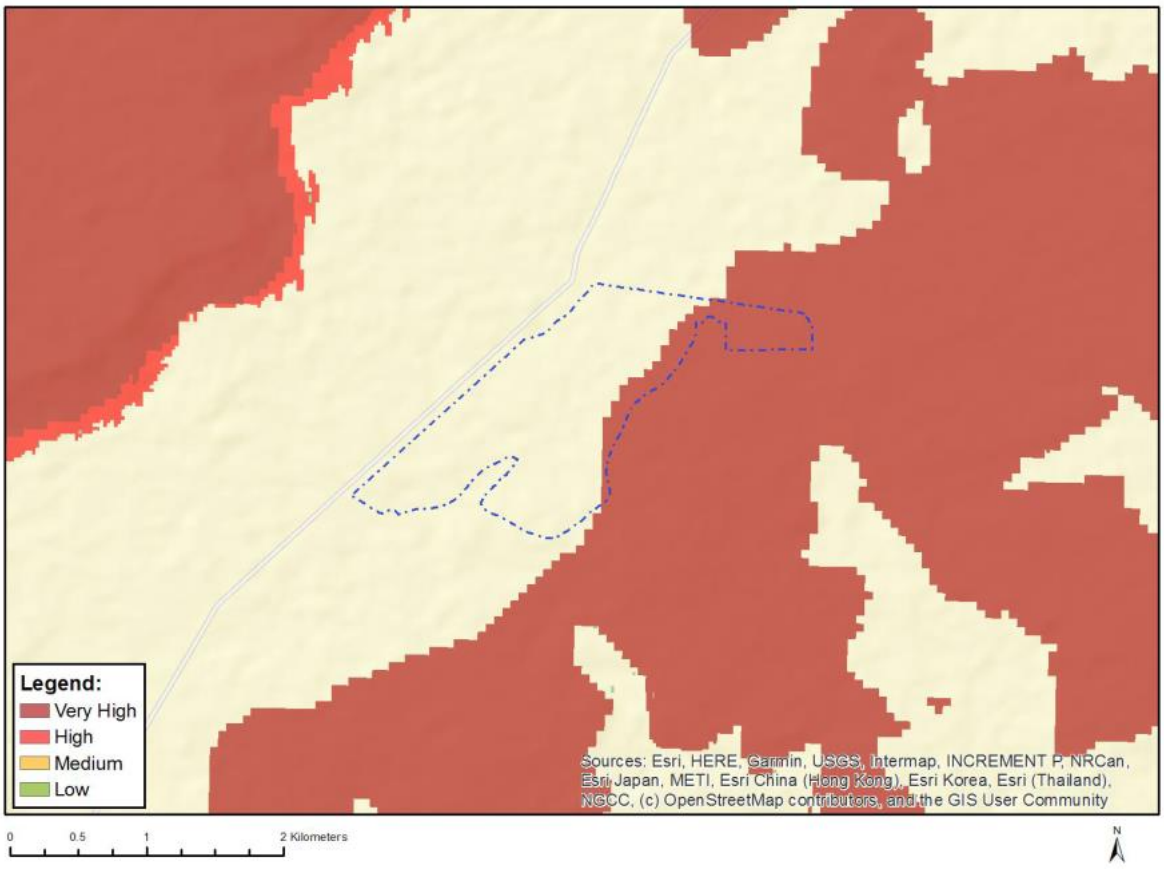


Figure 7-14 - Map of Landscape Sensitivity

Source: DFFE Screening Report

Visibility

Estimated degrees of visibility based on the scale of the facilities and related infrastructure, and on distance from various receptors are indicated in **Table 7-4** and **Table 7-5**.

Table 7-4 – Degrees of Visibility of Proposed Solar Project Facilities

Very high visibility	0-500m	Prominent feature within the observer's view frame
High visibility	500m-1km	Relatively prominent within observer's view frame
Moderate visibility	1-2km	Only prominent as part of the wider landscape
Low visibility	2-4km	Visible as a minor element in the landscape
Very low visibility	>4km	Hardly visible with the naked eye in the distance

Table 7-5 - Viewing Distances and Potential Visibility from Receptors

Farmsteads in the Study Area	Distance to PV1	Distance to PV2	Distance to PV3	Distance to PV4	Potential Visibility
Leeukloof	4.36km	4.42km	13.14km	12.4km	Low visibility. View shadow.
Gansfontein	8.54km	7.15km	5.7km	6.25km	Low visibility. Beyond 5km
Abramskraal	14.76km	13.87km	5.61km	6.74km	Low visibility. Beyond 5km
Bultfontein	2.97km	1.96km	4.96km	4.79km	Moderate visibility (see pano)
Booiskraal	9.05km	8.83km	5.07km	3.38km	Low visibility. View shadow.

Visual Exposure

The viewshed, or zone of visual influence, potentially extends for some 5km, but is partly restricted by topography in some directions, where parts of the surrounding area would be in a view shadow (Figure 7-15). The viewsheds of the proposed solar PV facilities tend to be fairly localised.

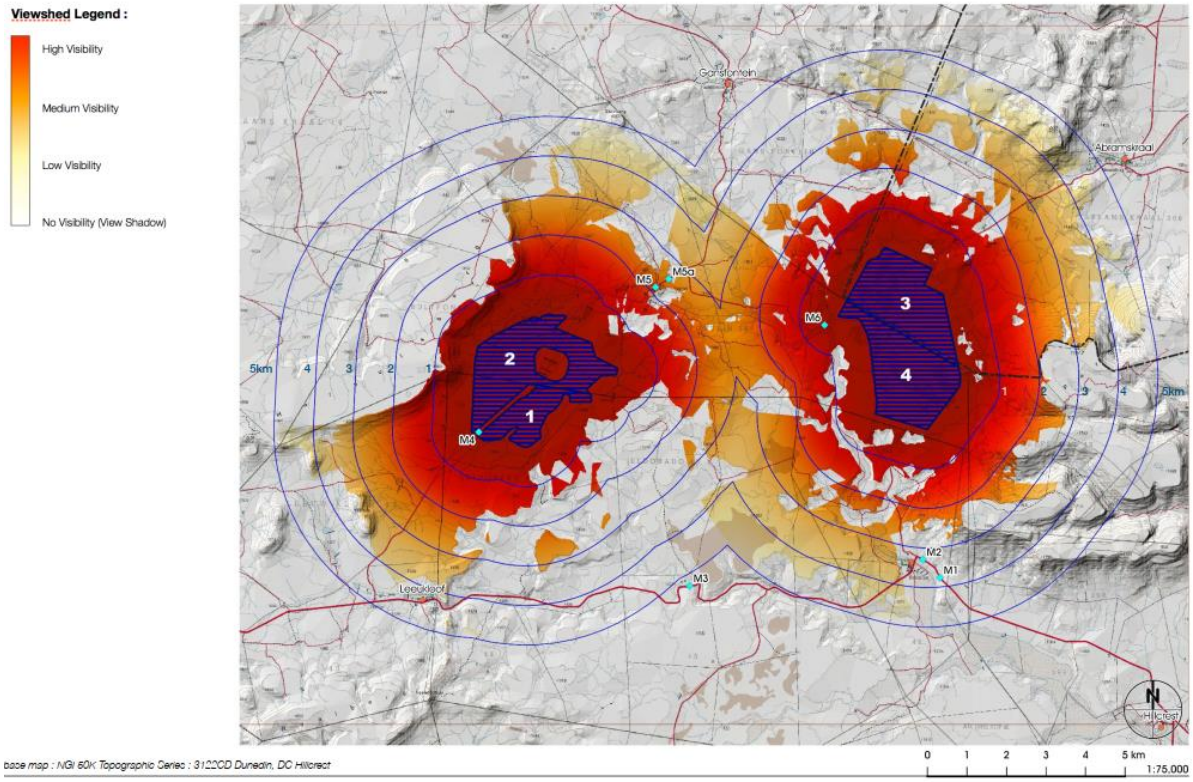


Figure 7-15 – Nominal Viewshed

Visual Absorption Capacity (VAC)

This relates to the potential of the landscape to screen the proposed solar projects from view. The largely treeless landscape provides little screening effect. In most cases, clumps of trees around farmsteads tend to reduce visibility by receptors.

Landscape Integrity

Landscape integrity tends to be enhanced by scenic or rural quality and intactness of the landscape, as well as absence of other visual intrusions. Cultural landscapes, such as rural or farming scenes also have visual or scenic value. On the other hand, industrial activity and visual 'clutter', including substations and powerlines, detract from these scenes. The sites for the solar projects generally have uncluttered, expansive landscapes with pastoral scenes.

Visually Sensitive Resources

Natural and cultural landscapes, or scenic resources, form part of the 'National Estate' and may have local, regional or even national significance, usually, but not only, of tourism importance. **Figure 7-16** indicates landscape features of interest Visual Impact Intensity.

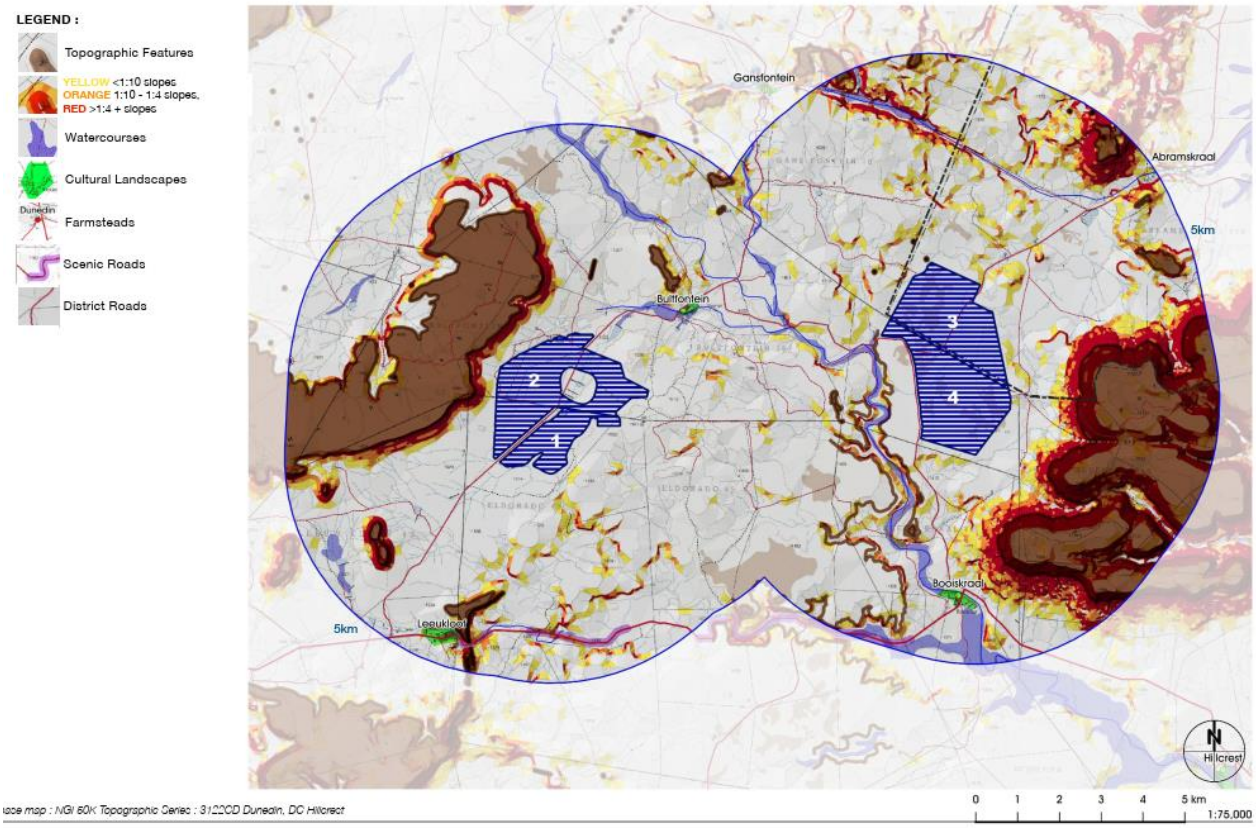


Figure 7-16 – Visual features

The overall potential visual impact intensity (or magnitude) is determined in **Table 7-6** below by combining all the factors above, namely visual exposure, visibility, visual absorption capacity, landscape integrity and visually sensitive resources.

Table 7-6 – Visual Impact Intensity

Visual Criteria	Comments	Solar facilities	Internal Access roads (incl. construction camps)
Visual exposure	Limited viewshed of solar facilities	Medium-low	Low
Visibility	Visible from a number of farmsteads.	Medium	Low
Visual absorption capacity (VAC)	Visually exposed plains, and therefore low VAC.	Medium	Low
Landscape integrity / intactness	Effect on rural / pastoral farming character.	Medium-high	Low-medium
Landscape / scenic sensitivity	Effect on scenic resources.	Low	Low
Impact intensity	Summary	Medium	Low

Visual Sensitivity Mapping

Landscape features of visual or scenic value, along with potential sensitive receptors in the surroundings, are described in **Table 7-7** below. Visual features are indicated on **Figure 7-16**.

Table 7-7 - Typical Scenic Features and Sensitive Receptors

Landscape features within study area	
Topographic features	Characteristic landforms include the mesas and koppies formed from horizontal dolerite sills and vertical dolerite dykes. These features contribute to the scenic value, providing visual interest or contrast in the open Karoo landscape.
Water Features	In the dry landscape, drainage features and the larger dams provide scenic and amenity value.
Cultural landscapes	Green patches of cultivated land and tree copses in alluvial valleys form part of the cultural landscape. Archaeological sites also form part of the cultural landscape, covered elsewhere in the Heritage Assessment.
Receptors within study area	
Protected Areas	Visual significance is increased by the protection status of reserves. There are no known proclaimed nature reserves, private reserves or game farms in the vicinity of the proposed solar projects.
Guest farms	Private guest farms and guest accommodation in the area are important for the local tourism economy and tend to be sensitive to loss or degradation of scenic quality. There are no guest farms within 3km of the solar projects.
Human settlements, farmsteads	Except for the nearby farmsteads, there are no other settlements within the study area.

Scenic and arterial routes	Much of the route between Leeukloof and Booiskraal has scenic features.

Scenic resources and sensitive receptors within the study area have been categorised into no-go, high sensitivity, medium and low visual sensitivity zones, for the proposed solar PV facilities, as indicated in **Table 7-8** below.

Table 7-8 – Sensitivity Categories

Category	Feature
No Go	Areas or features considered of such sensitivity or importance that any adverse effects upon them may be regarded as a fatal flaw.
High	Development to be limited and remain within acceptable limits of change determined by the specialist, and comply with restrictions or mitigation measures identified by the specialist.
Medium	Areas considered to be developable, but to remain within acceptable limits of change as determined by the specialist, and comply with restrictions or mitigation measures identified by the specialist.
Low	Low sensitivity areas that are considered to be developable. However specialists may still wish to define acceptable limits of change where necessary.

The visual sensitivity categories in relation to the mapping are outlined in **Table 7-9**, and indicated on **Figure 7-17**.

Table 7-9 – Visual Sensitivity Buffers for the Proposed Solar Project Areas

Scenic Resources	Very high sensitivity (No-go)	High visual sensitivity	Medium visual sensitivity	Low visual sensitivity
Topographic features	within 100m	within 250m	-	-
Steep slopes	Slopes > 1:4	Slopes > 1:10	-	-
River features	Feature	Within 500m	-	-
Cultural landscapes/ cropland	within 250m	within 500m	-	-
Protected Landscapes / Sensitive Receptors				
Private reserves /guest farms	within 500m	within 1 km	within 2 km	-
Farmsteads outside site	within 500m	within 1 km	within 2 km	-
Farmsteads inside site	within 250m	within 500m	-	-
Scenic routes, poorts, passes	within 750m	within 1 km	within 2 km	-
District roads	within 100m	within 150m	within 250m	-

Scenic Resources	Very high sensitivity (No-go)	High visual sensitivity	Medium visual sensitivity	Low visual sensitivity
Minor roads	within 50m	within 100m	within 150m	-

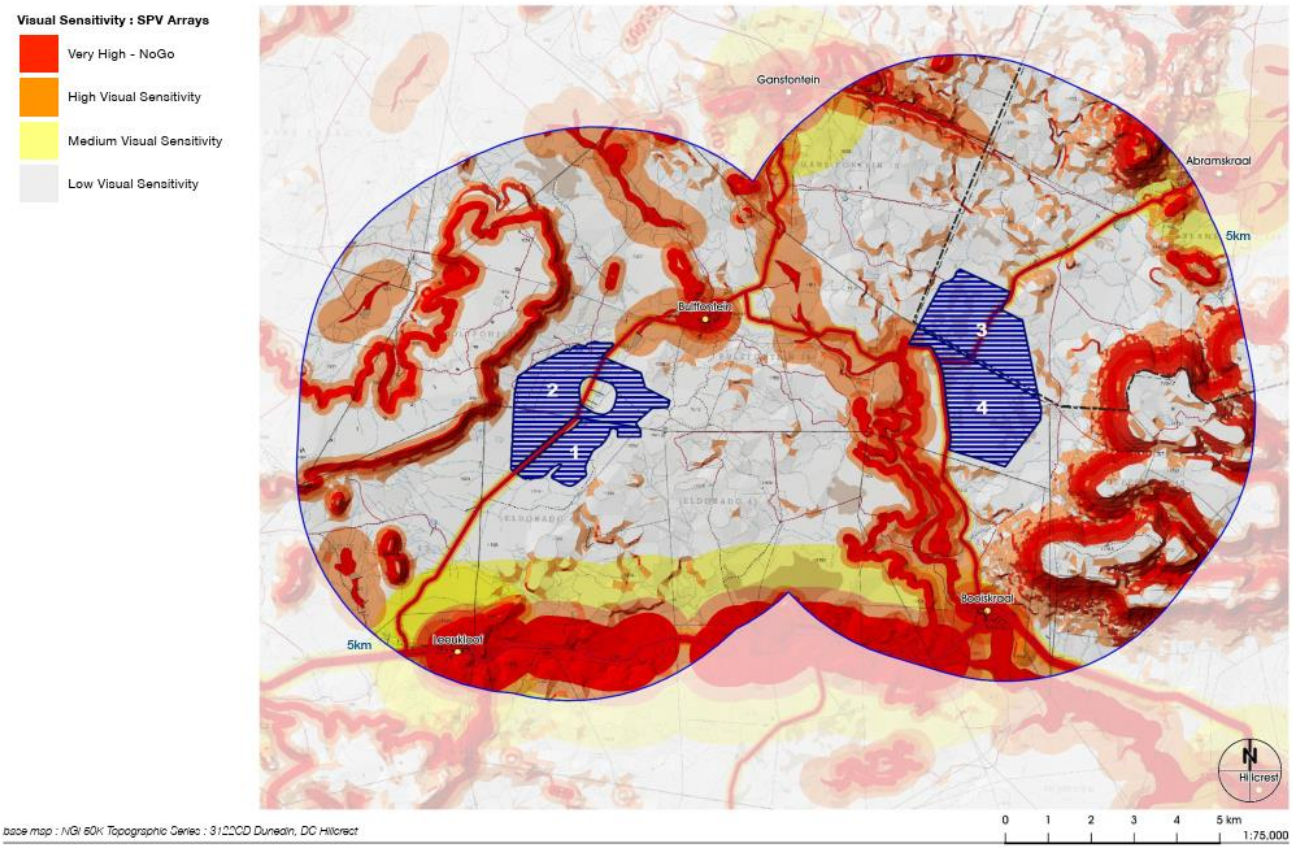


Figure 7-17 – Visual Sensitvity

7.10 SOCIAL

No preliminary socio-economic sensitivities or sensitivity rating was identified or provided based on the DFFE Screening Tool (i.e. a preliminary sensitivity rating was not provided that could then be confirmed or altered based on further assessment).

It was determined by the specialist that the site would have a low to medium sensitivity rating based on the following:

- The planning documents relevant to the site do not identify significant or inherent constraints to appropriate development. Considered as a whole, the planning documents reviewed recognise the importance of integrated and diversified economic development that makes optimal use of the area's comparative advantages and creates economic opportunities. The concept of a renewable energy project is therefore broadly supported provided environmental impacts and impacts on other land uses and potentials are acceptable.
- Tourism facilities and attractions in the areas are very limited and sparsely distributed reducing tourism sensitivities. However, it should be recognised that the area is relatively isolated with

wilderness quality and limited signs of civilisation which contributes to its tourism potential. It has a remote sense of place which makes it more sensitive to potential impacts on tourism and also on surrounding landowners and communities.

- Given its remote and relatively isolated location, the site would be relatively sensitive to the influx of people, including job seekers, that may be associated with the project. The influx of large numbers of people are not thought likely and these risks should be manageable and are common to most larger projects.
- The area is sensitive, in a positive sense, to increased economic opportunities as they are much needed as reflected in low employment and income levels. Projects that can provide such opportunities are therefore to be encouraged where possible.

7.11 RADIO FREQUENCY INTERFERENCE

The output of the DFFE Screening Tool for the RFI Theme is illustrated in **Figure 7-18** and indicates that the whole of the Mura 1 site falls within an area classified as High Sensitivity. The project site for the Mura 1 Solar PV facility falls outside the Karoo Central Astronomy Advantage Area (KCAAA). The protection of the KCAAAs were developed in terms of the Astronomy Geographic Advantage legislation (AGA Act of 2007). These regulations protect, preserve and properly maintain the KCAAAs in respect of radio frequency interference or interference in any other manner. The Mura 1 Solar PV Facility is located outside the KCAAA, as such, the site is considered low sensitivity for RFI.

Figure 7-18 - Map of RFI Sensitivity

Source: DFFE Screening Report

8 ENVIRONMENTAL IMPACT ASSESSMENT

This Chapter identifies the perceived environmental and social effects associated with the proposed Project. The assessment methodology is outlined in **Section 2.5**. The issues identified stem from those aspects presented in **Section 6** of this document as well as the Project description provided in **Section 3**.

Furthermore, a decommissioning assessment will be considered as part of the decommissioning process that will be subject to a separate authorisation and impact assessment process. Any decommissioning impacts will be assessed at this stage. The impact assessment in this section encompasses the geographical, physical, biological, social, economic, heritage and cultural aspects in accordance with Appendix 1 of GNR 326.

8.1 CLIMATE CHANGE ASSESSMENT

8.1.1 PROJECT IMPACT ON CLIMATE CHANGE

The project will lead to approximately 4.10 million tons CO_2e of avoided emissions (27.3 $ktCO_2e$ per MW). During the operation of the Project, the electricity generated by the Project will displace the use of more emission intensive technologies, such as coal-fired power stations.

The potential impact on climate change is indicated in **Table 8-1**.

Table 8-1 – Impact on climate change

Potential Impact: Climate change	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character
Without Mitigation	4	5	3	5	5	85	Very High	(+)
With Mitigation	N/A							
Mitigation and Management Measures	▪ Mitigation measures to address the impact of the Project on climate change is not required, as they are classified as renewable energy and therefore have an overall impact of very high positive significance.							

8.2 AGRICULTURAL POTENTIAL ASSESSMENT

There is ultimately only ever a single agricultural impact of a development and that is a change to the future agricultural production potential of the land. This impact occurs by way of different mechanisms some of which lead to a decrease in production potential and some of which lead to an increase. It is the net sum of positive and negative effects that determines the overall agricultural impact.

Two direct mechanisms have been identified that lead to decreased agricultural potential by:

- occupation of land - Agricultural land directly occupied by the development infrastructure will become restricted for agricultural use, with consequent potential loss of agricultural productivity for the duration of the project lifetime.
- soil erosion and degradation – Erosion can occur as a result of the alteration of the land surface run-off characteristics, predominantly through the establishment of hard surface areas including roads. Soil erosion is completely preventable. The stormwater management that will be an inherent part of the engineering on site and standard, best-practice erosion control measures recommended and included in the EMPR are likely to be effective in preventing soil erosion. Loss of topsoil can result from poor topsoil management during construction related excavations.

One indirect mechanism has been identified that could lead to increased agricultural potential through:

- increased financial security for farming operations – Reliable and predictable income will be generated by the farming enterprises through the lease of the land to the energy facilities. This is likely to increase their cash flow and financial security and could improve farming operations and productivity through increased investment into farming.

The extent to which any of these mechanisms is likely to actually affect levels of agricultural production is small and the overall impact of a change in agricultural production potential is therefore small and acceptable.

An Agricultural Compliance Statement is not required to formally rate agricultural impacts. It is only required to indicate whether or not the proposed development will have an unacceptable impact on the agricultural production capability of the site.

Nevertheless, it is hereby confirmed that the agricultural impact of the Mura 1 PV Facility is assessed as being of low significance, predominantly because of the low agricultural production potential of the site, and the impact is therefore acceptable.

Mitigation measures are all inherent in the project design and/or are standard, best-practice for construction sites:

- A system of stormwater management, which will prevent erosion, will be an inherent part of the engineering on site. Any occurrences of erosion must be attended to immediately and the integrity of the erosion control system at that point must be amended to prevent further erosion from occurring there.
- Any excavations done during the construction phase, in areas that will be re-vegetated at the end of the construction phase, must separate the upper 30 cm of topsoil from the rest of the excavation spoils and store it in a separate stockpile. When the excavation is back-filled, the topsoil must be back-filled last, so that it is at the surface. Topsoil should only be stripped in areas that are excavated. Across the majority of the site, including construction laydown areas, it will be much more effective for rehabilitation, to retain the topsoil in place. If levelling requires significant cutting, topsoil should be temporarily stockpiled and then re-spread after cutting, so that there is a covering of topsoil over the entire cut surface. It will be advantageous to have topsoil and vegetation cover below the panels during the operational phase to control dust and erosion.

8.3 TERRESTRIAL BIODIVERSITY COMPLIANCE STATEMENT

Due to low sensitivity of the site, only a terrestrial biodiversity compliance statement was undertaken for this project. As such, an impact assessment was not complied however **Table 8-2** includes avoidance and mitigation measures from the specialist that should be included in the EMPr for the Mura 1 Solar Facility in order to avoid, reduce and manage impacts on terrestrial biodiversity.

Table 8-2 – Proposed mitigation measures for terrestrial biodiversity

Impact/ Aspect	Mitigation/ Management Actions	Responsibility	Methodology	Mitigation/Management Objectives and Outcomes	Frequency
Construction Phase disturbance	Demarcate sensitive areas as no-go areas	Environmental Officer	Demarcate sensitive areas with construction tape, shield fencing etc as appropriate.	No excess habitat loss within sensitive areas.	Daily/As required during construction
Construction Phase disturbance	Rehabilitation of disturbed areas	Environmental Officer	Surface scarification and active rehabilitation of temporary use areas after construction with indigenous species.	Revegetation of cleared areas	After construction with annual follow-up to ensure adequate revegetation.
Alien Vegetation Management	Alien vegetation control	Environmental Officer	Walked Surveys of access roads, PV areas and associated infrastructure.	Alien vegetation clearing & control	Annual
Erosion Management	Erosion control and revegetation	Environmental Officer	Walked Surveys of PV perimeter, access roads and other areas adjacent to hard infrastructure.	Remedial action to reduce erosion including revegetation where necessary.	Annual

8.4 AQUATIC BIODIVERSITY IMPACT ASSESSMENT

8.4.1 CONSTRUCTION PHASE

There were several aquatic biodiversity related impacts identified during the construction phase. These include:

- Disturbance or modification of aquatic habitat (**Table 8-3** and **Table 8-4**);
- Increased water use(**Table 8-5**); and
- Water quality impacts (**Table 8-6** and **Table 8-8**).

The direct impacts expected on the aquatic biodiversity include:

- Degradation of aquatic ecosystem integrity (**Table 8-7**).

Table 8-3 – Impact on habitat integrity during the construction phase

Potential Impact: Decrease in habitat integrity Aquatic habitat modification / disturbance	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**
Without Mitigation	2	1	3	2	2	**16**	**Low**	(-)
With Mitigation	1	1	2	1	2	**10**	**Very Low**	(-)
Mitigation and Management Measures	▪ Minimise any works within aquatic ecosystems and buffers. Locate all infrastructure outside of high-sensitivity areas (except for underground cables and where existing roads will be upgraded) and limit the placement of infrastructure in areas of medium aquatic sensitivity as far as possible. Make sure that any construction materials brought onto the site are certified to be free of alien plant seed. ▪ Rehabilitate disturbed aquatic habitats by revegetating them with suitable local indigenous vegetation. ▪ Use existing disturbed areas (e.g., roads and access tracks), where possible. In terms of new service tracks, these must be kept to a minimum and should ideally not result in any new / permanent water course crossings, but if these are required, then a specific walk down should be conducted with the specialist to identify the most suited crossing position. Where these crossings do occur, it needs to be monitored for erosion ▪ Construction near sensitive aquatic features should preferably be undertaken in the dry season; if necessary, sediment traps should be placed downstream of works to capture sediment; Construction sites and laydown areas should be placed at least 35m away from the delineated aquatic features; Good housekeeping measures should be implemented at the construction sites that are set out in the EMPr and monitored by an appointed ECO for the project.							

Table 8-4 – Impact on aquatic ecosystem integrity during the construction phase

Potential Impact: Decrease in aquatic ecosystem integrity Removal of aquatic vegetation	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**
Without Mitigation	2	1	3	2	2	**16**	**Low**	(-)
With Mitigation	1	1	1	2	1	**5**	**Very Low**	(-)
Mitigation and Management Measures	▪ Minimise any works within aquatic ecosystems and buffers. Locate all infrastructure outside of high-sensitivity areas (except for underground cables and where existing roads will be upgraded) and limit the placement of infrastructure in areas of medium aquatic sensitivity as far as possible. Make sure that any construction materials brought onto the site are certified to be free of alien plant seed. ▪ Rehabilitate disturbed aquatic habitats by revegetating them with suitable local indigenous vegetation. ▪ Use existing disturbed areas (e.g., roads and access tracks), where possible. In terms of new service tracks, these must be kept to a minimum and should ideally not result in any new / permanent water course crossings, but if these are required, then a specific walk down should be conducted with the specialist to identify the most suited crossing position. Where these crossings do occur, it needs to be monitored for erosion ▪ Construction site camps should be placed at least 35m away from the delineated aquatic features ▪ Construction near sensitive aquatic features should preferably be undertaken in the dry season; if necessary, sediment traps should be placed downstream of works to capture sediment; Construction sites and laydown areas should be placed at least 35m away from the delineated aquatic features; Good housekeeping measures should be implemented at the construction sites that are set out in the EMPr and monitored by an appointed ECO for the project.							

Table 8-5 – Impact on stress on water resource during the construction phase

Potential Impact: Stress on water resource Abstraction of groundwater for use	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**
Without Mitigation	2	2	3	3	2	**20**	**Low**	(-)
With Mitigation	2	1	1	2	2	**12**	**Very Low**	(-)

Potential Impact: Stress on water resource Abstraction of groundwater for use	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character
Mitigation and Management Measures	▪ The water should be obtained for construction purposes from an existing water allocation to the property or should be provided from a viable water source, including new yield-tested boreholes.							

Table 8-6 – Impact on flow modification during the construction phase

Potential Impact: Flow modification Road crossing structures in watercourses	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character
Without Mitigation	2	1	1	2	2	**12**	**Very Low**	(-)
With Mitigation	1	1	1	2	2	**10**	**Very Low**	(-)
Mitigation and Management Measures	▪ Use existing disturbed areas (e.g., roads and access tracks), where possible. In terms of new service tracks, these must be kept to a minimum and should ideally not result in any new / permanent water course crossings, but if these are required, then a specific walk down should be conducted with the specialist to identify the most suited crossing position. Where these crossings do occur, it needs to be monitored for erosion ▪ Ensure road crossings structures are properly designed to not result in blockage in the watercourses or erosion. For this area, a low water crossing, concrete slab through the watercourses is preferred.							

Table 8-7 – Impact on decrease in aquatic ecosystem integrity during the construction phase

Potential Impact: Decrease in aquatic ecosystem integrity Alien vegetation infestation	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character
Without Mitigation	1	1	1	2	2	**10**	**Very Low**	(-)
With Mitigation	1	1	2	1	2	**10**	**Very Low**	(-)
Mitigation and Management Measures	▪ Minimise any works within aquatic ecosystems and buffers. Locate all infrastructure outside of high-sensitivity areas (except for underground cables and where existing roads will be upgraded) and limit the							

Potential Impact: Decrease in aquatic ecosystem integrity Alien vegetation infestation	Magnitude	Extent	Reversibility	Duration	Probability	Significance	Character
	placement of infrastructure in areas of medium aquatic sensitivity as far as possible. Make sure that any construction materials brought onto the site are certified to be free of alien plant seed. ▪ Rehabilitate disturbed aquatic habitats by revegetating them with suitable local indigenous vegetation. ▪ Construction near sensitive aquatic features should preferably be undertaken in the dry season; if necessary, sediment traps should be placed downstream of works to capture sediment; Construction sites and laydown areas should be placed at least 35m away from the delineated aquatic features; Good housekeeping measures should be implemented at the construction sites that are set out in the EMPr and monitored by an appointed ECO for the project.						

Table 8-8 – Impact water quality impacts during the construction phase

Potential Impact: Water quality impacts Increased sedimentation and surface water containment	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character
Without Mitigation	2	1	1	2	1	**6**	**Very Low**	(-)
With Mitigation	2	1	1	1	1	**5**	**Very Low**	(-)
Mitigation and Management Measures	▪ Use existing disturbed areas (e.g., roads and access tracks), where possible. In terms of new service tracks, these must be kept to a minimum and should ideally not result in any new / permanent water course crossings, but if these are required, then a specific walk down should be conducted with the specialist to identify the most suited crossing position. Where these crossings do occur, it needs to be monitored for erosion ▪ Ensure road crossings structures are properly designed to not result in blockage in the watercourses or erosion. For this area, a low water crossing, concrete slab through the watercourses is preferred. ▪ Construction near sensitive aquatic features should preferably be undertaken in the dry season; if necessary, sediment traps should be placed downstream of works to capture sediment; Construction sites and laydown areas should be placed at least 35m away from the delineated aquatic features; Good housekeeping measures should be implemented at the							

	construction sites that are set out in the EMPr and monitored by an appointed ECO for the project.

8.4.2 OPERATIONAL PHASE

There were several aquatic biodiversity related impacts identified during the operational phase. These include:

- Aquatic habitat disturbance (**Table 8-9** and **Table 8-10**).

The direct impacts expected on the aquatic biodiversity include:

- Degradation of ecological condition of aquatic ecosystems (**Table 8-11**);
- Erosion (**Table 8-12**); and
- Alien riparian vegetation invasion (**Table 8-9**).

Table 8-9 – Impact on aquatic ecosystem integrity during the operational phase

Potential Impact: Aquatic ecosystem integrity Ongoing disturbance and degradation of aquatic features and associated vegetation along access tracks or adjacent to the infrastructure	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**
Without Mitigation	2	2	3	3	3	**30**	**Low**	(-)
With Mitigation	1	1	3	2	2	**14**	**Very Low**	(-)
Mitigation and Management Measures	▪ Access project infrastructure using existing roads and access tracks established during the construction phase. ▪ Ensure road crossings structures are not resulting in blockage in the watercourses or erosion. ▪ Invasive alien plant growth and signs of erosion should be monitored on an ongoing basis to ensure that the disturbed areas do not become infested with invasive alien plants. ▪ Stormwater management systems must be in place at the access tracks and built areas to dissipate stormwater over a broad area by covering cleared areas with suitable local indigenous vegetation or by directing and spreading stormwater with berms or channels and swales adjacent to hardened surfaces.							

Table 8-10 – Impact on aquatic ecosystem integrity during the operational phase

Potential Impact: Aquatic ecosystem integrity Disturbance of cover vegetation and soil and modified runoff characteristics that have the potential to result in erosion and invasion of disturbed areas with alien vegetation	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**
Without Mitigation	2	1	3	3	3	**27**	**Low**	(-)
With Mitigation	1	1	3	2	2	**14**	**Very Low**	(-)
Mitigation and Management Measures	▪ Access project infrastructure using existing roads and access tracks established during the construction phase. ▪ Ensure road crossings structures are not resulting in blockage in the watercourses or erosion. ▪ Invasive alien plant growth and signs of erosion should be monitored on an ongoing basis to ensure that the disturbed areas do not become infested with invasive alien plants. ▪ Stormwater management systems must be in place at the access tracks and built areas to dissipate stormwater over a broad area by covering cleared areas with suitable local indigenous vegetation or by directing and spreading stormwater with berms or channels and swales adjacent to hardened surfaces.							

Table 8-11 – Impact of stress on watercourse integrity during the operational phase

Potential Impact: Stress on water resource Abstraction of groundwater for use	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**
Without Mitigation	2	2	1	2	2	**14**	**Very Low**	(-)
With Mitigation	2	2	1	2	2	**14**	**Very Low**	(-)
Mitigation and Management Measures	▪ Stormwater management systems must be in place at the access tracks and built areas to dissipate stormwater over a broad area by covering cleared areas with suitable local indigenous vegetation or by directing and spreading stormwater with berms or channels and swales adjacent to hardened surfaces.							

Table 8-12 – Impact on flow/hydraulic modification during the operational phase

Potential Impact: Flow/hydraulic modification Road crossing structures in watercourse	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**
Without Mitigation	2	1	3	2	2	**16**	**Low**	(-)
With Mitigation	1	1	1	2	1	**5**	**Very Low**	(-)
Mitigation and Management Measures	▪ Access project infrastructure using existing roads and access tracks established during the construction phase. ▪ Ensure road crossings structures are not resulting in blockage in the watercourses or erosion. ▪ Invasive alien plant growth and signs of erosion should be monitored on an ongoing basis to ensure that the disturbed areas do not become infested with invasive alien plants. ▪ Stormwater management systems must be in place at the access tracks and built areas to dissipate stormwater over a broad area by covering cleared areas with suitable local indigenous vegetation or by directing and spreading stormwater with berms or channels and swales adjacent to hardened surfaces.							

8.4.3 DECOMMISSIONING PHASE

There were several aquatic biodiversity related impacts identified during the decommissioning phase. These include:

- Disturbance of aquatic habitat habitats (**Table 8-13**); and
- Water quality impacts (**Table 8-14**).

Table 8-13 – Impact on loss of aquatic habitat and biota during the decommissioning phase

Potential Impact: Loss of aquatic habitat and biota Increased disturbance of aquatic habitat due to the increased activity on the site	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**
Without Mitigation	2	1	1	2	2	**12**	**Very Low**	(-)
With Mitigation	1	1	1	2	1	**5**	**Very Low**	(-)
Mitigation and Management Measures	▪ Access project infrastructure using existing roads and access tracks established during the construction phase. ▪ Ensure road crossings structures are not resulting in blockage in the watercourses or erosion.							

	▪ Invasive alien plant growth and signs of erosion should be monitored on an ongoing basis to ensure that the disturbed areas do not become infested with invasive alien plants. ▪ Stormwater management systems must be in place at the access tracks and built areas to dissipate stormwater over a broad area by covering cleared areas with suitable local indigenous vegetation or by directing and spreading stormwater with berms or channels and swales adjacent to hardened surfaces.

Table 8-14 – Impact on aquatic ecosystem integrity during the decommissioning phase

Potential Impact: Aquatic ecosystem integrity Increased sedimentation and risks of contamination of surface water runoff	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**
Without Mitigation	2	1	1	2	2	**12**	**Very Low**	(-)
With Mitigation	1	1	1	2	1	**5**	**Very Low**	(-)
Mitigation and Management Measures	▪ Access project infrastructure using existing roads and access tracks established during the construction phase. ▪ Ensure road crossings structures are not resulting in blockage in the watercourses or erosion. ▪ Invasive alien plant growth and signs of erosion should be monitored on an ongoing basis to ensure that the disturbed areas do not become infested with invasive alien plants. ▪ Stormwater management systems must be in place at the access tracks and built areas to dissipate stormwater over a broad area by covering cleared areas with suitable local indigenous vegetation or by directing and spreading stormwater with berms or channels and swales adjacent to hardened surfaces.							

8.5 PLANT SPECIES ASSESSMENT

Due to low sensitivity of the site, only a plant compliance statement was undertaken for this project. As such, an impact assessment was not complied however the following avoidance and mitigation measures should be included in the EMPr for the Mura 1 Solar Facility in order to avoid, reduce and manage impacts on vegetation and plant species:

- Develop and implement alien vegetation, soil erosion, revegetation and rehabilitation management plans based on the site attributes and environmental constraints. This can be developed post-authorisation once the project is certain to go ahead.
- Ensure that all vegetation-related preconstruction permits have been obtained, and surveys and walk-throughs have been conducted prior to the commencement of construction activity.

- Preconstruction walk-through of the final development footprint to check the final footprint areas and access road routes to verify that sensitive habitats are being avoided as much as possible and also provide certainty as to the zero expected impact on plant SCC.
- Annual rehabilitation activities in line with the Generic EMPr requirements (for example, any erosion problems observed on-site should be rectified as soon as possible using appropriate revegetation and erosion control works).

The following Monitoring and management actions should be included in the EMPr:

- Ensure that all vegetation-related preconstruction permits, surveys and walk-throughs have been conducted prior to the commencement of construction activity.
- Monitoring of vegetation clearing during construction by the EO to ensure that any protected plant within the development footprint area are translocated to safety where necessary.
- Annual monitoring of runoff and erosion from the PV area into the adjacent veld to ensure that the hardened surfaces and PV arrays within the PV area are not generating a lot of runoff that is impacting adjacent natural areas. There should be follow-up erosion control and alien vegetation clearing where required.

8.6 ANIMAL SPECIES ASSESSMENT

Due to low sensitivity of the site, only an animal compliance statement was undertaken for this project. As such, an impact assessment was not complied however the following avoidance and mitigation measures should be included in the EMPr for the Mura 1 Solar PV Facility in order to avoid, reduce and manage impacts on fauna and associated habitats:

- All vehicles should adhere to a low speed limit on site. Heavy vehicles should be restricted to 30km/h and light vehicles to 40km/h.
- All laydown areas, construction sites etc with waste disposal bins, should be provided with lockable bins that are tamper proof by baboons, monkeys and other fauna.
- Search and rescue for reptiles and other vulnerable species during construction, before areas of intact vegetation are cleared. Such search and rescue should be conducted by relevant experts with experience in search and rescue of the faunal groups concerned.
- Limiting access to the site and ensuring that construction staff and machinery remain within the demarcated construction areas during the construction phase. Environmental induction for all staff and contractors on-site.
- No excavated holes or trenches should be left open for extended periods as fauna may fall in become trapped.
- The design should ensure that there is no electrical fencing around substations (and associated battery facilities) or other features within 30cm of the ground as tortoises become stuck against such fences and are electrocuted to death. Alternatively, a guard wire set at 20cm can be used to keep larger tortoises away from the fence.

The following monitoring and management actions should be included in the EMPr:

- A log should be kept detailing all fauna-related incidences or mortalities that occur on site, including roadkill, electrocutions etc. during construction and operation. These should be reviewed annually and used to inform operational management and mitigation measures.
- There should be on-going maintenance and monitoring of the perimeter fences of the PV areas to ensure that there is not sedimentation or vegetation build-up that brings the electrified strands closer to the ground than the recommended 30cm. Should some fauna burrow under the fence,

such burrow access-points can be allowed to remain provided that the fauna accessing the facility are not causing problems inside the facility or would be endangered themselves.

8.7 AVIFAUNA IMPACT ASSESSMENT

8.7.1 CONSTRUCTION PHASE

There were several avifauna related impacts identified during the construction phase. These include:

- Habitat destruction associated with the construction of the facility (**Table 8-15**):
  - During the construction phase of this project, a certain amount of habitat destruction and alteration will take place. The nature of the proposed projects means that the majority of the development footprint (PV module) will be transformed from the current state to an industrial site. Most of this vegetation is currently in a fairly natural state. The habitat that will be affected (including the existing access roads that will be upgraded) is 178 ha.
- Disturbance of birds & displacement effects (**Table 8-16**):
  - Disturbance of avifauna during the construction of the projects is likely to occur. Disturbance of breeding birds is typically of greatest concern. In this regard any breeding sites of sensitive bird species would be the most important. Wildskies have not identified any such breeding sites at this stage, other than those identified during screening and where impacts have been avoided in the location of the proposed four solar projects.

Table 8-15 – Impact of destruction of habitat during the construction phase

Potential Impact: Destruction of habitat Habitat destroyed or altered in such a way as to render it unavailable to birds	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**
Without Mitigation	4	1	3	4	5	**60**	**Moderate**	(-)
With Mitigation	4	1	3	4	5	**60**	**Moderate**	(-)
Mitigation and Management Measures	▪ Impact avoidance has already been implemented in the project design phase through the adherence to no-go buffers around sensitive receptors on site. ▪ All staff, vehicle and machinery activities should be strictly controlled at all times so as to ensure that the absolute minimum of surface area is impacted. ▪ Care should be taken not to introduce or propagate alien plant species/weeds during construction.							

Table 8-16 – Impact of disturbance of birds during the construction phase

Potential Impact: Disturbance of birds Birds are disturbed during construction impacting on breeding, foraging	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character
Without Mitigation	2	3	1	2	3	**24**	**Low**	(-)
With Mitigation	2	3	1	2	3	**24**	**Low**	(-)
Mitigation and Management Measures	▪ Impact avoidance has already been implemented in the project design phase through the adherence to no-go buffers around sensitive receptors on site. ▪ All staff, vehicle and machinery activities should be strictly controlled at all times so as to ensure that the absolute minimum of surface area is impacted.							

8.7.2 OPERATIONAL PHASE

There were several avifauna related impacts identified during the operational phase. These include:

- Bird fatality at PV facility (**Table 8-17**):
  - Bird fatalities could occur at the site through a number of mechanisms, including collision with PV panels, entanglement in perimeter fence, electrocution in substations/electrical compounds, road kill and others.

Table 8-17 – Impact of fatality of birds during the operational phase

Potential Impact: Fatality of birds Birds killed through interaction with facility, collision with panels, fence entanglement	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character
Without Mitigation	2	3	5	4	3	**42**	**Moderate**	(-)
With Mitigation	2	3	5	4	2	**28**	**Low**	(-)
Mitigation and Management Measures	▪ The risk of electrocution of large birds in the substations should be managed reactively. If any such electrocutions are recorded once operational this should be reported to an ornithologist for suitable case specific mitigation measures. ▪ The risk of bird collision/entanglement with facility fences must be mitigated by using a fence design which is either highly visible to birds or has a tight enough mesh to avoid entanglement. ▪ A carefully considered surface water/drainage management plan must be developed for the site including attention to the use of environmentally friendly cleaning chemicals.							

	▪ It is strongly recommended that rodenticides not be used at the newly established Operation and Maintenance (O&M) buildings or around auxiliary infrastructure on the project site. While pest control of this nature may be effective, even so-called "environmentally friendly" rodenticides are toxic and pose significant secondary poisoning risk to predatory avifauna, especially owls. ▪ Operational phase bird monitoring should be conducted for at least one year as per the best practice guidelines. ▪ if facility staff identify any bird nesting which interferes with operations this should be reported on fully through the sites incident reporting system. A suitably qualified ornithologist should be consulted for any case specific reactive mitigation measures. All nest management measures should only be undertaken in compliance with national and provincial environmental legislation in this regard.

8.7.3 DECOMMISSIONING PHASE

There were avifauna related impacts identified during the decommissioning phase. These include:

- Disturbance of birds & displacement effects (**Table 8-18**):
  - Disturbance of avifauna during the decommissioning of the projects is likely to occur. Disturbance of breeding birds is typically of greatest concern. In this regard any breeding sites of sensitive bird species would be the most important. Wildskies have not identified any such breeding sites at this stage, other than those identified during screening and where impacts have been avoided in the project design.

Table 8-18 – Impact of disturbance of birds during the construction phase

Potential Impact: Disturbance of birds Birds are disturbed during construction impacting on breeding, foraging	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**
Without Mitigation	2	3	1	2	3	**24**	**Low**	(-)
With Mitigation	2	3	1	2	3	**24**	**Low**	(-)
Mitigation and Management Measures	▪ There is no specific mitigation required.							

8.8 ARCHAEOLOGICAL AND CULTURAL HERITAGE IMPACT ASSESSMENT

8.8.1 CONSTRUCTION PHASE

8.8.1.1 Impacts to archaeological resources

Direct impacts to archaeological resources would occur during the construction phase when equipment is brought onto site and excavations for foundations, services and roadworks commence. Because significant archaeology is lacking from the PV areas and margins of the access road, the

impact magnitude is very low. There is still a small chance that archaeological materials may be present though and the significance calculates to low negative (**Table 8-19**).

Table 8-19 – Impact to archaeological resources during the construction phase

Potential Impact: Archaeological resources	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character
Without Mitigation	1	2	5	5	2	24	Low	(-)
With Mitigation	1	1	5	5	1	12	Very Low	(-)
Mitigation and Management Measures	▪ Implement the Chance Finds Protocol							

8.8.1.2 Impacts to graves

Direct impacts to graves would occur during the construction phase when equipment is brought onto site and excavations for foundations, services and roadworks commence. Because graves are not known from the PV areas and margins of the access road, the impact magnitude is very low. The chances of graves being present and impacted are very low and the significance calculates to very low negative (**Table 8-20**).

Table 8-20 – Impact to graves during the construction phase

Potential Impact: Graves	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character
Without Mitigation	1	1	5	5	1	12	Very Low	(-)
With Mitigation	1	1	5	5	1	12	Very Low	(-)
Mitigation and Management Measures	▪ Report any chance finds							

8.8.1.3 Impacts to the cultural landscape

Direct impacts to the cultural landscape would occur during the construction phase when construction equipment is brought onto the site and construction activity commences. The very remote location means that the magnitude is low but because impacts would definitely occur if the project goes ahead the significance calculates to moderate negative (Table 8-21). Mitigation would entail (1) keeping the construction duration as short as possible, (2) ensuring that the smallest area possible is cleared for construction and (3) ensuring that any areas not required during operation are rehabilitated. This would not affect the ratings, however, and the significance remains moderate negative after mitigation.

Table 8-21 – Impact to cultural landscape during the construction phase

Potential Impact: Cultural landscape	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character
Without Mitigation	2	2	3	2	5	**45**	**Moderate**	(-)
With Mitigation	2	2	3	2	5	**45**	**Moderate**	(-)
Mitigation and Management Measures	▪ Keep the construction duration as short as possible. ▪ Ensure that the smallest area possible is cleared for construction. ▪ Ensure that any areas not required during operation are rehabilitated.							

8.8.2 OPERATIONAL PHASE

8.8.2.1 Impacts to the cultural landscape

Direct impacts to the cultural landscape would occur during the operation phase due to the presence of the facility in the landscape. The magnitude is low because of the remoteness of the site, and despite the long duration of impact (for the lifetime of the project), the significance calculates to moderate negative (**Table 8-22**).

Table 8-22 – Impact to cultural landscape during the operational phase

Potential Impact: Cultural landscape	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character
Without Mitigation	2	2	3	4	5	**55**	**Moderate**	(-)
With Mitigation	2	2	3	4	5	**55**	**Moderate**	(-)
Mitigation and Management Measures	▪ Ensure that all maintenance activities remain within the approved footprint. ▪ Ensure that night time light pollution is minimised.							

8.8.3 DECOMMISSIONING PHASE

8.8.3.1 Impacts to the cultural landscape

Direct impacts to the cultural landscape would occur during the decommissioning phase when construction equipment is brought onto the site and decommissioning activities commence. The very remote location means that the magnitude is low but because impacts would definitely occur if the project were decommissioned the significance calculates to moderate negative (**Table 8-23**).

Table 8-23 – Impact to cultural landscape during the decommissioning phase

Potential Impact: Cultural landscape	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character
Without Mitigation	2	2	3	2	5	45	Moderate	(-)
With Mitigation	1	2	3	2	5	40	Moderate	(-)
Mitigation and Management Measures	▪ Keep the decommissioning duration as short as possible. ▪ Ensure that the site is fully rehabilitated after the facility has been removed.							

8.9 PALAEONTOLOGY IMPACT ASSESSMENT

8.9.1 CONSTRUCTION PHASE

The potential impact on fossil heritage resources within the project footprint that are of scientific and conservation value are indicated in **Table 8-24**.

If any substantial new fossil sites are revealed during the Construction Phase of the developments they should be handled using the Chance Fossil Finds Protocol included in the EMPr (**Appendix H**). If no new fossils are found then no mitigation is required.

Table 8-24 – Impact on fossil heritage resources during the construction phase

Potential Impact: Loss of fossil heritage resources	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character
Without Mitigation	2	1	5	5	2	26	Low	(-)
With Mitigation	2	1	5	5	1	13	Very Low	(-)
Mitigation and Management Measures	▪ Implement the Chance Fossil Finds Protocol							

Once any new fossil finds have been collected there will be no significant further impacts on local palaeontological heritage. Therefore the impact assessment is only applicable to the construction phase. The operation and de-commissioning phases of the development will NOT impact the palaeontology.

8.10 TRAFFIC ASSESSMENT

8.10.1 CONSTRUCTION PHASE

There were several traffic related impacts identified during the construction phase. These include:

- Increased Road Incidents
  - The impact of increased traffic volumes on public roads will cause congestion and increase the potential of incidents on the road network within the study area (**Table 8-25**).
- Road Degradation
  - The impact of increased traffic volumes on the public roads will increase the potential for localised road network degradation within the study area (**Table 8-26**).
- Dust
  - The larger the vehicle, the more dust is likely to be generated. This dust hinders the drivers wishing to over-take without a clear view for over-taking, resulting in drivers taking unnecessary chances, which could result in unfavourable consequences. The impact of increased traffic volumes on the unpaved public roads will generate dust (**Table 8-27**).
- Intersection Safety
  - The impact due to the increased traffic volumes at intersections will increase the potential risk of accidents at the intersections, resulting in serious injuries or even fatalities, especially at the intersection on the main roads, when vehicles from the site needing to cross over oncoming traffic (**Table 8-28**).

Table 8-25 – Impact of increased road incidents during the construction phase

Potential Impact: Increased Road Incidents The increased traffic volumes on the public roads will increase the potential of incidents on the road network within the study area	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**
Without Mitigation	4	3	5	2	4	**56**	**Moderate**	(-)
With Mitigation	4	3	5	2	3	**42**	**Moderate**	(-)
Mitigation and Management Measures	▪ Post relevant road signage along affected routes. ▪ Create local WhatsApp Group, notifying other road users of expected deliveries and associated routes. ▪ Traffic Management Plan (TMP) is to be compiled once the contractor has been appointed and all the relevant details of the construction process are known. The TMP needs to address, inter alia: • clearly defined route/s to the site for specific vehicles needed to transport equipment and materials • scheduled deliveries to avoid local congestion; ▪ Ensure all vehicles are roadworthy, visible, adequately marked, and operated by an appropriately licenced operator. ▪ The developer shall ensure that the contractor provides the necessary driver training to key personnel to minimise the potential of incidents on the public road network.							

	▪ The developer shall ensure that the contractor erects temporary signs warning motorists of construction vehicles on the approaches to the access road.

Table 8-26 – Impact of road degradation during the construction phase

Potential Impact: Road degradation The increased traffic volumes on public roads will increase the potential for localised road network degradation within the study area.	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**
Without Mitigation	3	3	3	2	4	**44**	**Moderate**	(-)
With Mitigation	3	3	3	2	3	**33**	**Moderate**	(-)
Mitigation and Management Measures	▪ Create a local WhatsApp Group for the local community and post notices of road conditions and proposed alternatives. Developer to contribute to the maintenance of the public roads in the area during the construction phase of the development/s. ▪ A photographic record of the road condition should be maintained throughout the various phases of the development/s. This provides an objective assessment and mitigates any subjective views from road users. ▪ Upgrade unpaved roads to a suitable condition for proposed construction vehicles. ▪ Ensure that the roads are left in the same or better condition, post-construction. ▪ All remedial work or modifications to any of the public roads shall be done in consultation with and have the approval of the local road's authority (as is standard practice, this will be finalised during and be a requirement of the municipal planning approval process. ▪ The treacherous section of the gravel road, through the De Jager's Pass and Molteno Pass, is safety concern that need to be addressed by the developer in consultation with the local roads authority. ▪ The route for construction vehicles from the TR 01606/7 to the TR05801 should not unduly impact the local community of Loxton and should avoid the commercial centre of Loxton. ▪ The developer shall ensure that the condition of the roads impacted by construction of the development is left in a similar or better state once the construction phase is complete. ▪ All vehicles delivering equipment and material to the proposed development using the Molteno Pass and De Jager's Pass, shall be limited to a gross vehicle mass not exceeding ten tonnes.							

Table 8-27 – Impact of dust during the construction phase

Potential Impact: Dust The increased traffic volumes on unpaved public roads will generate more dust. The higher the speed and the larger the vehicle, the more dust is likely to be generated. This dust hinders the drivers wishing to over-take without a clear view of over-taking, resulting in drivers taking unnecessary chances, which could result in unfavourable consequences	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character
Without Mitigation	3	3	1	2	4	36	Moderate	(-)
With Mitigation	3	3	1	2	3	27	Low	(-)
Mitigation and Management Measures	▪ Reduce travel speed for construction vehicles on the gravel road to reduce dust ▪ Dust suppression of the roads in the immediate vicinity of the site where feasible ▪ Regular preventative maintenance of roads within the immediate vicinity of the site should be conducted over weekends to minimise the impact on the average construction period.							

Table 8-28 – Impact of intersection safety during the construction phase

Potential Impact: Intersection safety The increased traffic volumes at intersections will increase the potential risk of accidents at the intersections, resulting in serious injuries or even fatalities, especially at the intersection on the main roads, when slow moving vehicles from the site need to cross over fast travelling oncoming traffic.	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character
Without Mitigation	4	3	5	2	4	56	Moderate	(-)
With Mitigation	4	3	5	2	3	42	Moderate	(-)
Mitigation and Management Measures	▪ Compile TMP. ▪ Reduce speed at intersections and use appropriate traffic warning signs ▪ Identify alternative routes where possible ▪ Request the assistance of local law enforcement ▪ Ensure that all construction vehicles are roadworthy, visible, adequately marked, and operated by an appropriately licenced operator. ▪ Provide drivers with advanced driver training.							

8.10.2 OPERATIONAL PHASE

The traffic related impacts identified during the operational phase, include:

- Intersection Safety

- Due to the increased traffic volumes at intersections this will increase the potential risk of accidents at the intersections, resulting in serious injuries or even fatalities especially at the intersection on the main roads, when vehicles from the site need to cross over oncoming traffic.

Table 8-29 – Impact of intersection safety during the operational phase

Potential Impact: Intersection safety The increased traffic volumes at intersections will increase the potential risk of accidents at the intersections, resulting in serious injuries or even fatalities, especially at the intersection on the main roads, when slow moving vehicles from the site need to cross over fast travelling oncoming traffic.	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**
Without Mitigation	1	3	5	2	3	**33**	**Moderate**	(-)
With Mitigation	1	3	5	2	3	**33**	**Moderate**	(-)
Mitigation and Management Measures	▪ Compile TMP. ▪ Reduce speed at intersections and use appropriate traffic warning signs ▪ Identify alternative routes where possible ▪ Request the assistance of local law enforcement ▪ Ensure that all construction vehicles are roadworthy, visible, adequately marked, and operated by an appropriately licenced operator. ▪ Provide drivers with advanced driver training.							

8.11 VISUAL IMPACT ASSESSMENT

8.11.1 CONSTRUCTION PHASE

There were visual related impacts identified during the construction phase. These include:

- Visual effect of construction activities on scenic resources and sensitive receptors (**Table 8-30**); and
- Visual effect of construction activities of new access roads and construction camps on scenic resources and sensitive receptors (**Table 8-31**).

Table 8-30 – Impact of visual effect of construction activities on scenic resources and sensitive receptors during the construction phase

Potential Impact: Visual effect of construction activities on scenic resources and sensitive receptors Visual intrusion of heavy vehicles and construction activities required for the erection of solar arrays and related infrastructure, temporary construction areas e.g. camps and batching plants. Litter generated from construction site. Noise and dust from construction activity.	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**
Without Mitigation	3	2	3	2	4	**40**	**Moderate**	(-)
With Mitigation	3	2	3	2	3	**30**	**Low**	(-)
Mitigation and Management Measures	▪ Disturbed areas to be rehabilitated / revegetated as soon as possible during the construction phase. ▪ The layout of the solar project (including all associated infrastructure) must avoid the very high (No-go) areas identified. ▪ Stockpiles to be located within approved construction footprints. ▪ Recycling and refuse bins to be provided to eliminate litter from the site.							

Table 8-31 – Impact of construction activities of new access Roads and construction Camps on scenic resources and sensitive receptors during the construction phase

Potential Impact: construction activities of new access roads and construction camps on scenic resources and sensitive receptors Visual intrusion of heavy vehicles and construction activities required for the widening/construction of roads, side drains and culverts. Developing of construction camps. Noise and dust from construction activity.	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**
Without Mitigation	2	2	3	2	3	**27**	**Low**	(-)
With Mitigation	2	2	3	2	2	**18**	**Low**	(-)
Mitigation and Management Measures	▪ Disturbed areas to be rehabilitated / revegetated as soon as possible during the construction phase. ▪ New construction camps to be located away from main district roads and if possible the camps authorised as part of the Nuweveld WEF should be utilised, if these are constructed.							

8.11.2 OPERATIONAL PHASE

There were visual related impacts identified during the operational phase. These include:

- Visual intrusion on scenic resources and sensitive receptors (**Table 8-32**); and
- Visual effect of traffic on sensitive receptors (**Table 8-33**).

Table 8-32 – Impact of visual intrusion on scenic resources and sensitive receptors during the operational phase

Potential Impact: Visual intrusion on scenic resources and sensitive receptors Potential visual effect of solar facilities on the rural landscape, scenic resources, and sensitive receptors. Change in the pastoral character and sense of place of the local area.	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**
Without Mitigation	3	2	3	4	4	**48**	**Moderate**	(-)
With Mitigation	3	2	3	4	3	**36**	**Moderate**	(-)
Mitigation and Management Measures	▪ Mitigation only achievable by means of avoidance of very high visual sensitivity areas and receptors or reduction in the extent of facilities.							

Table 8-33 – Impact of visual effect of traffic on sensitive receptors during the operational phase

Potential Impact: Visual effect of traffic on sensitive receptors Potential intrusion of dust and noise from maintenance vehicles.	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**
Without Mitigation	2	2	3	4	2	**22**	**Low**	(-)
With Mitigation	2	2	3	4	2	**22**	**Low**	(-)
Mitigation and Management Measures	▪ Limited mitigation possible but could include speed control measures.							

8.11.3 DECOMISSIONING PHASE

There were visual related impacts identified during the operational phase. These include:

- Visual intrusion of activities to remove infrastructure (**Table 8-34**).

Table 8-34 – Impact of visual intrusion of activities to remove infrastructure during the decommissioning phase

Potential Impact: Visual intrusion of activities to remove infrastructure Visual effect of construction activities to remove infrastructure at the end of the life of the project, including substations, buildings and internal overhead powerlines.	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character
Without Mitigation	3	1	3	2	4	36	Moderate	(-)
With Mitigation	2	1	3	2	3	24	Low	(-)
Mitigation and Management Measures	▪ Disturbed areas to be rehabilitated / revegetated as soon as possible after the decommissioning phase. ▪ Structures to be removed at the end of the life of the project.							

8.12 SOCIAL IMPACT ASSESSMENT

8.12.1 CONSTRUCTION PHASE

The following impacts have been identified for the construction phase, as relevant for assessment based on the guidelines for socio-economic specialist inputs, the nature of the project, stakeholder inputs and the receiving environment:

- Impacts from expenditure on the construction and operation of the project (**Table 8-35**);
- Impacts associated primarily with the influx of people including job seekers (**Table 8-36**);
- Impacts on tourism (**Table 8-37**); and
- Impacts on surrounding landowners and communities (**Table 8-38**).

Table 8-35 – Impact on regional employment and household income during the construction phase

Potential Impact: Regional employment and household income	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character
Without Mitigation	3	3	3	2	5	55	Moderate	(+)
With Mitigation	4	3	3	2	5	60	Moderate	(+)
Mitigation and Management Measures	▪ Setting targets for how much local labour should be used based on the needs of the applicant and the availability of existing skills and people that are willing to undergo training. Opportunities for the training of unskilled and skilled workers from local communities should be maximized, including those from adjacent farms who have indicated that they would like to benefit from the proposed project and its related opportunities.							

	▪ Using local sub-contractors where possible and requiring that contractors from outside the local area that tender also meet targets for how many locals are given employment. ▪ Exploring ways to enhance local community benefits with a focus on broad-based BEE and preferential procurement.

Table 8-36 – Impact of influx of people during the construction phase

Potential Impact: Influx of people	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character
Without Mitigation	4	2	3	2	3	33	Moderate	(-)
With Mitigation	2	2	3	2	3	27	Low	(-)
Mitigation and Management Measures	▪ A 'locals first' policy with regard to construction and operational labour needs. ▪ The community should be able to contact the site manager or his/her representative to report any issues which they may have. The site manager and his/her representative should be stationed within the area and should therefore be available on hand to deal with and address any concerns which may be raised. ▪ A complaints register should be available on site to any individual who may have a particular complaint with regards to the construction or operations processes. ▪ The applicant and the contractors should develop a Code of Conduct for the project. The code should identify what types of behaviour and activities by workers are not permitted in agreement with surrounding landowners and land managers. For example, access to land that is not part of the development will not be allowed. ▪ The applicant and the contractor should implement a Tuberculosis and HIV/AIDS awareness programme for all construction workers at the outset of the construction phase.							

Table 8-37 – Impact on tourism during the construction phase

Potential Impact: Tourism	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character
Without Mitigation	3	2	3	2	3	30	Low	(-)

With Mitigation	2	2	3	2	3	27	Low	(-)
Mitigation and Management Measures	▪ Impacts on tourism are dependent on how the site is developed and managed to minimise negative biophysical impacts. The measures recommended in other specialist reports to these impacts (primarily the minimisation of visual, heritage, traffic and ecological impacts) would thus also minimise tourism impacts.							

Table 8-38 – Impact of surrounding landowners and communities during the construction phase

Potential Impact: Surrounding landowners and communities	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character
Without Mitigation	4	2	3	2	4	44	Moderate	(-)
With Mitigation	3	2	3	2	3	30	Low	(-)
Mitigation and Management Measures	▪ No construction workers, with the exception of security personnel, should be allowed to stay on the site overnight. ▪ The community should be able to contact the site manager to report any issues which they may have. The site manager should be stationed within the area and should therefore be available on hand to deal with and address any concerns which may be raised. ▪ A complaints register should be available on site to any individual who may have a particular complaint with regards to the construction or operations processes. ▪ The applicant should develop a Code of Conduct for the project. The Code should identify what types of behaviour and activities by workers are not permitted in agreement with surrounding landowners and land managers. ▪ The movement of workers on and off the site should be closely managed and monitored by the contractors. In this regard the contractors should be responsible for making the necessary arrangements for transporting workers to and from site on a daily basis. ▪ The applicant should implement measures to assist and, if needed, fairly compensate potentially affected surrounding landowners whereby damages to farm property, stock theft or significant disruptions to farming activities can be minimized or reduced. Measures should be agreed on before construction commences. ▪ The EMPr must outline procedures for managing and storing waste on site, specifically plastic waste that poses a threat to livestock if ingested.							

8.12.2 OPERATIONAL PHASE

The following impacts have been identified for the operational phase, as relevant for assessment based on the guidelines for socio-economic specialist inputs, the nature of the project, stakeholder inputs and the receiving environment:

- Impacts from expenditure on the construction and operation of the project (**Table 8-39**);
- Impacts on local socio-economic development, enterprise development and shareholding (**Table 8-40**);
- Impacts associated primarily with the influx of people including job seekers (**Table 8-41**);
- Impacts on tourism (**Table 8-42**); and
- Impacts on surrounding landowners and communities (**Table 8-43**).

Table 8-39 – Impact on regional employment and household income during the operational phase

Potential Impact: Regional employment and household income	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character
Without Mitigation	2	3	3	4	5	60	Moderate	(+)
With Mitigation	3	3	3	4	5	65	High	(+)
Mitigation and Management Measures	▪ Setting targets for how much local labour should be used based on the needs of the applicant and the availability of existing skills and people that are willing to undergo training. Opportunities for the training of unskilled and skilled workers from local communities should be maximized, including those from adjacent farms who have indicated that they would like to benefit from the proposed project and its related opportunities. ▪ Using local sub-contractors where possible and requiring that contractors from outside the local area that tender also meet targets for how many locals are given employment. ▪ Exploring ways to enhance local community benefits with a focus on broad-based BEE and preferential procurement.							

Table 8-40 – Impact of funding of local socio-economic development during the operational phase

Potential Impact: Funding of local socio-economic development	Magnitude	Extent	Reversibility	Duration	Probability	Significance	Character

Without Mitigation	1	3	3	4	5	55	Moderate	(+)
With Mitigation	2	3	3	4	5	60	Moderate	(+)
Mitigation and Management Measures	▪ The applicant must establish a communications committee early on in the project to ensure inclusive planning and regular feedback from stakeholders. ▪ Community development should be guided by a community needs analysis, drawn up by a third party and based on local socio-economic conditions, a review of planning documents such as the IDP, and discussions with local government and community representatives. Interventions should be planned in collaboration with other energy developers in the area where relevant. ▪ Close liaison with local municipal managers, local councillors and other stakeholders involved in socio-economic development is required to ensure that any projects are integrated into wider socio-economic development strategies and plans.							

Table 8-41 – Impact of influx of people during the operational phase

Potential Impact: Influx of people	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character
Without Mitigation	2	2	3	4	3	33	Moderate	(-)
With Mitigation	1	2	3	4	3	30	Low	(-)
Mitigation and Management Measures	▪ A 'locals first' policy with regard to construction and operational labour needs. ▪ A complaints register should be available on site to any individual who may have a particular complaint with regards to the construction or operations processes. ▪ Close coordination with the municipality is required, including regular meetings.							

Table 8-42 – Impact on tourism during the operational phase

Potential Impact: Tourism	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character
Without Mitigation	2	2	3	4	3	33	Moderate	(-)
With Mitigation	1	2	3	4	3	30	Low	(-)

Mitigation and Management Measures	▪ Impacts on tourism are dependent on how the site is developed and managed to minimise negative biophysical impacts. The measures recommended in other specialist reports to these impacts (primarily the minimisation of visual, heritage, traffic and ecological impacts) would thus also minimise tourism impacts.

Table 8-43 – Impact of surrounding landowners and communities during the operational phase

Potential Impact: Surrounding landowners and communities	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character
Without Mitigation	3	2	3	4	3	36	Moderate	(-)
With Mitigation	2	2	3	4	2	22	Low	(-)
Mitigation and Management Measures	▪ A complaints register should be available on site to any individual who may have a particular complaint with regards to the construction or operations processes.							

8.12.3 DECOMMISSIONING PHASE

The ratings provided below are the same as those provided for the construction phase of the project. This is because the assessment assumes that decommissioning will involve a similar process. However, it should be noted that decommissioning may not necessarily occur after the 20-year minimum life cycle of the project. Instead, the facility may undergo a regeneration/refurbishment in which Solar Arrays other project elements are upgraded or replaced. This would result in temporary positive impacts including those from additional expenditure and temporary employment, as well as risks. Following the regeneration, operational impacts similar to those experienced during the first 20 years of operations would continue to occur.

The impact associated with the decommissioning phase of the project includes:

- Impacts from expenditure on the construction and operation of the project (**Table 8-44**);
- Impacts associated primarily with the influx of people including job seekers (**Table 8-45**);
- Impacts on tourism (**Table 8-46**); and
- Impacts on surrounding landowners and communities (**Table 8-47**).

Table 8-44 – Impact on regional employment and household income during the decommissioning phase

Potential Impact: Regional employment and household income	Magnitude	Extent	Reversibility	Duration	Probability	Significance	Character

Without Mitigation	3	3	3	2	5	55	Moderate	(+)
With Mitigation	4	3	3	2	5	60	Moderate	(+)
Mitigation and Management Measures	▪ Setting targets for how much local labour should be used based on the needs of the applicant and the availability of existing skills and people that are willing to undergo training. Opportunities for the training of unskilled and skilled workers from local communities should be maximized, including those from adjacent farms who have indicated that they would like to benefit from the proposed project and its related opportunities. ▪ Using local sub-contractors where possible and requiring that contractors from outside the local area that tender also meet targets for how many locals are given employment. ▪ Exploring ways to enhance local community benefits with a focus on broad-based BEE and preferential procurement.							

Table 8-45 – Impact of influx of people during the decommissioning phase

Potential Impact: Influx of people	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character
Without Mitigation	4	2	3	2	3	33	Moderate	(-)
With Mitigation	2	2	3	2	3	27	Low	(-)
Mitigation and Management Measures	▪ A ‘locals first’ policy with regard to construction and operational labour needs. ▪ The community should be able to contact the site manager or his/her representative to report any issues which they may have. The site manager and his/her representative should be stationed within the area and should therefore be available on hand to deal with and address any concerns which may be raised. ▪ A complaints register should be available on site to any individual who may have a particular complaint with regards to the construction or operations processes. ▪ The applicant and the contractors should develop a Code of Conduct for the project. The code should identify what types of behaviour and activities by workers are not permitted in agreement with surrounding landowners and land managers. For example, access to land that is not part of the development will not be allowed. ▪ The applicant and the contractor should implement a Tuberculosis and HIV/AIDS awareness programme for							

	all construction workers at the outset of the construction phase. ▪ Arrangements must be made to enable workers from outside the area to return home over the weekends or at regular intervals. This would reduce the risk posed by non-local construction workers to local family structures and social networks. ▪ Condoms should be freely available to employees and all contractor workers. ▪ Introduce alcohol testing on a weekly basis for construction workers. ▪ The contractor should make the necessary arrangements for ensuring that all non-local construction workers are transported back to their place of residence once the construction phase is completed. ▪ Close coordination with the municipality is required, including regular meetings.

Table 8-46 – Impact on tourism during the decommissioning phase

Potential Impact: Tourism	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character
Without Mitigation	3	2	3	2	3	**30**	**Low**	(-)
With Mitigation	2	2	3	2	3	**27**	**Low**	(-)
Mitigation and Management Measures	▪ Impacts on tourism are dependent on how the site is developed and managed to minimise negative biophysical impacts. The measures recommended in other specialist reports to these impacts (primarily the minimisation of visual, heritage, traffic and ecological impacts) would thus also minimise tourism impacts.							

Table 8-47 – Impact of surrounding landowners and communities during the decommissioning phase

Potential Impact: Surrounding landowners and communities	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character
Without Mitigation	4	2	3	2	4	**44**	**Moderate**	(-)
With Mitigation	3	2	3	2	3	**30**	**Low**	(-)

Mitigation and Management Measures	▪ No construction workers, with the exception of security personnel, should be allowed to stay on the site overnight. ▪ The community should be able to contact the site manager to report any issues which they may have. The site manager should be stationed within the area and should therefore be available on hand to deal with and address any concerns which may be raised. ▪ A complaints register should be available on site to any individual who may have a particular complaint with regards to the construction or operations processes. ▪ The applicant should develop a Code of Conduct for the project. The Code should identify what types of behaviour and activities by workers are not permitted in agreement with surrounding landowners and land managers. ▪ The movement of workers on and off the site should be closely managed and monitored by the contractors. In this regard the contractors should be responsible for making the necessary arrangements for transporting workers to and from site on a daily basis. ▪ The applicant should implement measures to assist and, if needed, fairly compensate potentially affected surrounding landowners whereby damages to farm property, stock theft or significant disruptions to farming activities can be minimized or reduced. Measures should be agreed on before construction commences. ▪ The EMPr must outline procedures for managing and storing waste on site, specifically plastic waste that poses a threat to livestock if ingested.

8.13 RISK

The main risks to the environment, as a result of BESS installations, are fires and pollution arising from spillage of the liquid component of the cells by accident. The risk sources are shown schematically in **Figure 8-1** and discussed below. In terms of other environmental impacts such as the impact of the clearance of 4 ha of vegetation, the visual impact and increase traffic, these have been assessed within the respective specialist assessments.

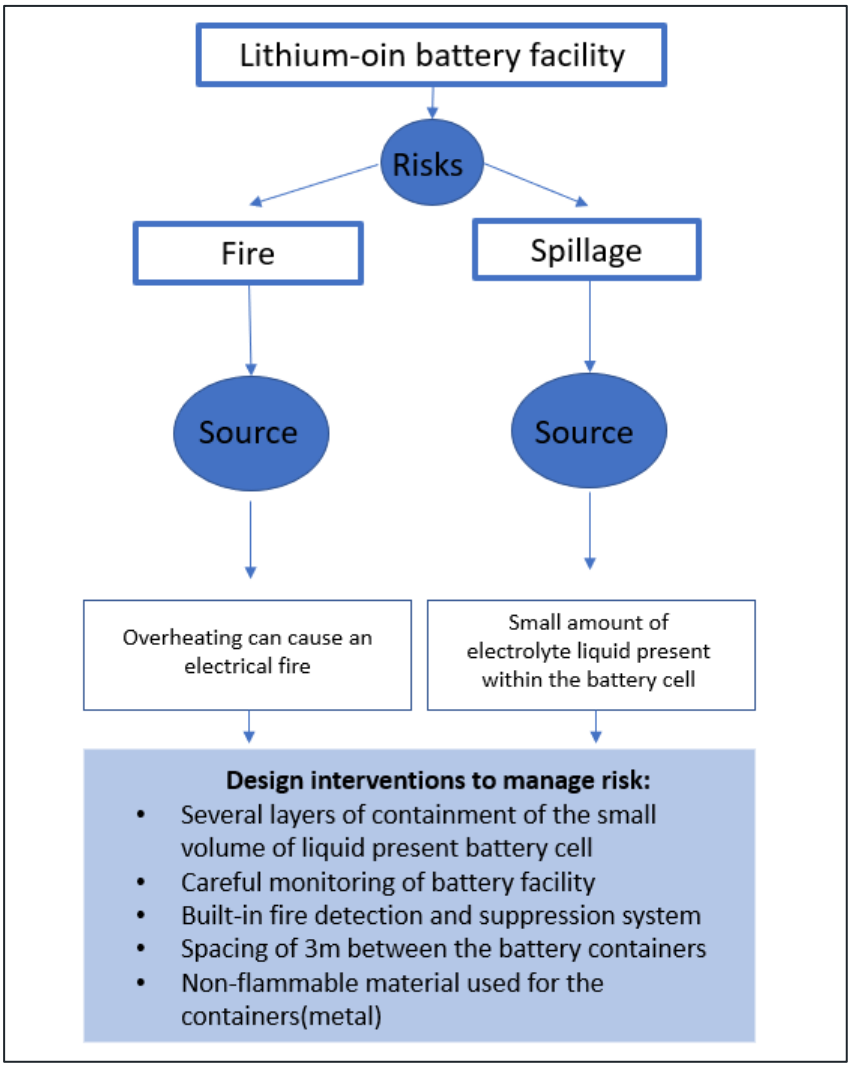


Figure 8-1 - Risk sources of the battery facility

As has been noted above, there is a small volume of liquid within the cells (most of which is absorbed into the solid components of the battery) and this is sealed in a plastic housing at the cell level as well as at the module level and then these are housed in a container ensuring there are three levels of containment. This ensures that the risk of a spill of any liquid is unlikely to the extent that it does not warrant detailed assessment in the impact assessment phase and has been screened out.

Regarding the potential fire, the design of these battery systems will be undertaken in compliance with all the local and international standards that ensures that fire risk is minimal. The electrical nature of the facility is such that there is a risk of overheating of components that could lead to electrical fire. Due to the risk overheating batteries may have on human health (in terms of off-gassing) and implications for the performance of the batteries, the facility is carefully monitored to prevent this. Each container is equipped with a built-in fire detection and suppression system that in an unlikely event of a fire will supress the fire using an inert gas. The nature of the vegetation of the site is also such that the risk of the facility being exposed to a significant wildfire leading to the ignition of the facility is also remote (assuming the facility is kept free of combustible materials).

Each container is also spaced about 3m apart ensuring the chance of a fire spreading between two containers (which are made of metal and thus not easily flammable) is also minimal. These design measures, the HVAC systems and the continuous monitoring of the battery cells for heat/fire are such that the likelihood of a fire spreading in the facility following ignition is very remote.

When the battery cells reach end of life they will be returned to a battery provider for recycling or disposal in accordance with the legal practices. Currently there are no Lithium-Ion Battery Recycling facilities in South Africa but EWASA are lobbying for one (Dataweek, 2019). Due to the value of these materials making up the batteries it is unlikely they will end up in landfill, and more likely be recycled by a future bespoke facility in South Africa or exported for recycling. In terms of air emissions from the battery facility during operations, this is not considered to be an issue and does not pose a risk during operation to the environment or staff.

Based on the technology used and the safety mechanisms forming part of the design of the facility, the likelihood of the construction and/or operation of the battery storage facility causing a fire/spill is considered to be low and therefore the risk of having the battery facility on site is considered to be negligible.

9 CUMULATIVE IMPACT ASSESSMENT

Although the objective of the NEMA BA process is to undertake an impact and risk assessment process, inclusive of cumulative impacts, which is essential to assessing and managing the environmental and social impacts of projects, it may be insufficient for identifying and managing the incremental impacts on areas or resources used or directly affected by a given development from other existing, planned, or reasonably defined developments at the time the risks and impacts are identified.

IFC PS 1 recognizes that, in some instances, cumulative effects need to be considered in the identification and management of environmental and social impacts and risks. For private sector management of cumulative impacts, IFC considers good practice to be two pronged:

- Effective application of and adherence to the mitigation hierarchy in environmental and social management of the specific contributions by the project to the expected cumulative impacts; and
- Best efforts to engage in, enhance, and/or contribute to a multi-stakeholder, collaborative approach to implementing management actions that are beyond the capacity of an individual project proponent.

Even though Performance Standard 1 does not expressly require, or put the sole onus on, private sector clients to undertake a cumulative impact assessment (CIA), in paragraph 11 it states that the impact and risk identification process "*will take into account the findings and conclusions of related and applicable plans, studies, or assessments prepared by relevant government authorities or other parties that are directly related to the project and its area of influence" including "master economic development plans, country or regional plans, feasibility studies, alternatives analyses, and cumulative, regional, sectoral, or strategic environmental assessments where relevant*."

Cumulative impacts are those that result from the successive, incremental, and/or combined effects of an action, project, or activity when added to other existing, planned, and/or reasonably anticipated future ones. For practical reasons, the identification and management of cumulative impacts are limited to those effects generally recognized as important on the basis of scientific concerns and/or concerns of affected communities (IFC GPH).

Evaluation of potential cumulative impacts is an integral element of an impact assessment. In reference to the scope for an impact assessment, IFC's Performance Standards specify that "*Risks and impacts will be analysed in the context of the project's area of influence. This area of influence encompasses…areas potentially impacted by cumulative impacts from further planned development of the project, any existing project or condition, and other project-related developments that are realistically defined at the time the Social and Environmental Assessment is undertaken; and (iv) areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location.*" (IFC 2006).

A cumulative impact assessment is the process of (a) analysing the potential impacts and risks of proposed developments in the context of the potential effects of other human activities and natural environmental and social external drivers on the chosen Valued Environmental and Social Components (VECs) over time, and (b) proposing concrete measures to avoid, reduce, or mitigate such cumulative impacts and risk to the extent possible (IFC GPH).

Cumulative impacts with existing and planned facilities may occur during construction and operation of the proposed Mura 1 Solar PV Facility. While one project may not have a significant negative

impact on sensitive resources or receptors, the collective impact of the projects may increase the severity of the potential impacts.

Therefore, a number of renewable energy developments within the surrounding area which have submitted applications for environmental authorisation (some of which have been approved and others now operational). It is important to note that the existence of an approved EA does not directly equate to actual development of the project.

The surrounding projects that have not already been awarded Preferred Bidder (PB) status under the REIPPPP Bid window 5 or the Risk Mitigation IPP procurement programme (RMIPPPP), are still subject to the REIPPPP bidding process or subject to securing an off taker of electricity through an alternative process. Some of the surrounding proposed WEFs secured EAs several years ago but have not obtained PB status (or a private off taker agreement) and as such have not been developed.

These existing surrounding projects of varying approval status have been detailed in **Figure 9-1**. Given the site's location within the Beaufort West REDZ, it is considered to be located within the renewable energy hub that is developing in this focus area.

Projects within 30 km of the Mura sites includes:

- The three approved Nuweveld Wind Farm Projects
- The four proposed Hoogland Wind Farm Projects
- The approved Nuweveld gridline
- The two proposed gridline connections proposed as part of the Hoogland Wind Farm Projects
- The proposed Gamma gridline project
- The proposed WKN Wind Farm Projects (Soutrivier and Taaibos)

Potential cumulative impacts identified are summarised below. Other planned or existing projects that can interact with the Project will be identified during stakeholder engagement and finalisation of the BAR process.

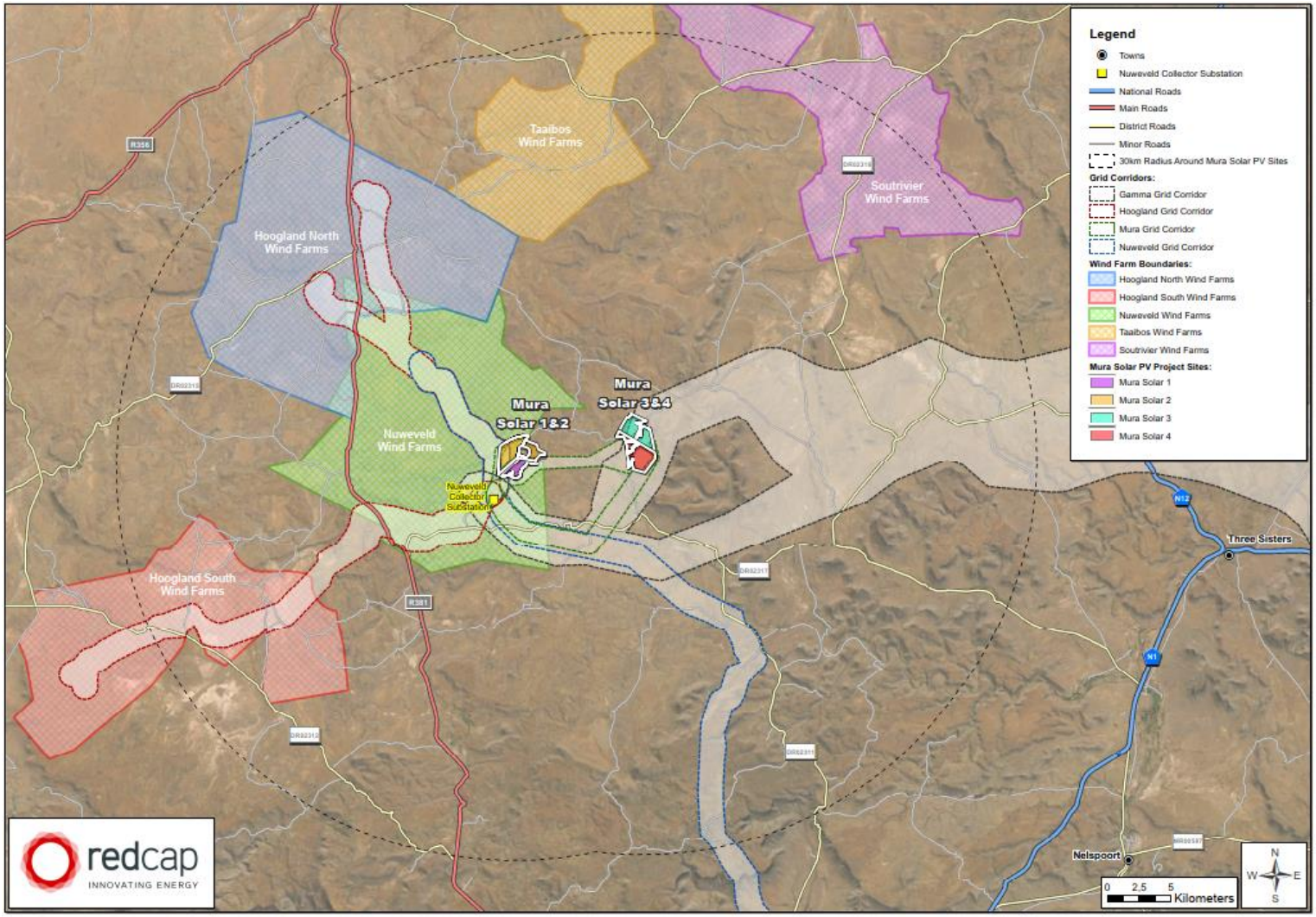


Figure 9-1 - Renewable Energy Projects with 30km of the Mura Solar Development

9.1 CLIMATE CHANGE

Cumulative impacts can be defined as “the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may be significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities” (NEMA EIA Reg GN R982 of 2014).

In relation to the Hoogland Wind Farm Project, based on the assumption that 60 turbines would be constructed on each wind farm, over the lifetime of the project, the avoided emissions are approximately 11.6 million tonnes CO_2e of emissions per wind farm. This equates to 46.3 million tons CO_2e of emissions for the four wind farms (or 41 000 tonnes $CO¬_2e$ per MW installed). This could be considered as a very high positive impact as the avoided emissions for all four wind farms equate to 1.21% of the carbon budget. Therefore, the cumulative impact of this project on climate change is considered to be very high positive as a result of the avoided emissions opportunity. Furthermore, as although not quantified, the Nuweveld Projects cumulative emissions is also considered very high as a result of the avoided emissions that will accumulate.

As for the indirect emissions in relations to the Mura Solar PV Projects, the indirect emissions reported below considers only the construction phase of the four Mura Solar PV projects. The operation emissions have been excluded due to being immaterial. It is assumed that each solar facility will have a capacity of 150 MW with approximately 250 000 PV panels.

Four 150MW solar farms will only contribute 73.7 kt of indirect emissions from the construction phase (equivalent to 0.013 tCO_2e per MWh or 0.49$ktCO_2e$ per MW installed). Most emissions during the construction phase are associated with the upstream production of construction materials and the purchasing of the PV panels. The emissions that would occur from operating and maintenance activities are negligible.

These emissions would equate to about 0.00195% of South Africa’s carbon budget. Relative to South Africa’s updated NDC, this is 0.0016% of the high emission scenario and 0.0020% of the low emission scenario. Based on this assessment, the impact of the four 150MW farms in relation to South Africa’s carbon budget is medium, as the solar Project emissions amount to approximately 0.0019% of the carbon budget. However, the cumulative impact of these projects on climate change is considered to be high positive as the Mura Solar PV Projects also further increase the opportunity for avoided emissions.

Whilst the Project’s indirect emissions for four 150MW solar farms in relation to South Africa’s carbon budget is medium, the cumulative impact of the Development, with Nuweveld and Hoogland, on climate change is considered to be very high positive. This is as a result of the avoided emissions that the Development creates over the lifetime of the project, with the Mura Solar PV Development of all four wind farms resulting in avoided emissions of around 16.39 million tons CO_2e of emissions over the life of the project and the Hoogland Wind Farms resulting in avoided emissions of 46.3 million tons CO_2e.

9.2 AGRICULTURAL POTENTIAL

The cumulative impact of a development is the impact that development will have when its impact is added to the incremental impacts of other past, present, or reasonably foreseeable future activities that will affect the same environment.

The most important concept related to a cumulative impact is that of an acceptable level of change to an environment. A cumulative impact only becomes relevant when the impact of the proposed development will lead directly to the sum of impacts of all developments causing an acceptable level of change to be exceeded in the surrounding area. If the impact of the development being assessed does not cause that level to be exceeded, then the cumulative impact associated with that development is not significant.

The potential cumulative agricultural impact of importance is a regional loss (including by degradation) of future agricultural production potential. The defining question for assessing the cumulative agricultural impact is this:

What loss of future agricultural production potential is acceptable in the area, and will the loss associated with the proposed development, when considered in the context of all past, present or reasonably foreseeable future impacts, cause that level in the area to be exceeded?

The DFFE requires compliance with a specified methodology for the assessment of cumulative impacts. This is positive in that it ensures engagement with the important issue of cumulative impacts. However, the required compliance has some limitations and can, in the opinion of the author, result in an over-focus on methodological compliance, while missing the more important task of effectively answering the above defining question.

DFFE compliance for this project requires considering all renewable energy applications within a 30 km radius. There are a total of 5 other renewable energy project applications plus the 4 Mura applications within 30km of the proposed site. These are shown in **Figure 9-1**.

All of these projects have the same agricultural impacts in an almost identical agricultural environment, and therefore the same mitigation measures apply to all.

In quantifying the cumulative impact, the area of land taken out of grazing as a result of all 9 of the renewable energy developments within 30 km (total generation capacity of 4,920 MW) will amount to a total of approximately 4,292 hectares. This is calculated using the industry standards of 2.5 and 0.3 hectares per megawatt for solar and wind energy generation respectively, as per the Department of Environmental Affairs (DEA) Phase 1 Wind and Solar Strategic Environmental Assessment (SEA) (2015). As a proportion of the total area within a 30km radius (approximately 282,700 ha), this amounts to 1.52% of the surface area. That is within an acceptable limit in terms of loss of low potential agricultural land which is only suitable for grazing and of which there is no scarcity in the country. This is particularly so when considered within the context of the following point.

In order for South Africa to develop the renewable energy generation that it urgently needs, agriculturally zoned land will need to be used for renewable energy generation. It is far more preferable to incur a cumulative loss of agricultural land in a region such as the one being assessed, which has no crop production potential, and low grazing capacity, than to lose agricultural land that has a higher potential, and that is much scarcer, to renewable energy development elsewhere in the country. The limits of acceptable agricultural land loss are far higher in this region than in regions with higher agricultural potential.

It should also be noted that there are few land uses, other than renewable energy, that are competing for agricultural land use in this area. The cumulative impact from developments, other than renewable energy, is therefore likely to be very low.

As discussed above, the risk of a loss of agricultural potential by soil degradation can effectively be mitigated for renewable energy developments and the cumulative risk is therefore low.

Due to all of the considerations discussed above, the cumulative impact of loss of future agricultural production potential will be of low significance and will not have an unacceptable negative impact on the agricultural production capability of the area. The proposed development is therefore acceptable in terms of cumulative impact, and it is therefore recommended that it be approved.

9.3 TERRESTRIAL BIODIVERSITY

In terms of cumulative impacts in and around the site, there are no built PV or wind energy facilities within 30km of the site to date. The three Nuweveld WEFs adjacent to the site have been authorised and there is also the Hoogland 1 and Hoogland 2 WEFs which have not yet been authorised and lie adjacent and to the north and west of the Nuweveld WEF site. The total footprint from these projects is estimated at 600ha, while the Mura 3 and 4 PV projects which are currently in process would cover an area of approximately 800ha. The adjacent Mura 1 project would add an additional 160 ha to this total. While it is clear that there is node of renewable energy development starting to develop south of Loxton, there are no facilities built to date and the current level of transformation in the area remains low. The contribution of the Mura 1 project at 160 ha is therefore considered low and acceptable, especially given the low sensitivity of the affected habitats.

In terms of specific cumulative impacts, the major fauna species of potential concern in the area would be the Riverine Rabbit and Karoo Dwarf Tortoise. However, as the current development lies outside of the habitat of either species, the contribution of the current project to cumulative impact on these two species is considered very low. In addition, there are no specific plant communities or habitats present within the footprint that are considered to be rare, localised or of high ecological significance, the development would not contribute to an impact on these features. As such, the contribution of the Mura 1 PV Facility to habitat loss would not change the overall threat status of any vegetation types or special habitats and the overall level of cumulative impact in the area is considered acceptable.

9.4 AQUATIC BIODIVERSITY

Land use in the area currently consists mostly of low-density livestock farming due to the limited water supply and poor carrying capacity of the cover vegetation. Current land and water use impacts on the watercourses and surrounding area are therefore low to very low. The cumulative impact of the project activities, together with the existing activities in the area, could have the potential to 1) reduce the integrity of the watercourses and 2) overuse available groundwater, if not properly mitigated and managed. The largest potential impact to watercourses is a result of the associated new tracks and infrastructure, which can be mitigated such that its impact on the aquatic ecosystems will be of low significance.

Figure 9-1 shows the renewable energy projects within 30km of the proposed PV projects. These projects include 4 Hoogland wind farms (proposed), 3 Nuweveld wind farms (Approved EA), Gamma Grid, Mura EGI, Soutrivier WEF, and Taaibos WEF. The projects all lie within the catchment of the

Krom and larger Sout River in the Gamtoos River System and thus do have some potential to result in cumulative impacts. These impacts can however be easily mitigated as mentioned above.

Availability of water is a limiting factor in the further development of this area; however, the water requirements of these projects are the highest during the construction phase, and are the lowest during operation. It is assumed that not all these projects will not have overlapping construction phases and will adhere to the abstraction thresholds applicable to groundwater abstraction. Given this, the impact is expected to be of low significance. The assessment of the cumulative impact of the projects during the various phases are indicated in **Table 9-1** to **Table 9-5**.

Table 9-1 – Cumulative impact of loss of aquatic habitat and biota during the construction phase

Potential Impact: Loss of aquatic habitat and biota Aquatic habitat modification / disturbance	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character
Without Mitigation	2	2	3	3	3	**30**	**Low**	(-)
With Mitigation	2	2	3	2	2	**18**	**Low**	(-)
Mitigation and Management Measures	▪ Minimise works within aquatic ecosystems as far as possible. Construct in the dry season. Rehabilitate disturbed areas. ▪ As far as possible share the infrastructure between existing disturbed areas. ▪ Manage stormwater impacts.							

Table 9-2 – Cumulative impact on stressed water resources during the construction phase

Potential Impact: Stressed water resources Increased water use in the construction phases	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character
Without Mitigation	2	2	1	2	2	**14**	**Very Low**	(-)
With Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)
Mitigation and Management Measures	▪ Limit and monitor water use.							

Table 9-3 – Cumulative impact on aquatic ecosystem integrity during the operational phase

Potential Impact: Aquatic ecosystem integrity Degradation of ecological condition of aquatic ecosystems	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character
Without Mitigation	2	2	3	4	3	**33**	**Moderate**	(-)
With Mitigation	2	2	3	3	2	**20**	**Low**	(-)
Mitigation and Management Measures	▪ Monitor and manage for impacts such as alien vegetation growth and erosion. Limit disturbance and rehabilitate disturbed areas. Ensure there is sufficient stormwater management to prevent erosion along roads. Ensure road crossings structures are properly designed to not result in blockage in the watercourses or erosion.							

Table 9-4 – Cumulative impact on stressed water resources during the operational phase

Potential Impact: Stressed water resources Increased water use in the operational phases	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character
Without Mitigation	2	2	1	2	2	**14**	**Very Low**	(-)
With Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)
Mitigation and Management Measures	▪ Limit and monitor water use.							

Table 9-5 – Cumulative impact on loss of aquatic habitat and biota during the decommissioning phase

Potential Impact: Loss of aquatic habitat and biota Increased disturbance of aquatic habitat due to the increased activity in the wider area	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character
Without Mitigation	1	2	3	2	2	**16**	**Low**	(-)
With Mitigation	1	1	1	2	2	**10**	**Very Low**	(-)
Mitigation and Management Measures	▪ Decommission works near aquatic features should preferably be undertaken in the dry season. ▪ Minimise disturbance and rehabilitate.							

9.5 PLANT SPECIES

Cumulative impacts associated with the Mura 1 Solar Facility are assessed in the Terrestrial Biodiversity Assessment and are not assessed in detail here. From a plant species and vegetation perspective, the Mura 1 Solar Facility would have very low impact on plant SCC and the Eastern Upper Karoo vegetation type is little impacted by renewable energy development to date. As a result, the contribution of the Mura 1 Solar Facility towards cumulative impact on plant SCC and vegetation is considered acceptable.

9.6 ANIMAL SPECIES

From a faunal species and associated habitat perspective, the Mura 1 Solar PV Facility would have very low impact on fauna SCC and the broader area has been little impacted by renewable energy development to date. As a result, the contribution of the Mura 1 Solar PV Facility to cumulative impact on fauna is considered acceptable.

9.7 AVIFAUNA

The assessment of the cumulative impact on avifauna is indicated in **Table 9-6**.

Table 9-6 – Cumulative impact on destruction of habitat

Potential Impact: Destruction of habitat Habitat destroyed or altered in such a way as to render it unavailable to birds	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**
Without Mitigation	4	3	3	4	4	**56**	**Moderate**	(-)
With Mitigation	4	3	3	4	4	**56**	**Moderate**	(-)
Mitigation and Management Measures	▪ There is no specific mitigation required.							

9.8 HERITAGE

Cumulative impacts would occur through the construction, operation and decommissioning of many projects in the same area. **Figure 9-1** shows the projects considered in the assessment of cumulative impacts. In terms of archaeology, the magnitude and probability would increase but mitigation would still bring the significance down from moderate negative to very low negative (**Table 9-7**). Graves are unlikely to be impacted and mitigation would reduce the impact significance from low negative to very low negative (**Table 9-8**). Cumulative impacts to the landscape are likely to be moderate negative both before and after mitigation for both the construction (**Table 9-9**) and decommissioning phases (**Table 9-11**). The operation phase impact significance could potentially be high negative before mitigation but with a slight reduction in intensity after mitigation this drops to moderate negative (**Table 9-10**).

Table 9-7 – Cumulative impact to archaeological resources during the construction phase

Potential Impact: Archaeological resources	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character
Without Mitigation	2	1	5	5	3	39	Moderate	(-)
With Mitigation	1	1	5	5	1	12	Very Low	(-)
Mitigation and Management Measures	▪ Implement the Chance Finds Protocol							

Table 9-8 – Cumulative impact to graves during the construction phase

Potential Impact: Graves	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character
Without Mitigation	1	1	5	5	2	24	Low	(-)
With Mitigation	1	1	5	5	1	12	Very Low	(-)
Mitigation and Management Measures	▪ Report any chance finds							

Table 9-9 – Cumulative impact to cultural landscape during the construction phase

Potential Impact: Cultural landscape	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character
Without Mitigation	3	3	3	2	5	55	Moderate	(-)
With Mitigation	2	2	3	2	5	45	Moderate	(-)
Mitigation and Management Measures	▪ Keep the construction duration as short as possible. ▪ Ensure that the smallest area possible is cleared for construction. ▪ Ensure that any areas not required during operation are rehabilitated.							

Table 9-10 – Cumulative impact to cultural landscape during the operational phase

Potential Impact: Cultural landscape	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character
Without Mitigation	3	3	3	4	5	65	High	(-)
With Mitigation	2	2	3	4	5	55	Moderate	(-)
Mitigation and Management Measures	▪ Ensure that all maintenance activities remain within the approved footprint. ▪ Ensure that night time light pollution is minimised.							

Table 9-11 – Cumulative impact to cultural landscape during the decommissioning phase

Potential Impact: Cultural landscape	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character
Without Mitigation	3	3	3	2	5	55	Moderate	(-)
With Mitigation	1	2	3	2	5	40	Moderate	(-)
Mitigation and Management Measures	▪ Keep the decommissioning duration as short as possible. ▪ Ensure that the site is fully rehabilitated after the facility has been removed.							

9.9 TRAFFIC

The cumulative impact on the safety and road network integrity impacts have been assessed.

Cumulative impacts during the construction phase have been assessed as follows:

- Increased Road Incidents
  - The impact of increased traffic volumes on public roads will cause congestion and increase the potential of incidents on the road network within the study area (**Table 9-12**).
- Road Degradation
  - The impact of increased traffic volumes on the public roads will increase the potential for localised road network degradation within the study area (**Table 9-13**).
- Dust
  - The larger the vehicle, the more dust is likely to be generated. This dust hinders the drivers wishing to over-take without a clear view for over-taking, resulting in drivers taking

unnecessary chances, which could result in unfavourable consequences. The impact of increased traffic volumes on the unpaved public roads will generate dust (**Table 9-14**)

- Intersection Safety
  - The impact due to the increased traffic volumes at intersections will increase the potential risk of accidents at the intersections, resulting in serious injuries or even fatalities, especially at the intersection on the main roads, when vehicles from the site needing to cross over oncoming traffic (**Table 9-15**).

Table 9-12 – Cumulative impact of increased road incidents during the construction phase

Potential Impact: Increased Road Incidents The increased traffic volumes on the public roads will increase the potential of incidents on the road network within the study area	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character
Without Mitigation	4	3	5	2	4	**56**	**Moderate**	(-)
With Mitigation	4	3	5	2	3	**42**	**Moderate**	(-)
Mitigation and Management Measures	▪ Post relevant road signage along affected routes. ▪ Create local WhatsApp Group, notifying other road users of expected deliveries and associated routes. ▪ Traffic Management Plan (TMP) is to be compiled once the contractor has been appointed and all the relevant details of the construction process are known. The TMP needs to address, inter alia: • clearly defined route/s to the site for specific vehicles needed to transport equipment and materials • scheduled deliveries to avoid local congestion; ▪ Ensure all vehicles are roadworthy, visible, adequately marked, and operated by an appropriately licenced operator. ▪ The developer shall ensure that the contractor provides the necessary driver training to key personnel to minimise the potential of incidents on the public road network. ▪ The developer shall ensure that the contractor erects temporary signs warning motorists of construction vehicles on the approaches to the access road.							

Table 9-13 – Cumulative impact of road degradation during the construction phase

Potential Impact: Road degradation The increased traffic volumes on public roads will increase the potential for localised road network degradation within the study area.	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**
Without Mitigation	3	3	3	2	4	**44**	**Moderate**	(-)
With Mitigation	3	3	3	2	3	**33**	**Moderate**	(-)
Mitigation and Management Measures	▪ Create a local WhatsApp Group for the local community and post notices of road conditions and proposed alternatives. Developer to contribute to the maintenance of the public roads in the area during the construction phase of the development/s. ▪ A photographic record of the road condition should be maintained throughout the various phases of the development/s. This provides an objective assessment and mitigates any subjective views from road users. ▪ Upgrade unpaved roads to a suitable condition for proposed construction vehicles. ▪ Ensure that the roads are left in the same or better condition, post-construction. ▪ All remedial work or modifications to any of the public roads shall be done in consultation with and have the approval of the local road's authority (as is standard practice, this will be finalised during and be a requirement of the municipal planning approval process. ▪ The treacherous section of the gravel road, through the De Jager's Pass and Molteno Pass, is safety concern that need to be addressed by the developer in consultation with the local roads authority. ▪ The route for construction vehicles from the TR 01606/7 to the TR05801 should not unduly impact the local community of Loxton and should avoid the commercial centre of Loxton. ▪ The developer shall ensure that the condition of the roads impacted by construction of the development is left in a similar or better state once the construction phase is complete. ▪ All vehicles delivering equipment and material to the proposed development using the Molteno Pass and De Jager's Pass, shall be limited to a gross vehicle mass not exceeding ten tonnes.							

Table 9-14 – Cumulative impact of dust during the construction phase

Potential Impact: Dust The increased traffic volumes on unpaved public roads will generate more dust. The higher the speed and the larger the vehicle, the more dust is likely to be generated. This dust hinders the drivers wishing to over-take without a clear view of over-taking, resulting in drivers taking unnecessary chances, which could result in unfavourable consequences	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**
Without Mitigation	3	3	1	2	4	**36**	**Moderate**	(-)
With Mitigation	3	3	1	2	3	**27**	**Low**	(-)
Mitigation and Management Measures	▪ Reduce travel speed for construction vehicles on the gravel road to reduce dust ▪ Dust suppression of the roads in the immediate vicinity of the site where feasible ▪ Regular preventative maintenance of roads within the immediate vicinity of the site should be conducted over weekends to minimise the impact on the average construction period.							

Table 9-15 – Cumulative impact of intersection safety during the construction phase

Potential Impact: Intersection safety The increased traffic volumes at intersections will increase the potential risk of accidents at the intersections, resulting in serious injuries or even fatalities, especially at the intersection on the main roads, when slow moving vehicles from the site need to cross over fast travelling oncoming traffic.	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**
Without Mitigation	4	3	5	2	4	**56**	**Moderate**	(-)
With Mitigation	4	3	5	2	3	**42**	**Moderate**	(-)
Mitigation and Management Measures	▪ Compile TMP. ▪ Reduce speed at intersections and use appropriate traffic warning signs ▪ Identify alternative routes where possible ▪ Request the assistance of local law enforcement ▪ Ensure that all construction vehicles are roadworthy, visible, adequately marked, and operated by an appropriately licenced operator. ▪ Provide drivers with advanced driver training.							

Cumulative impacts during the operational phase have been assessed as follows:

- Intersection Safety

- Due to the increased traffic volumes at intersections this will increase the potential risk of accidents at the intersections, resulting in serious injuries or even fatalities especially at the intersection on the main roads, when vehicles from the site need to cross over oncoming traffic (**Table 9-16**).

Table 9-16 – Cumulative impact of intersection safety during the construction phase

Potential Impact: Intersection safety The increased traffic volumes at intersections will increase the potential risk of accidents at the intersections, resulting in serious injuries or even fatalities, especially at the intersection on the main roads, when slow moving vehicles from the site need to cross over fast travelling oncoming traffic.	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**
Without Mitigation	1	3	5	2	3	**33**	**Moderate**	(-)
With Mitigation	1	3	5	2	3	**33**	**Moderate**	(-)
Mitigation and Management Measures	▪ Compile TMP. ▪ Reduce speed at intersections and use appropriate traffic warning signs ▪ Identify alternative routes where possible ▪ Request the assistance of local law enforcement ▪ Ensure that all construction vehicles are roadworthy, visible, adequately marked, and operated by an appropriately licenced operator. ▪ Provide drivers with advanced driver training.							

9.10 VISUAL

Figure 9-1 indicates other similar renewable energy projects, either existing or proposed, in order to assess cumulative visual impacts within a 30km radius of the proposed Mura solar project. The proposed Hoogland WEF, and Nuweveld WEF by Redcap fall within this radius. Only parts of the Nuweveld WEF would potentially be seen in combination with the proposed Mura solar projects, although the nature of the topography would largely screen these projects from each other. Cumulative Impacts have been assessed in the Cumulative Visual Impact summary in (**Table 9-17**).

Table 9-17 – Cumulative impact of visual impact of renewable energy projects within 30km

Potential Impact: Visual effect of renewable energy projects within 30km Combined visual effect of existing and proposed renewable energy projects on scenic resources and sensitive receptors	**Magnitude**	**Extent**	**Reversibilit**	**Duration**	**Probability**	**Significance**		**Character**
Without Mitigation	3	3	5	4	3	**45**	**Moderate**	(-)
With Mitigation	3	3	5	4	3	**45**	**Moderate**	(-)

Mitigation and Management Measures	▪ Mitigation only achievable by means of avoidance or reduction in the extent of energy facilities.

9.11 SOCIAL

Assessment of cumulative impacts considered Mura 1, 2, 3 and 4 SEFs; Hoogland 1, 2, 3 and 4 WEFs; Nuweveld North, East and West WEFs, Taaibos WEFs, Soutrivier WEFs, as well as the Mura, Hoogland, Nuweveld and Gamma Grid Corridors. The following cumulative impacts have been identified in terms of socio-economic:

- Impacts on regional employment and household income associated with project activities and expenditure (Table 9-18:
  - The projects would generate construction expenditure which would accrue to construction workers. The cumulative annual operational spend would be equivalent to 53% of BWLM's Regional Gross Domestic Product (RGDP) and 37% of CKDM's RGDP. Note however that only a portion of operational expenditure would occur within the local and regional areas in accordance with REIPPPP requirements, with most of the impact likely to be experienced at the provincial level in the case of the Mura Development.
  - The projects would generate temporary jobs during construction and the operational phase. For reference, the number of jobs which would accrue to locals represents about 2–3% of the total jobs in BWLM as of 2019.
- Impacts associated with the funding of local socio-economic development, enterprise development and shareholding (**Table 9-19**):
  - The total cumulative funding of local socio-economic and enterprise development associated with the projects in the area would generate a substantial amount of economic activity.
- Impacts associated primarily with the influx of people (**Table 9-20**):
  - The projects in the area would increase in the likelihood of a larger influx of people to the area whether they have jobs secured or are job seekers. This would result in a higher risk of social problems associated with influx particularly during construction.
  - It is expected that adequate accommodation will be available. With adequate forewarning, it is also likely that businesses will respond to the opportunity and add accommodation stock if needed.
- Impacts on tourism (**Table 9-21**):
  - The projects in the area would result in an increase in tourism risk but also tourism opportunities from business tourism, particularly during construction.
  - The significance of this impact is rated as Moderate Positive.
- Impacts on surrounding landowners and communities (**Table 9-22**):
  - The assessment partially draws on the findings of other specialist studies including the TIA and VIA.

Table 9-18 – Cumulative impact on regional employment and household income

Potential Impact: Regional employment and household income	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character
Without Mitigation	4	3	3	4	5	70	High	(+)
With Mitigation	5	3	3	5	5	80	High	(+)
Mitigation and Management Measures	▪ Setting targets for how much local labour should be used based on the needs of the applicant and the availability of existing skills and people that are willing to undergo training. Opportunities for the training of unskilled and skilled workers from local communities should be maximized, including those from adjacent farms who have indicated that they would like to benefit from the proposed project and its related opportunities. ▪ Using local sub-contractors where possible and requiring that contractors from outside the local area that tender also meet targets for how many locals are given employment. ▪ Exploring ways to enhance local community benefits with a focus on broad-based BEE and preferential procurement.							

Table 9-19 – Cumulative impact of funding of local socio-economic development

Potential Impact: Funding of local socio-economic development	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character
Without Mitigation	3	3	3	4	5	65	High	(+)
With Mitigation	4	3	3	5	5	75	High	(+)
Mitigation and Management Measures	▪ The applicant must establish a communications committee early on in the project to ensure inclusive planning and regular feedback from stakeholders. ▪ Community development should be guided by a community needs analysis, drawn up by a third party and based on local socio-economic conditions, a review of planning documents such as the IDP, and discussions with local government and community representatives. Interventions should be planned in collaboration with other energy developers in the area where relevant. ▪ Close liaison with local municipal managers, local councillors and other stakeholders involved in socio-economic development is required to ensure that any							

	projects are integrated into wider socio-economic development strategies and plans.

Table 9-20 – Cumulative impact of influx of people

Potential Impact: Influx of people	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character
Without Mitigation	4	2	3	4	4	52	Moderate	(-)
With Mitigation	3	2	3	4	4	48	Moderate	(-)
Mitigation and Management Measures	▪ A 'locals first' policy with regard to construction and operational labour needs. ▪ A complaints register should be available on site to any individual who may have a particular complaint with regards to the construction or operations processes. ▪ Close coordination with the municipality is required, including regular meetings.							

Table 9-21 – Cumulative impact on tourism

Potential Impact: Tourism	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character
Without Mitigation	4	2	3	4	3	39	Moderate	(-)
With Mitigation	3	2	3	4	3	36	Low	(-)
Mitigation and Management Measures	▪ Impacts on tourism are dependent on how the site is developed and managed to minimise negative biophysical impacts. The measures recommended in other specialist reports to these impacts (primarily the minimisation of visual, heritage, traffic and ecological impacts) would thus also minimise tourism impacts.							

Table 9-22 – Cumulative impact of surrounding landowners and communities

Potential Impact: Surrounding landowners and communities	Magnitude	Extent	Reversibility	Duration	Probability	Significance	Character

Without Mitigation	5	2	3	2	4	**48**	**Moderate**	(-)
With Mitigation	4	2	3	2	3	**33**	**Moderate**	(-)
Mitigation and Management Measures	▪ A complaints register should be available on site to any individual who may have a particular complaint with regards to the construction or operations processes.							

10 SENSITIVITY MAPPING AND DEVELOPMENT ENVELOPE

The Mura site boundary, as indicated in **Section 3.1**, was assessed by the specialists as part of desktop assessments and subsequent fieldwork. The outcomes of their assessments are outlined in **Sections 7**,**8** and **9**. The specialists provided their sensitivity layers indicating the various sensitivities present on site in line with the mapping criteria detailed below (**Table 10-1)**.

Table 10-1 - Mapping criteria utilised by the specialists for the assessment

No-Go	Areas or features that are considered of such sensitivity or importance that any adverse effects upon them may be regarded as a fatal flaw.
High	Areas or features that are considered to have high sensitivity. Development in these areas must be limited and must remain within any acceptable limits of change as determined by the specialist. Development should also comply with any other restrictions or mitigation measures identified by the specialist.
Medium	Medium sensitivity areas are considered to be developable; however, the nature of the effects should remain within any acceptable limits of change as determined by the specialist. Development should also comply with any other restrictions or mitigation measures identified by the specialist.
Low	Low sensitivity areas that are considered to be developable however specialists may still wish to define acceptable limits of change should they deem this necessary.

The environmental sensitivities identified on site are included in **Table 10-2**. Utilising the sensitivity layers (which includes the required buffers) provided by the specialists, a preliminary consolidated environmental sensitivity map showing the “No-Go” areas (**Figure 10-1**) has been compiled. From this, the Development Envelope for the site has been determined. The Development Envelope avoids the no-go areas and adheres to the recommendations made by the specialists, as discussed in **Section 8**. The Development Envelope is shown in **Figure 10-2**.

Table 10-2 - Environmental Sensitivities identified by specialists

Discipline	Infrastructure Type and Sensitivity Criteria		Exceptions
	Solar and associated infrastructure	New roads outside of the solar area	
Agriculture	MEDIUM: ▪ Land capability Value of 6 - 8	MEDIUM: ▪ Land capability Value of 6 - 8	
	LOW: ▪ Land capability Value of 1 - 5	LOW: ▪ Land capability Value of 1 - 5	
Aquatic Ecology	NO-GO:	NO-GO:	Underground cables and limited-service tracks

	▪ 35m buffer of the Krom Rivier and surrounding valley bottom and floodplains wetlands ▪ 35m buffer of small tributaries ▪ 35m buffer of valley bottom wetlands	▪ 35m buffer of the Krom Rivier and surrounding valley bottom and floodplains wetlands ▪ 35m buffer of small tributaries ▪ 35m buffer of valley bottom wetlands	may be constructed through these features. The proposed widening of the access roads are along existing roads and the watercourse crossings can be adequately mitigated so that these aquatic ecosystems would not be a constraint to the required upgrade to the existing roads.
Heritage	NO-GO: ▪ Grade IIIA features	NO-GO: ▪ Grade IIIA features with 50 m buffer	
	HIGH: ▪ Grade IIIB features	HIGH: ▪ Grade IIIB features with 50 m buffer	
	MEDIUM: ▪ Grade IIIC/GPA/GPB features	MEDIUM: ▪ Grade IIIC/GPA/GPB features with 50 m buffer	
Avifauna	NO-GO: ▪ 2km buffer around a Verreaux Eagle nest ▪ 250m buffer around dams	NO-GO: ▪ 2km buffer around a Verreaux Eagle nest ▪ 250m buffer around dams	Use may be made of existing roads (which may be widened) within the no-go areas.
Terrestrial Ecology	NO-GO: ▪ Optimal Riverine Rabbit Habitat ▪ Drainage lines ▪ Valleys ▪ Hills	NO-GO: ▪ Optimal Riverine Rabbit Habitat ▪ Drainage lines ▪ Valleys ▪ Hills	The buffers do not apply to the widening of existing roads
Visual	NO-GO: ▪ Topographic features within 100m ▪ Steep slopes > 1:4 ▪ River features ▪ Cultural landscapes and croplands within 250m ▪ Private reserves or guest farms and	NO-GO: ▪ Topographic features within 100m ▪ Steep slopes > 1:4 ▪ Private reserves/guest farms	The sensitivity buffers do not apply to the widening of existing roads

	farmsteads outside the sites within 500m ▪ Farmsteads inside the site within 250m ▪ Scenic routes, ports, and passes within 750m ▪ District roads within 100m ▪ Minor roads within 50m		
	HIGH: ▪ Topographic features within 250m ▪ Steep slopes > 1:10 ▪ River features within 500m ▪ Private reserves or guest farms and farmsteads outside the sites within 1km ▪ Cultural landscapes and croplands within 500m ▪ Farmsteads inside the sites within 500m ▪ Scenic routes, ports, and passes within 1km ▪ District roads within 150m ▪ Minor roads within 100m	HIGH: ▪ Topographic features within 50m ▪ Steep slopes > 1:10 ▪ River features within 50m ▪ Private reserves or guest farms within 250m	
	MEDIUM: ▪ Limited viewshed of solar ▪ Private reserves or guest farms and farmsteads outside the sites within 2km ▪ Scenic routes, ports, and passes within 2km ▪ District roads within 250m ▪ Minor roads within 250m	MEDIUM: ▪ River features within 100m ▪ Cultural landscapes and cropland within 150m ▪ Private reserves and guest farms within 350m	

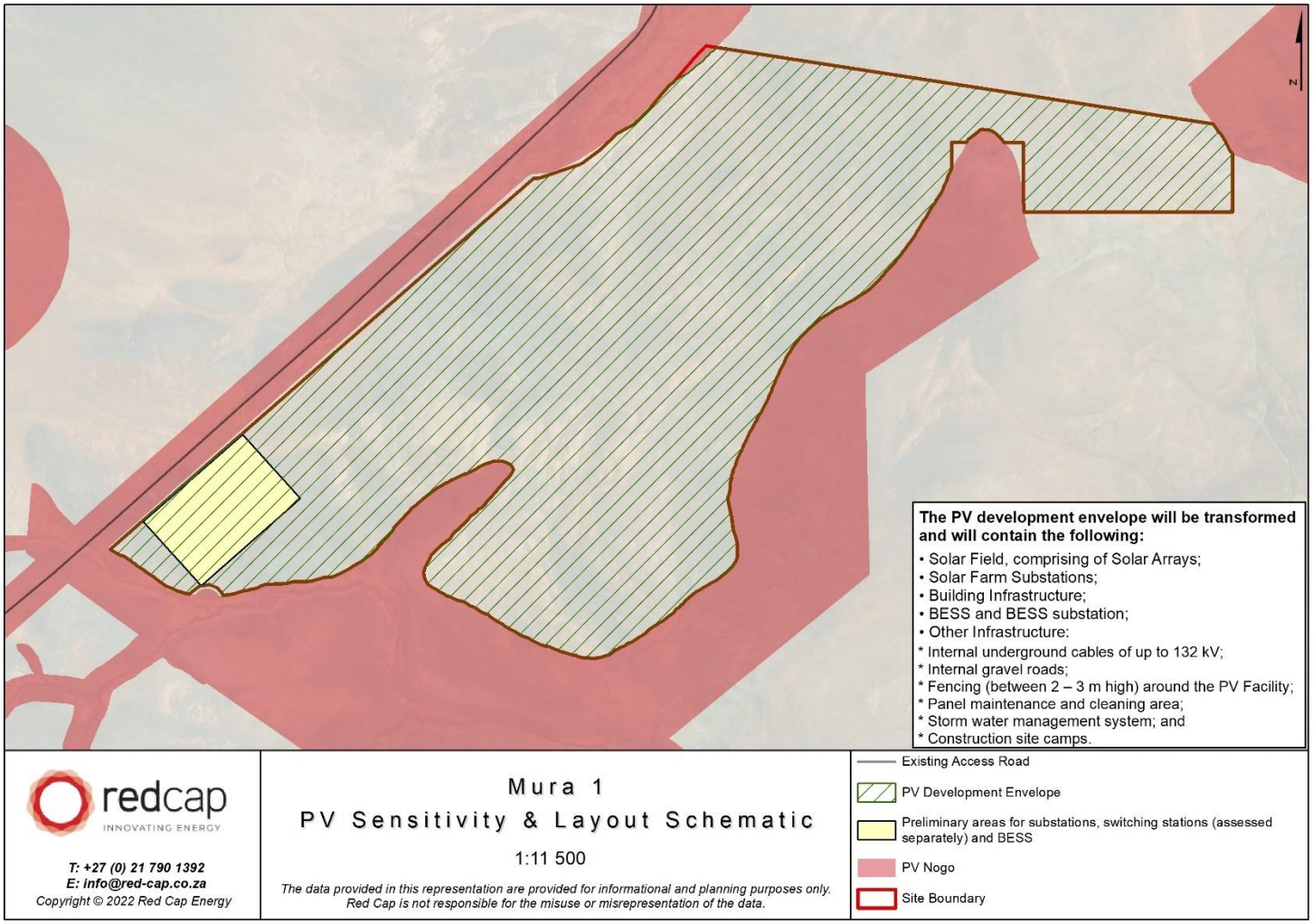


Figure 10-1 - Combined No-Go Sensitivity Map and Proposed Development Envelope for Mura 1 PV Facility

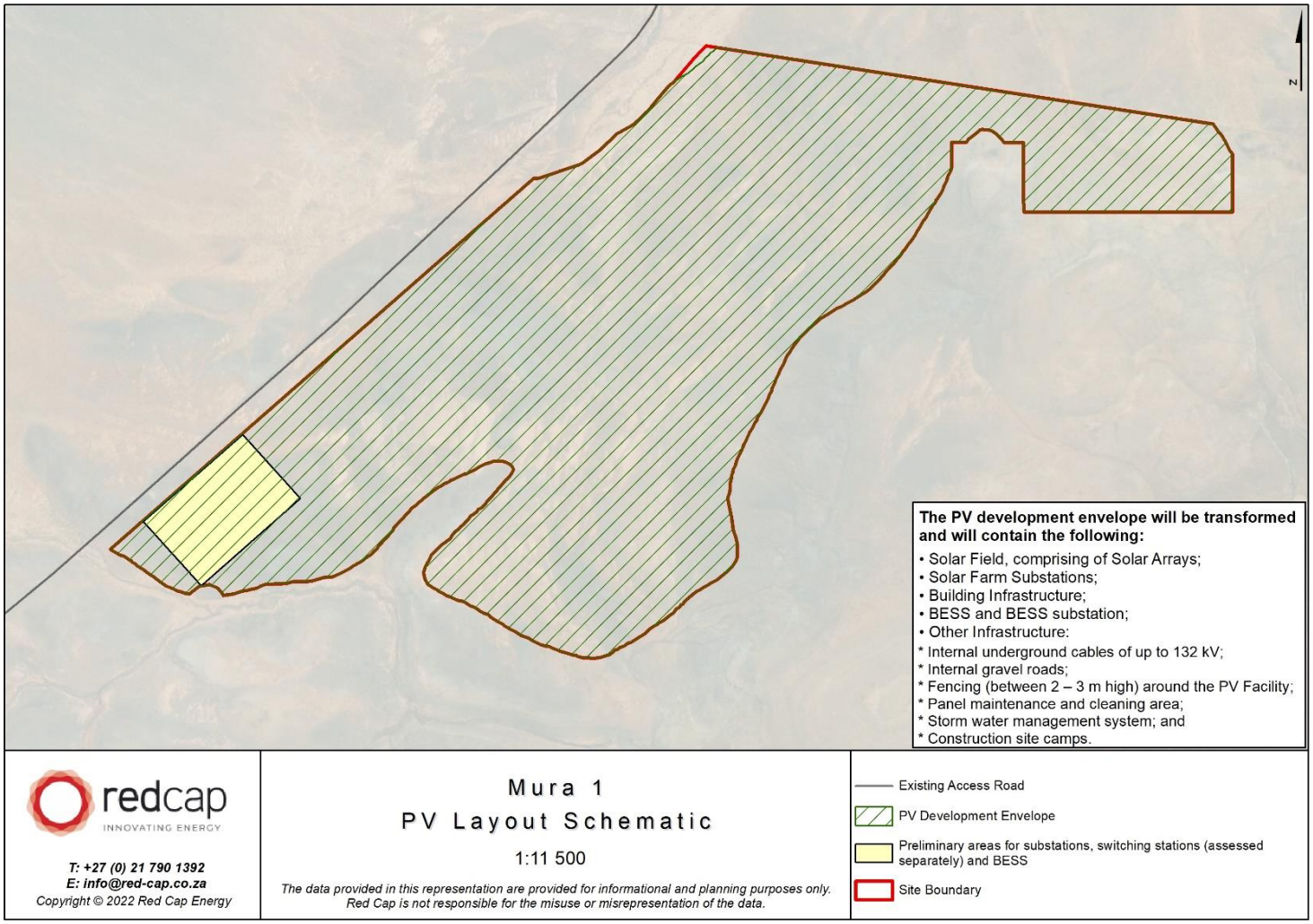


Figure 10-2 - Proposed Development Envelope for Mura 1 PV Facility

11 ENVIRONMENTAL IMPACT STATEMENT

The essence of any impact assessment process is aimed at ensuring informed decision-making, environmental accountability, and to assist in achieving environmentally sound and sustainable development. In terms of NEMA, the commitment to sustainable development is evident in the provision that “development must be socially, environmentally and economically sustainable…. and requires the consideration of all relevant factors…”. NEMA also imposes a duty of care, which places an obligation on any person who has caused, is causing, or is likely to cause damage to the environment to take reasonable steps to prevent such damage. In terms of NEMA’s preventative principle, potentially negative impacts on the environment and on people’s environmental rights (in terms of the Constitution of the Republic of South Africa, Act No. 108 of 1996) should be anticipated and prevented, and where they cannot be prevented altogether, they must be minimised and remedied in terms of “reasonable measures”.

In assessing the environmental feasibility of the proposed construction of the proposed Project, the requirements of all relevant legislation have been considered. The identification and development of appropriate mitigation measures that should be implemented to minimise potentially significant impacts associated with the project, has been informed by best practice principles, past experience, and the relevant legislation (where applicable).

The conclusions of this BA are the result of comprehensive assessments. These assessments were based on issues identified through the BA process and public participation undertaken to date. The BAR will be subject to public review, which will be undertaken according to the requirements of NEMA with every effort made to include representatives of all stakeholders within the process. The BAR will be updated and finalised taking into consideration all comments received during the public review period before being submitted to the CA for consideration.

11.1 IMPACT SUMMARY

A summary of the identified impacts and corresponding significance ratings for the proposed Mura 1 Solar PV Facility is provided in **Table 11-1** below. With the implementation of the mitigation measures prescribed by the specialists, the impacts are rated as Moderate to Very Low.

Table 11-1 – Impact Summary

Aspect	Impact Description	Phase	Character	Without Mitigation		With Mitigation	
Climate Change	Impact of project on climate change	O	(+)	85	Very High	N/A	
Aquatic Biodiversity	Decrease in habitat integrity	C	(-)	16	Low	10	Very Low
	Decrease in aquatic ecosystem integrity	C	(-)	16	Low	5	Very Low
	Stress on water resource	C	(-)	20	Low	12	Very Low
	Flow modification	C	(-)	12	Very Low	10	Very Low

Aspect	Impact Description	Phase	Character	Without Mitigation		With Mitigation	
	Decrease in aquatic ecosystem integrity	C	(-)	10	Very Low	10	Very Low
	Water quality impacts	C	(-)	6	Very Low	5	Very Low
	Aquatic ecosystem integrity	O	(-)	30	Low	14	Very Low
	Aquatic ecosystem integrity	O	(-)	27	Low	14	Very Low
	Stress on water resource	O	(-)	14	Very Low	14	Very Low
	Flow/hydraulic modification	O	(-)	16	Low	5	Very Low
	Loss of aquatic habitat and biota	D	(-)	12	Very Low	5	Very Low
	Aquatic ecosystem integrity	D	(-)	12	Very Low	5	Very Low
Avifauna	Destruction of habitat	C	(-)	60	Moderate	60	Moderate
	Disturbance of birds	C	(-)	24	Low	24	Low
	Fatality of birds	O	(-)	42	Moderate	28	Low
	Disturbance of birds	D	(-)	24	Low	24	Low
Archaeological and Cultural Heritage	Archaeological resources	C	(-)	24	Low	12	Very Low
	Graves	C	(-)	12	Very Low	12	Very Low
	Cultural landscape	C	(-)	45	Moderate	45	Moderate
	Cultural landscape	O	(-)	55	Moderate	55	Moderate
	Cultural landscape	D	(-)	45	Moderate	40	Moderate
Palaeontology	Loss of fossil heritage resources	C	(-)	26	Low	13	Very Low
Traffic	Increased Road Incidents	C	(-)	56	Moderate	42	Moderate
	Road degradation	C	(-)	44	Moderate	33	Moderate
	Dust	C	(-)	36	Moderate	27	Low
	Intersection safety	C	(-)	56	Moderate	42	Moderate

Aspect	Impact Description	Phase	Character	Without Mitigation		With Mitigation	
	Intersection safety	O	(-)	33	Moderate	33	Moderate
Visual	Visual effect of construction activities on scenic resources and sensitive receptors	C	(-)	40	Moderate	30	Low
	construction activities of new access roads and construction camps on scenic resources and sensitive receptors	C	(-)	27	Low	18	Low
	Visual intrusion on scenic resources and sensitive receptors	O	(-)	48	Moderate	36	Moderate
	Visual effect of traffic on sensitive receptors	O	(-)	22	Low	22	Low
	Visual intrusion of activities to remove infrastructure	D	(-)	36	Moderate	24	Low
Social	Regional employment and household income	C	(+)	55	Moderate	60	Moderate
	Influx of people	C	(-)	33	Moderate	27	Low
	Tourism	C	(-)	30	Low	27	Low
	Surrounding landowners and communities	C	(-)	44	Moderate	30	Low
	Regional employment and household income	O	(+)	60	Moderate	65	High
	Funding of local socio-economic development	O	(+)	55	Moderate	60	Moderate
	Influx of people	O	(-)	33	Moderate	30	Low
	Tourism	O	(-)	33	Moderate	30	Low
	Surrounding landowners and communities	O	(-)	36	Moderate	22	Low
	Regional employment and household income	C	(+)	55	Moderate	60	Moderate
	Influx of people	C	(-)	33	Moderate	27	Low
	Tourism	C	(-)	30	Low	27	Low

Aspect	Impact Description	Phase	Character	Without Mitigation		With Mitigation	
	Surrounding landowners and communities	C	(-)	44	Moderate	30	Low

11.2 SPECIALIST CONCLUSIONS

11.2.1 CLIMATE CHANGE

It is the opinion of the specialist, from a climate change perspective, that each of the four Mura Solar PV projects should receive authorisation, based on the following key aspects:

- The project will adopt solar technology and will therefore significantly reduce the consumption of fossil-fuel generated energy and reduce the environmental impact associated with these fuels. According to the Integrated Resource Plan (2019), Solar PV presents an opportunity to diversify the energy mix to produce distributed generation and provide off-grid electricity in South Africa.
- The project will contribute to the Nationally Determined Contribution of South Africa, which is aligned to the Paris Agreement, in that it will play a role in the decarbonisation efforts for South Africa.
- Solar energy presents the basic environmental benefit of the displacement, or the avoidance of emissions associated with conventional electricity generation. Solar energy also has the potential to address the need for energy access in remote areas, create jobs and increase localisation.

Each solar farm will only contribute 18.4 kt of indirect emissions from the construction phase (or 0.12 $ktCO_2e$ per MW), with a total contribution of 73.7 5 $ktCO_2e$ (0.49 $ktCO_2e$ per MW) indirect emissions from the construction phase of all four solar farms. This will result in a medium impact per solar farm in relations to the South Africa's carbon budget. However, the cumulative impact of the Development, with the proposed wind farms in the area, on climate change is considered to be very high positive. This is as a result of the avoided emissions that the Development creates over the lifetime of the project.

11.2.2 AGRICULTURAL POTENTIAL

The site has low agricultural potential and no dryland cropping potential predominantly because of aridity constraints but also because of soil constraints. As a result of the constraints, agricultural production is limited to low density grazing. The land across the site is verified in this assessment as being of low agricultural sensitivity.

Two potential mechanisms of negative agricultural impact were identified, occupation of agricultural land and land degradation. One potential mechanism of positive agricultural impact was identified as increased financial security for farming operations.

All mechanisms are likely to lead to low impact on the agricultural production potential and the agricultural impact is therefore assessed as having low significance.

The conclusion of this assessment is that the agricultural impact of the proposed development is acceptable because:

- it will occupy land that is of very limited land capability, which is insufficient for crop production. There is not a scarcity of such agricultural land in South Africa and its conservation for agricultural production is not therefore a priority.

- The amount of agricultural land use by the development is within the allowable development limits prescribed by the agricultural protocol. These limits reflect the national need to conserve valuable agricultural land and therefore to steer, particularly renewable energy developments, onto land with low agricultural production potential.
- The PV panels will not necessarily totally exclude agricultural production. The area can still be used to graze sheep that will, in addition, be protected against stock theft within the security area of the facility.
- All renewable energy development in South Africa decreases the need for coal power and thereby contributes to reducing the large agricultural impact that open cast coal mining has on highly productive agricultural land throughout the coal mining areas of the country.

From an agricultural impact point of view, it is recommended that the developments be approved.

The conclusion of this assessment on the acceptability of the proposed developments and the recommendation for its approval is not subject to any conditions, other than recommended mitigation.

11.2.3 TERRESTRIAL BIODIVERSITY

The DFFE Screening Tool indicates that the Mura 1 PV project site has a low sensitivity for Terrestrial Biodiversity Theme and the field assessment was able to confirm that there are no significant vegetation or faunal features within the development footprint. The site does not lie within a NPAES Focus Area or a Strategic Water Resource Area (SWSA). The contribution of the current project to cumulative impact is considered to be relatively low given the low sensitivity of the features within the development footprint and the low level of transformation the broader area has experienced. This Terrestrial Biodiversity Theme Compliance Statement therefore finds that the footprint of the Mura 1 Solar PV Facility is restricted to low sensitivity areas with no observed plant or animal species of conservation concern present, and as such, there are no reasons to oppose the Mura 1 Solar PV facility.

11.2.4 AQUATIC BIODIVERSITY

The study area is in the upper reaches of several tributaries of the Krom River, a tributary of the Sout River in the Groot / Gamtoos River System. The Screening Tool map for the Aquatic Biodiversity Combined Sensitivity at the site indicates most of the wider area to be of low sensitivity, with only the main channels of the larger rivers mapped as being of very high sensitivity. The very high sensitivity is linked to aquatic CBAs that are associated with larger rivers that contain instream wetland habitat. These larger river channels will need to be crossed by the proposed existing access roads to the Mura PV Projects. The findings of this assessment largely agree with the screening tool mapping.

The study area does not lie within a FEPA River Subcatchment. The only natural instream wetland areas within the study area are within the larger channel of the Krom River downstream of the site that has been mapped in the FEPA Wetland mapping as Upper Nama Karoo unchanneled valley-bottom wetlands. These wetlands are also mapped in the National Wetland Map (version 5) as valley-bottom wetland. All other FEPA wetland mapping within the study area comprises artificial wetlands associated with farm dams. The watercourses are all mapped as aquatic ESAs (ESA1). Some aquatic ESAs (ESA2) occur where there is localised disturbance within the watercourses, such as at the track/road crossings. Within the terrestrial CBAs, the watercourses have also been mapped as aquatic CBAs.

The rivers and wetlands within the study area are still in a natural ecological condition with few modifications. The Krom River is more impacted by surrounding landuse activities and is in a largely natural to moderately modified ecological condition. The Krom River in the study area is deemed to be of a high ecological importance and sensitivity. This is due to the importance of this larger aquatic ecosystem in providing a diversity of habitats and being important refugia for biota as well as corridors for the movement within the landscape. The wetland features within the study area are considered of moderate ecological importance and sensitivity as they are closely associated with the larger Krom River, providing habitat and ecological corridors for the movement of biota.

Based on the present ecological condition and the ecological sensitivity and importance, aquatic sensitivity and recommended buffers have been mapped to protect these ecosystems. The recommended buffer area between the aquatic features and the project components to ensure these aquatic ecosystems are not impacted by the proposed activities is 35m from the centre of these streams or along the delineated edge of the wide associated floodplain area.

In terms of the proposed Mura solar PV locations, there are some minor watercourses that occur within each of the proposed PV Facilities. These watercourses are deemed of moderate sensitivity and the potential impact of the proposed activities is likely to be of low significance that they would not pose a constraint to the proposed development if mitigated. Similarly, the proposed access road is along existing roads and the watercourse crossings can be adequately mitigated so that these aquatic ecosystems would not be a constraint to the required upgrade to the existing roads.

Based on the findings of this specialist assessment, there is no reason, from a freshwater perspective, why the proposed development (with the implementation of mitigation measures) should not be authorized.

11.2.5 PLANT SPECIES

The compliance statement is applicable to the Mura 1 Solar Facility development with specific reference to the layout as provided for the assessment.

The vegetation of the site is mapped as Eastern Upper Karoo with no other vegetation types present within the development footprint. There are no threatened vegetation types present within the site or nearby. No plant SCC, were observed within the site despite extensive walked transects across the PV area, confirming the low sensitivity of the project footprint. The low sensitivity of the site as identified by the DFFE Screening Tool for the Plant Species Theme was confirmed by the field assessment there are no significant vegetation features within the site.

As such, from a plant species perspective there are no reasons to oppose the Mura 1 PV facility.

11.2.6 ANIMAL SPECIES

The compliance statement is applicable to the Mura 1 Solar PV Facility development with specific reference to the layout as provided for the assessment.

Although the DFFE Screening Tool identified the site as having medium sensitivity due to the possible presence of the Karoo Dwarf Tortoise and Riverine Rabbit, the field assessment indicates that there is no suitable habitat within the PV footprint areas for either species. A desktop analysis indicates that there are several other fauna of concern that are confirmed present in the wider area. However, interrogation of the available information and the observed features of the PV footprint areas indicates that none of these species are likely to occur within the affected area. No fauna species of concern, were observed within the site despite sampling the site with camera trapping

over more than four months and walked transects across the PV area, confirming the low sensitivity of the project footprint.

Given the above results, the site is therefore considered low sensitivity from an Animal Species Theme perspective. The footprint of the Mura 1 Solar PV Facility is restricted to low sensitivity areas with no observed faunal species of conservation concern present or likely to be present.

As such, from a faunal species perspective there are no reasons to oppose the Mura 1 Solar PV Facility.

11.2.7 AVIFAUNA

The avifauna specialist (Wildskies) made the following findings with respect to avifauna:

- A total of 88 bird species were recorded on site by Wildskies pre-construction bird monitoring methods. Five of these 88 species are regionally Red Listed: Ludwig's Bustard is Endangered; Verreaux's Eagle is Vulnerable; and Karoo Korhaan, Blue Crane and Sclater's Lark are Near-threatened (Taylor et al, 2015).
- Wildskies judge Ludwig's Bustard and Karoo Korhaan to be at High risk if the proposed projects proceed, due to habitat destruction and disturbance. Verreaux's Eagle and Sclater's Lark are judged to be at Medium risk, and Blue Crane at Low risk.

The construction of each of the proposed projects will transform a relatively large area of natural habitat. However, the avifaunal community using this habitat is not remarkable, nor is the habitat particularly unique or scarce. The impacts of the proposed project are all rated as Moderate Negative or even Low Negative significance after mitigation. Wildskies recommend that each of the projects be authorised, provided that the recommendations of the report are implemented.

11.2.8 HERITAGE

The heritage specialist concludes that there are no highly significant concerns for any of the four Mura PV projects. Heritage indicators are specified in **Table 11-2**. Given that there are no significant concerns for this project, it is the opinion of the heritage specialist that the project should be authorised in full.

Table 11-2 – Heritage indicators and responses

Indicator	Response
Uncontrolled damage to fossils should be minimised as far as possible	Significant fossils are not expected in the study area but a Chance Finds Protocol has been supplied for inclusion in the EMPr.
Direct damage to archaeological sites should be avoided as far as possible and, where some damage to significant sites is unavoidable, scientific/historical data should be rescued.	This has been done.
Buffers of at least 30 m should be maintained around known archaeological sites as far as possible.	This has been done.

11.2.9 PALAEONTOLOGY

The Mura 1 PV Facility areas is underlain by continental sediments of the Teekloof Formation (Poortjie and Hoedemaker Members) within the Lower Beaufort Group, Karoo Supergroup). Fossil assemblages of the Endothiodon Assemblage Zone of latest Middle to earliest Late Permian age are associated with the Lower Beaufort Group beds mapped within most or all of the combined project area; however, representatives of the older Tapinocephalus Assemblage Zone might also be present within the lower parts of the Poortjie Member (unconfirmed). These fossils record the recovery phase on land from the end-Middle Permian Mass Extinction Event of c. 260 million years ago.

It is concluded that the Mura 1 PV facility, including the footprints of all associated infrastructure (e.g. access road network) are, in practice, of LOW Palaeosensitivity, although the potential for unrecorded fossil sites of high scientific value cannot be entirely discounted. The provisional Medium to Very High Palaeosensitivity mapped by the DFFE Screening Tool is accordingly contested here.

No recorded fossil sites of unique scientific or conservation value are likely to be directly impacted by the proposed renewable energy and electrical infrastructure developments and no further palaeontological studies or mitigation is proposed here with regard to these sites. Pending the discovery of significant new fossil finds before or during construction, no further specialist palaeontological studies, monitoring or mitigation are recommended for these renewable energy and electrical infrastructure projects. The Environmental Control Officer (ECO) responsible for the developments should be aware of the potential for fossil sites of scientific value and should monitor substantial surface clearance and excavations for fossils on an ongoing basis during the Construction Phase. Any new fossil sites revealed during the Construction Phase of the developments are best handled by the Chance Fossil Finds Protocol included in the EMPR.

11.2.10 TRAFFIC

Based on the information provided the following conclusions can be drawn:

- The proposed developments are to be constructed simultaneously, over a period of 24 months.
- Assessment Assumptions:
  - The simultaneous construction of the proposed developments, based on a manpower complement of approximately 1 272 individuals.
  - The three Nuweveld WEF are assumed to have been constructed and are in the operational phase, based on a manpower complement of 96 individuals.
  - The two Hoogland WEF Clusters, each cluster consisting of two WEF and associated infrastructure, are assumed to be in their construction phase, based on a manpower complement not exceeding 1 200 individuals.
  - The Gamma Grid Connection is assumed to be its construction phase, based on a manpower complement not exceeding 60 individuals.
  - The construction schedule of the renewable projects is unknown at this stage. A conservative assessment has been adopted which assumes that the traffic volumes of all the projects identified, peak at the same time, resulting in a worst-case scenario.
  - It is not possible to determine the volume of traffic that will be generated during the decommissioning phase. It can, however, be expected that the volumes will be lower than

during the construction phase. As part of the decommissioning process, a separate traffic impact assessment should be undertaken, since many of the characteristics related to the traffic impact assessment, i.e. access routes, road geometry, traffic volumes etc., would have changed over the operational life of the development.

- Road Conditions:
  - Many of the roads within the study area are gravel roads. Some of the roads are in better condition than others. There is a higher level of maintenance on the roads in the Western Cape than there is in the Northern Cape. All roads adjacent to the proposed development are expected to deteriorate due to the increased traffic volumes. Thus, the developer would have to assist local roads authorities with regular maintenance of these roads.
  - Some roads can be used by light vehicles but are not conducive to busses or delivery vehicles. The TMP needs to prescribe which roads are to be used.
  - Traverses the Molteno Pass and De Jager's Pass, are extremely treacherous, with very few barriers, steep drop-offs, very tight corners, negative banking and loose gravel. The contractor needs to assess the viability of using this road for the commuting of personnel to and from site safely.
  - The majority of the deliveries to the proposed developments will be transported via the TR 05801 via Loxton and DR 02317;
  - All vehicles delivering equipment and material to the proposed development using the Molteno Pass and De Jager's Pass, shall be limited to a gross vehicle mass not exceeding ten tonnes.
  - The expected traffic increase on the road network during the peak construction phase will lead to more significant wear and tear of the roads but will not have an undue detrimental impact on the structure of the roads if the roads are properly maintained. The developer shall contribute to maintaining the public road network affected by the development as identified by the local roads' authorities. It is proposed that the developer contribute to the maintenance of the road network during the construction and the operational phases, commencing the year after successfully achieving Commercial Operation.
  - Additional ongoing funding from the developer towards the maintenance of the roads will have a positive impact on the local road conditions and community.
  - The public road network within the study are will need to be reassessed at the time of implementation to verify the functionality of the roads, which could have changed since the initial inspection.
- Transportation Route
  - The proposed developments are accessed from well-established transportation routes between large commercial centres within South Africa.
  - Previously established transportation routes from the Commercial Centres and Container Terminal in South Africa are to be used.
  - The final route selection is subject to the limitations specified in the transport permits and the vehicles to be used by the appointed logistics company.
  - All site entrances from public roads, existing intersection and road alignments that require upgrading to accommodate the transportation requirements of equipment and material are to comply with geometric standards and approved by the relevant roads' authorities.
  - All equipment and material transported to the proposed developments on vehicles with a gross vehicle mass exceeding ten tonnes shall be on the TR05801 via Loxton.

- All vehicles transporting equipment and material to the proposed developments via the Molteno Pass and De Jager's Pass, shall be limited to a gross vehicle mass of not exceeding ten tonnes due to the constraints imposed by the road geometry;
- No anomalies associated with the proposed transportation routes were observed or identified that will compromise the development. However, this will have to be confirmed by the logistics contractor once appointed.

- Traffic Volumes
  - The most significant impact on traffic volumes results from the commuting of personnel, to and from the proposed developments, in the morning and the afternoon;
  - At no point during the construction or operational phases of the proposed developments does the traffic volume on the various roads exceed 50 trips per hour, which is the threshold for a detailed Traffic Impact Assessment.
  - The cumulative traffic volume generated during the peak construction phase of the Mura SEF and Grid Connection, together with the operational phase of the three Nuweveld WEF and the construction of Hoogland WEF (North), Hoogland WEF (South) and the Gamma Grid Connection, is in the order of:
    - Peak Traffic: The maximum number of vehicles on any one section of the public road network within a given hour is estimated to be in the order of 89 vph.
    - Diurnal Traffic: The maximum number of vehicles on the road network within a given hour is estimated to be in the order of 87 vph. Which equates to approximately 696 vehicles, over an eight-hour period.
  - The cumulative traffic volume generated during the operational phase of four Mura SEF, the three Nuweveld WEF, the Hoogland WEF (North), and the Hoogland WEF (South), is in the order of:
    - Peak Traffic: The maximum number of vehicles on the road network within a given hour is estimated to be in the order of 29 vph;
    - Diurnal Traffic: The maximum number of vehicles on the road network within a given hour is estimated to be in the order of 6 vph. Which equates to approximately 48 vehicles, over an eight-hour period.
  - The minimum required level of service for gravel roads is LOS C. For the worst-case scenario, the additional traffic volume of the proposed developments results in a LOS B. Thus, the additional traffic volume does not compromise the level of service of the roads.
- Safety
  - The winding roads through the De Jager's Pass and Molteno Pass, is a serious safety concern that needs to be addressed by the developer in consultation with the local roads' authority.
  - The vertical alignment of the DR 02317, raises a number of serious concerns, ranging from blind rises to loss of control when travelling at high speeds.
  - This is a rural area, home to many species of small fauna, including livestock and wild animals. Stray animals on/crossing the road is a common occurrence that could result in a collision.
  - Excessive fine and loose material was observed along the various roads creating visibility concerns in dry weather and slippery conditions in wet weather.

- Additional vehicles on the road will be subject to these hazards, with a potential for an increase in incidents.
- The passing through homesteads that straddle the roads is a serious safety concern that needs to be included in the TMP.
- The area is prone to flash flooding, resulting in drifts being impassable. Road users need to be sensitised as to the intrinsic dangers of crossing these drifts when in flood.

11.2.11 VISUAL

The layout of the Mura solar facilities has been subject to an iterative planning process, based on the various specialist findings, including the mapping of scenic resources and sensitive receptors. The currently proposed layout succeeds in avoiding visually sensitive areas as indicated on the visual sensitivity map in **Section 7.9**.

The cumulative visual impact of the solar facilities and related infrastructure, such as the substations, BESS and grid connection powerlines, could affect the rural quality of the area, but this would be fairly localised.

It is the opinion of the Visual Specialists that provided the recommended mitigation measures and EMPr are implemented, the project would not present a potential fatal flaw in visual terms and could be authorised.

11.2.12 SOCIAL

In term of positive impacts, the Mura Solar Energy Facilities would be largely supportive of local and regional socio-economic development and energy supply planning imperatives. The projects would contribute to the growth and diversification of the economy as well as increased energy generation capacity. Implementation of the projects would result in construction expenditure of R2–2.9 billion per Solar Facility (R8–11.6 billion for all four). During operations, a further R36.7–52 million would be spent by each Solar Facility (R147–208 million for all four). Roughly 275 to 455 jobs of 18 to 24-month duration would be associated with construction of each 100–240 MW Solar Facility (1100–1820 for all four, although likely closer to the 1,100 given likely economies of scale). Each facility would create 21–37 permanent jobs during operations. Positive mitigation of this impact includes the timely communication of skills profiles needed, particularly during operations, so that local skills development priorities can be expanded or adapted accordingly to enable members of the local community to benefit from positions in the solar industry. Assuming that spending on socio-economic development, local community shareholding and enterprise development is spread evenly over the 20-year project period, each facility is projected to result in an annual contribution of R6–7.4 million (R24–29.6 million for all four facilities) to these objectives collectively. As these figures are based on the minimum requirements, they represent conservative estimates.

Negative impacts would occur primarily at the local and regional scale, concentrated at the project sites as well as in communities residing on neighbouring farms and in surrounding towns. These include impacts associated with the influx of people which are not anticipated to be pronounced should the suggested mitigation be implemented. To inform the rating of impacts on tourism, the area's remote location and unique sense of place has been considered, along with the findings of the VIA and HIA outlining expected changes to the area's cultural landscape. A review of local tourism establishments suggests that negative impacts on tourism are manageable, while slight benefits from business tourism are expected to compensate, at least in part, for any reduction in demand which may be experienced by tourism operators. Impacts on surrounding landowners and

communities are expected to diminish with the suggested mitigation measures, and close coordination with key stakeholders is recommended to ensure that negative impacts can be limited by effective action.

It is considered most likely that the combined positive impacts of the project would exceed its negative impacts resulting in an overall net benefit with mitigation. The projects are therefore deemed acceptable in terms of socio-economic impacts and should be allowed to proceed.

11.3 RECOMMENDATIONS

The following key aspects are recommended to be included as conditions of authorisation:

- The Development Envelope and associated layout must avoid all the no-go areas identified by the specialists;
- EMPr is to be updated to include the final layout map once finalised and approved by DFFE;
- The EMPr and BAR mitigation measures must be adhered to;
- Recommendations for the layout as provided by the relevant specialists must be implemented;
- The final EMPr must form part of all contractual documents with contractors during construction and operational phases of the project. Furthermore, a dedicated Environmental Control Officer (ECO) must be appointed to ensure compliance to all EA conditions and EMPr commitments throughout the construction phase;
- Appropriate permits in terms of the Western Cape Nature Conservation Laws Amendment Act (Act No 3 of 2000) must be obtained before commencement; and
- Where required, water use authorisation under NWA is to be obtained from the Department of Water and Sanitation prior to construction.

The following specialist recommendations have been made in respect of the project:

- Agricultural Potential:
  - The stormwater management that will be an inherent part of the engineering on site and standard, best-practice erosion control measures recommended and included in the EMPr, are likely to be effective in preventing soil erosion.
- Terrestrial Biodiversity:
  - The avoidance and mitigation measures proposed from the specialist should be included in the EMPr for the Mura 1 Solar Facility in order to avoid, reduce and manage impacts on terrestrial biodiversity.
- Aquatic Biodiversity:
  - Specific recommendations to be included in the EA are:
    - The water for construction and operation of the PV facilities should be provided from a viable water source.
    - No infrastructure or panels may be placed within the high sensitivity watercourses but the underground cables and limited-service tracks may be constructed through these features, as well as existing access roads widened.
    - Use existing disturbed areas (e.g., roads and access tracks), where possible. In terms of new service tracks, these must be kept to a minimum and should ideally not result in any new / permanent water course crossings, but if these are required, then a specific walk

down should be conducted with the specialist to identify the most suited crossing position. Where these crossings do occur, it needs to be monitored for erosion
  - Construction near sensitive aquatic features should preferably be undertaken in the dry season. If necessary, sediment traps should be placed downstream of works to capture sediment.
  - Construction sites and laydown areas should be placed at least 35m away from the delineated aquatic features. Good housekeeping measures should be implemented at the construction sites that are set out in the EMPr and monitored by an appointed ECO for the project.
  - Invasive alien plant growth and signs of erosion should be monitored on an ongoing basis to ensure that the disturbed areas do not become infested with invasive alien plants.
- The recommended mitigation measures proposed must be included in the EMPr.

- Plant Species:
  - The avoidance and mitigation measures proposed should be included in the EMPr for the Mura 1 Solar Facility in order to avoid, reduce and manage impacts on vegetation and plant species.
- Animal Species:
  - The avoidance and mitigation measures proposed should be included in the EMPr for the Mura 1 Solar PV Facility in order to avoid, reduce and manage impacts on fauna and associated habitats.
  - R100 000 per year based on 2022 value must be made available for two years once construction has commenced. The way in which the funding is structured should be flexible, however, it is recommended that if Riverine Rabbit monitoring is still being undertaken on the Nuweveld Wind Farms and/or Hoogland Wind Farms, the project funding should prioritise contributing to these associated monitoring programmes or alternatively, contribute to the broader conservation initiative by any wind farms in the broader area
- Avifauna:
  - The mitigation measures recommended must be included in each project's EMPr.
- Heritage:
  - The mitigation measures recommended must be included in each project's EMPr as well as the Fossil Chance Finds Procedure (as supplied in the palaeontological specialist study).
- Palaeontology:
  - Implement the Chance Fossil Finds Protocol (included in the EMPr) should any fossils be found during the construction phase.
- Traffic:
  - The following recommendations are made and should be included in the conditions of the environmental authorisation:

- All remedial work or modifications to any of the public roads shall be done in consultation with and have the approval of the local road's authority (as is standard practice, this will be finalised during and be a requirement of the municipal planning approval process).
- The treacherous section of the gravel road, through the De Jager's Pass and Molteno Pass, is safety concern that need to be addressed by the developer in consultation with the local roads authority.
- The route for construction vehicles from the TR 01606/7 to the TR05801 should not unduly impact the local community of Loxton and should avoid the commercial centre of Loxton.
- The developer shall contribute to the maintenance of all roads affected by the development, during the construction and operational phases of the development.
- A TMP is required to outline specific traffic management measures across all phases of the development. The focus of the TMP will be the construction phase since this is when the traffic movements and risks are most significant. TMP be compiled once the contractor has been appointed and all the relevant details of the construction process are known.
- The TMP should consider the scope of the development and take cognisance of the existing condition of the road network at the time the project commences.
- The developer shall ensure that the contractor provides the necessary driver training to key personnel to minimise the potential of incidents on the public road network.
- The developer shall ensure that the contractor erects temporary signs warning motorists of construction vehicles on the approaches to the access road.
- The developer shall ensure that the condition of the roads impacted by construction of the development is left in a similar or better state once the construction phase is complete.
- Implement the relevant transport impact mitigations measures.

- Visual:
  - Include mitigation measures suggested in the visual impact assessment into the EMPr. This should be included in the Environmental Authorisation for the project.

11.4 EA AUTHORISATION PERIOD

Appendix 1(3)(1)(q) of the NEMA EIA Regulations 2014, as amended requires "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" must be included in the BA Report.

The EA is required for a period of 10 years from the date of issuance of the EA to the end of the construction period (including rehabilitation), when the proposed activities applied for are completed. This is a reasonable period as it allows Eskom to conduct its internal processes which can only begin after issuance of the EA, when the proposed route is confirmed.

11.5 FINALISATION OF THE EMPR AND DEVELOPMENT ENVELOPE

It is important to note that the no project layout has been presented within this reports but rather a Development Envelope which restricts any layout to areas outside of no-go areas.The final site layout. Similarly the EMPr (**Appendix H**) included in this BAR is not final and although included in this BAR, it is not submitted for approval at this stage. Subsequent to the decision-making phase, if environmental authorisation is granted for the Mura 1 Solar PV Facility, the EMPr will have to be amended to include measures as dictated by the final layout map and micro-siting (where required),

including the requirements of the EA. The amended EMPr and final layout subjected to micro-siting will be submitted to the DFFE for review and approval following detailed design.

Similarly,

12 CONCLUSION AND WAY FORWARD

The overall objective of the BA is to provide sufficient information to enable informed decision-making by the authorities. This was undertaken through consideration of the proposed Project components, identification of the aspects and sources of potential impacts and subsequent provision of mitigation measures.

It is the opinion of WSP that the information contained in this document (read in conjunction the EMPr) is sufficient for DFFE to make an informed decision for the environmental authorisation being applied for in respect of this Project.

Mitigation measures have been developed, where applicable, for the above aspects and are presented within the EMPr. It is imperative that all impact mitigation recommendations contained in the EMPr, of which the environmental impact assessment took cognisance, are legally enforced.

Considering the findings of the respective studies, no fatal flaws were identified for the proposed Project. Should the avoidance and mitigation measures prescribed be implemented, the significance of the considered impacts for all negative aspects pertaining to the environmental aspects is expected to be acceptable. It is thus the opinion of the EAP that the Project can proceed, and that all the prescribed mitigation measures and recommendations are considered by the issuing authority.

WAY FORWARD

This Draft BAR is available for review from **06 March 2023** to **06 April 2023**. All issues and comments submitted to WSP will be incorporated in the Comments and Responses Table of the SER.

The Draft BAR will be updated with all comments and submitted as a Final BAR to the delegated competent authorities responsible for authorising this project.

If you have any further enquiries, please feel free to contact:

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Appendix A

EAP CV

Appendix B

EAP DECLARATION

Appendix C

SPECIALIST DECLARATIONS

Appendix D

STAKEHOLDER ENGAGEMENT REPORT

Appendix E

MAPS

Appendix F

DFFE SCREENING TOOL REPORTS

Appendix G

SPECIALIST STUDIES

Appendix G.1

CLIMATE CHANGE ASSESSMENT

Appendix G.2

AGRICULTURAL COMPLIANCE STATEMENT

Appendix G.3

TERRESTRIAL BIODIVERSITY COMPLIANCE STATEMENT

Appendix G.4

AQUATIC BIODIVERSITY ASSESSMENT

Appendix G.5

PLANT SPECIES COMPLIANCE STATEMENT

Appendix G.6

ANIMAL SPECIES COMPLIANCE STATEMENT

Appendix G.7

AVIFAUNAL IMPACT ASSESSMENT

Appendix G.8

HERITAGE ASSESSMENT

Appendix G.9

PALAEONTOLOGICAL ASSESSMENT

Appendix G.10

TRAFFIC IMPACT ASSESSMENT

Appendix G.11

VISUAL IMPACT ASSESSMENT

Appendix G.12

SOCIAL ASSESSMENT

Appendix G.13

GEOHYDROLOGICAL ASSESSMENT

Appendix H

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