Pofadder Wind Facility 1 (Pty) Ltd

Proposed Commercial Wind Energy Facility (WEF)

Visual Impact Assessment

DEA Reference: *(or applicable)*
Report Prepared by: VRM Africa cc
Issue Date: 31 July 2022
Version No.: Final V1

POFADDER WIND FACILITY 1 (PTY) LTD

PROPOSED COMMERICAL WIND ENERGY FACILITY

VISUAL IMPACT ASSESSMENT

EXECUTIVE SUMMARY

Visual Resource Management Africa CC (VRMA) was appointed Pofadder Wind Facility 1 (Pty) Ltd to undertake a Visual Impact Assessment for the proposed Pofadder Wind Energy Facility 1 VIA. The proposed development site is located in the Northern Cape Province, within the Kai !Garib Local Municipality and the Z F Mgcawu District Municipality in the Northern Cape Province (as mapped in Figure 2). Three windfarms and associated infrastructure are proposed on a site located 25km southeast of the small town of Pofadder and 162km west of large town of Upington in the Northern Cape Province of South Africa. This report assesses the impacts of one of three Wind Farms associated with the Pofadder WEF project, with the same author assessing the Pofadder WEF 2 & WEF 3 as well.

A full Level 4 Visual Impact Assessment was undertaken for the proposed Pofadder Wind Energy Facility 1. The finding of the assessment is that the project should be authorised WITH MITIGATION for the following reasons:

- The area is remote, and only four farmstead receptors were located within the project ZVI, with Medium to Low Exposure (approximately 8km).
- No significant landscape resources were identified within the ZVI, and no tourist related activities are making use of the visual resources of the surrounding landscapes.
- As such, Landscape and Visual Impacts can be moderated with mitigation, specifically with regards to the management of night-time AWL.
- The nearest other proposed renewable energy project is Namies and Poortjie WEF (authorised, unbuilt), with location approximately 30km east where intervisibility is highly unlikely and cumulative effects rated Low (with mitigation).
- While the proposed collective views of the combined 90 turbines will be a dominating landscape feature, the effect is limited to the local landscape context, as with the arid environment, the atmospheric influences reduce clear visibility during the day to the Mid-ground distance region.
- Shadow Flicker impacts are unlikely to occur, and if they did, they would be low intensity and suitably addressed with mitigation.

Mitigations have been provided and should be implemented as part of authorisation, with special attention to the management of AWL. Clear methodology should also be provided on the demolishing of the concrete towers and associated rehabilitation, should concrete towers be utilised. On condition the above mitigation measures are implemented, the proposed development is acceptable from a visual and landscape perspective and there is no objection to its authorisation.

POLICY FIT	**Positive**

In terms of the *local and regional planning*, there is a strong emphasis on maintaining the rural agricultural sense of place, as well as ensuring that the significant landscapes of the region are not degraded. The local planning also highlights the need for renewable energy and economic

development that leads to employment opportunities. In terms of regional and local planning fit for landscape and visual related themes, the **expected visual/ landscape policy fit of the landscape change is rated Positive.**

METHODOLOGY **Bureau of Land Management's Visual Resource Management (VRM) method**

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

ZONE OF VISUAL INFLUENCE **High**

The extent of the impact is defined as the spatial or geographic area of influence of the visual impact. Due to the mainly flat surrounding terrain in relation to the 300m height of the turbines, the expected visible extent is likely to be Regional and the Extent of the visual impact is described as **High**.

RECEPTORS AND KEY OBSERVATION POINTS **5 receptor locations and 3 Key Observation Points**

Key Observation Points (KOPs) are the people (receptors) located in strategic locations surrounding the property that make consistent use of the views associated with the site where the landscape modifications are proposed. Due to the remote location, the number of receptors is limited to approximately five local farmsteads with Medium to Low levels of Visual Exposure, of which 1 farmstead was identified as Key Observation Points due to the location approximately 7.5km. The other is a local farm road that is routed through the proposed WEF area. The latter would have Very High levels of Visual Exposure, but very low usage.

SCENIC QUALITY **Medium**

The scenic quality of the proposed development site is rated Medium. Two main landscapes were identified within the study area; Bushmanland Arid Grassland and a low rocky outcrop. The scenic quality of the portions of the site are defined as Bushmanland Arid grassland, which are essentially flat with few landform features, and is rated **Low**. This is due to the flat terrain that has no water features, limited vegetation and colour variation and is not a scarce visual resource regionally. The only value element is the Adjacent Scenery which includes the low northern rocky outcrops which do have value and add to the regional landscape character. The overall sense of place is that of a rural, arid agricultural landscape that does not offer much in terms of scenic resources. The low ridgeline which includes steep slope areas is rated **Medium,** as this area is a key landscape element defining the ***local*** sense of place. This area also includes several shallow washes where drainage from the south has incised an opening through the rock creating a 'poort'. These areas have also been used as location points for farming activities and have a cultural value if they are of a scale that can be clearly noticeable. Only one 'poort' has landform value due to the steep sided nature of the adjacent low ridgeline.

RECEPTOR SENSITIVITY TO LANDSCAPE CHANGE	**Medium to Low**

Receptor sensitivity to landscape changes is rated Medium to Low. Receptor sensitivity to landscape changes for the flat Nama-karoo biome areas is rated **Low**. As the area is very remote with few essentially farming related receptors, it is expected that receptor sensitivity to the landscape change would be Low. The area has limited visual resources and the strong presence of the southern Eskom power line does reduce the sensitivity to landscape change on the site, due to the existing higher VAC levels generated by the pylons. The rocky outcrop and visual buffers are likely to have a higher sensitivity to landscape change and are rated **Medium** due to their scenic value and close proximity to human habitat areas. No I&AP comments were made regarding Visual of Landscape issues.

SHADOW FLICKER	**Low**

In South Africa, there are no specific guidelines as to how to assess shadow flicker generated by wind turbines. However, international guidelines state that the practical extent to which shadow flicker should be assessed is to a distance of 265 times the distance of the blade chord (the widest part of the turbine blade), or approximately 1.1 km. A buffer of 1.1km was generated for each of the turbines to determine if any residential structures were located within the potential SF impact area. As potential residential structures were identified within the broad brush 1.1km SF buffer, a more detailed analysis of the expected SF impact area was generated making use of 3D model of the turbine using 3D modelling software that allows a location specific representation of the SF impact area.

As outlined in Appendix F, nine structures were identified as falling within, or in close proximity to the SF impact area, but only three occupied structures falling marginally within the potential SF impact area. Impact Assessment of this effect was undertaken, and the expected SF Impact without mitigation was rated **Low**. This was based on the low probability of the SF impact occurring due to the location of the dwellings on the outer edge of the potential SF Impact Area. Mitigation was proposed, where the SF Impact could be reduced to a **Negligible** effect with simple mitigations. This would require an on-site survey to the dwellings once Operation Phase has commenced to determine if the SF effect was applicable and has the potential to incur a nuisance factor to the occupants.

VISUAL RESOURCE MANAGEMENT ASSESSMENT

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

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

Class I (No-go)	• Any river / streams and associated flood lines buffers identified as significant in terms of the WULA process. • Any wetlands identified as significant in terms of the WULA process. • Any ecological areas (or plant species) identified as having a high significance.

- Any heritage area identified as having a high significance.
- 1 in 4m steep slope areas.

Class II (Not recommended)

- No applicable

Class III (suitable with mitigation)

- Bushmanland Grasslands.
- Low prominence rocky outcrop (excluding 1 in 4 m steep gradient areas).

Class IV (not applicable)

- As the area is zoned agricultural and located adjacent to an area that does have scenic value and could carry tourist receptors in the area region, no Class IV areas were defined.

EXPECTED IMPACT SIGNIFICANCE

High (-ve)
(without mitigation)

The visual impact significance for the wind energy facility is defined as **High** without mitigation, as AWL at night has the potential to be a significant visual limitation to the area.

Medium (-ve)
(with mitigation)

With mitigation and strategic placement of AWL, the visual significance would be reduced to **Medium.** The area is remote and the change in landscape character would not detract from any significant visual resources or view corridors in the area. Mitigation includes the strategic placement of AWL.

CUMULATIVE EFFECTS

High (-ve)
(without mitigation)

Low (-ve)
(with mitigation)

The main issue associated with negative cumulative effects is intervisibility between renewable energy projects, where the combined views create a massing effect that detracts from the rural sense of place of the locality. The three Pofadder Wind Farms will be viewed as a single entity, and will create a localised massing effect, with strong levels of local contrast generated by the 90 turbines. The key issue at hand is the AWL lights at night, where the collective views of the flashing red light on each turbine hub would significantly detract from the existing dark sky of the rural landscape. Without mitigation the potential for AWL massing effects taking place to the detriment of the rural landscape is rated as **High**. Mitigation is provided to reduce this collective effect. In terms of other RE projects, the nearest other project is the Namies and Poortjie WEF that is located approximately 35km to the west. With the large distance between projects, intervisibility is unlikely to take place. With mitigation, cumulative effects are rated **Low**.

CONFIDENCE **Sure**

Detailed information for the proposed WEF project has been provided, and photomontages generated from Key Observation points identified during the site visit.

KEY MITIGATIONS MEASURES (AMONGST OTHERS)

Landscape Element	Mitigation
Wind blown dust and dust from moving vehicles	• Dust suppression and reduced speed for moving vehicles. • Communication structures to be set up with local farm residents within 500m of a gravel access road.
AWL at night	• Strategic placement of AWL on outer turbines of total project area. • Placing of AWL in a shallow cup to reduce ground level light spillage.
Concrete tower demolishing	• Should concrete towers be constructed, a detailed plan on the towers will be demolished, and the rubble processed such that landscape degradation does not take place.

NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT NO. 107 OF 1998) AND ENVIRONMENTAL IMPACT REGULATIONS, 2014 (AS AMENDED) - REQUIREMENTS FOR SPECIALIST REPORTS (APPENDIX 6)

Regulation GNR 326 of 4 December 2014, as amended 7 April 2017, Appendix 6	**Section of Report**
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	SPECIALIST INFORMATION
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	DFFE DoI
c) an indication of the scope of, and the purpose for which, the report was prepared;	Scope and Objectives
(cA) an indication of the quality and age of base data used for the specialist report;	SPECIALIST INFORMATION
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Description of the receiving environment
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	NA
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Assessment Methodology
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternative;	Landscape Context
g) an identification of any areas to be avoided, including buffers;	**Classes I and II** are the most valued and have been identified as potential landscape impact areas.
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Figure 19
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Assumptions and Limitations

j) a description of the findings and potential implications of such findings on the impact of the proposed activity, (including identified alternatives on the environment) or activities;	Impact Assessment
k) any mitigation measures for inclusion in the EMPr;	Environmental Management Plan
l) any conditions for inclusion in the environmental authorisation;	Environmental Management Plan
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	NA
n) a reasoned opinion- i. (as to) whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	It is the recommendation that the proposed development should commence WITH MITIGATION for the key reasons motivated in the Executive Summary.
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Not applicable
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Not applicable
q) any other information requested by the competent authority.	Not applicable
2) Where a government notice *gazetted* by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Not applicable

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEA/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

VISUAL IMPACT ASSESSMENT OF PROPOSED POFADDER WIND FACILITY 1 (PTY) LTD

Kindly note the following:

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

Postal address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

Physical address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House

473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:				
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	0
Specialist name:	Stephen Stead			
Specialist Qualifications:	BA Honours Geography			
Professional affiliation/registration:	Association of Professional Heritage Practitioners			
Physical address:	Farm D3, Bossie Alleen Road, Moerasrivier, 6531			
Postal address:	P.O Box 7233 Blanco			
Postal code:	6531	Cell:	0835609911	
Telephone:		Fax:		
E-mail:	steve@vrma.co.za			

2. DECLARATION BY THE SPECIALIST

I, Stephen Stead, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

Director VRM Africa cc

Name of Company:

18-2-2020

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, Stephen Stead, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Director VRM Africa cc

Name of Company

Date

POST@GEORGE
4343 GEORGE EAST 6539
COMMISSIONER OF OATHS
SARIS VAN EDE
REF/VERW. 9/1/8/2 GEORGE(A4)

Signature of the Commissioner of Oaths

18-2-2022

Date

Details of Specialist, Declaration and Undertaking Under Oath

POFADDER WIND FACILITY 1 (PTY) LTD

PROPOSED COMMERICAL WIND ENERGY FACILITY

VISUAL IMPACT ASSESSMENT

Contents

1. SPECIALIST INFORMATION 10

1. INTRODUCTION 18

1.1 Scope and Objectives 18

1.2 Terms of Reference 18

1.3 Specialist Credentials 19

1.4 Assessment Methodology Outline 20

1.5 Baseline Analysis Stage 21

1.5.1 Scenic Quality 21

1.5.2 Receptor Exposure 22

1.5.3 Receptor Sensitivity 23

1.5.4 Visual Resource Management Classes 23

1.5.5 Key Observation Points 24

1.6 Assessment and Impact Stage 25

1.6.1 Contrast Rating 25

1.6.2 Photomontages 25

1.7 Impact Methodology 26

2 ASSUMPTIONS AND LIMITATIONS 26

3 PROJECT LOCALITY 27

4 LEGAL REQUIREMENT AND GUIDELINES 28

4.1 Landscape and Visual Impact International and National Good Practice 28

4.1.1 Guidelines for Landscape and Visual Impact Assessment, Second Edition 28

4.1.2 International Finance Corporation (IFC) 28

4.1.3 World Bank Group 29

4.1.4 Millennium Ecosystem Assessment 30

4.2 Landscape and Visual Impact National and Regional Legislation and Policies 31

4.2.1 DEA&DP Visual and Aesthetic Guidelines 31

4.2.2 Renewable Energy Development Zone Status 32
4.2.3 Local and Regional Planning. 33

5 TECHNICAL DESCRIPTION 34

6 DESCRIPTION OF THE RECEIVING ENVIRONMENT 38
6.1 Site Investigation 38
6.2 Landscape Context 40
6.2.1 Regional Locality 40
6.2.2 Infrastructure and Road Access 40
6.2.3 Landuse 41
6.2.4 Conservation 42
6.2.5 Other Renewable Energy Projects 42
6.2.6 Vegetation 43
6.2.7 Regional Topography 46
6.2.8 Site Topography 47
6.3 Project Zone of Visual Influence 48
6.3.1 Viewshed Analysis 48
6.4 Receptors and Key Observation Points 52
6.5 Physiographic Rating Units 53
6.6 Scenic Quality Assessment 57
6.7 Receptor Sensitivity Assessment 57
6.8 Visual Resource Management (VRM) Classes 57
6.8.1 Class I 57
6.8.2 Class II 58
6.8.3 Class III 58
6.8.4 Class IV 58
6.9 Photomontages and Model Proof. 59

7 IMPACT ASSESSMENT 65
7.1 Contrast Rating from Key Observation Points. 65
7.2 Impact Assessment Ratings 67
7.3 Impact Assessment Findings 73
7.3.1 Status 73
7.3.2 Extent 73
7.3.3 Duration 73
7.3.4 Magnitude 73
7.3.5 Probability 73
7.3.6 Confidence 73

7.3.7 Reversibility 73
7.3.8 Visual Impact Significance 74
7.3.9 Shadow Flicker Impact Significance 74
7.3.10 Cumulative Effects 74
7.4 Environmental Management Planning 75
7.4.1 Pre-Construction Phase 75
7.4.2 Construction Phase 76
7.4.3 Operational Phase 78
7.4.4 Decommissioning Phase 81

8 CONCLUSION 84

9 REFERENCES 85

10 APPENDIX A: SITE SENSITIVITY VERIFICATION 87
10.1 Introduction 87
10.2 Landscape Site sensitivity verification 88
10.3 Shadow Flicker Site sensitivity verification 89
10.4 National environmental screening tool 90

11 APPENDIX B: SITE SURVEY PHOTOGRAPHIC RECORDS 91

12 APPENDIX C: SIVEST EIA METHODOLOGY 106

13 APPENDIX D: SPECIALIST INFORMATION 113
13.1 Professional Registration Certificate 113
13.2 Curriculum Vitae (CV) 113

14 APPENDIX E: VRM CHECKLISTS AND TERMINOLOGY 120

15 APPENDIX F: SHADOW FLICKER SCREENING METHODOLOGY AND FINDINGS. 124
15.1 Shadow Flicker Background Information 124
15.2 Shadow Flicker Best International Practice Review 124
1.8 Best Practice Recommendations Summary 128
15.3 Shadow Flicker Screening Methodology 128
15.4 Shadow Flicker Screening 132
15.5 Shadow Flicker Findings 135
15.6 Shadow Flicker Conclusion 136

16 APPENDIX G: GENERIC LIGHTS AT NIGHT MITIGATION GUIDELINES 136

List of Tables

Table 1. Specialist declaration of independence. 19
Table 2: Authors and Contributors to this Report. 20
Table 3: Methodology Summary Table 20
Table 4. Hull and Bishop graphic depicting reducing visibility over distance. 22
Table 5: VRM Class Matrix Table 24
Table 6: General Guide for Mapping of Visual Buffers for Wind Farms Table. 32
Table 7: Governance administrative table 33
Table 8: ZF Mgcawu District Municipality Integrated Development Plan (Namakwa District Municipality) 33
Table 9: Kai !Garib Local Municipality Integrated Development Plan Revised 2021 (Kai !Garib Local Municipality) 33
Table 10. Site Investigation Information Description Table. 38
Table 11. SiVEST Renewable Energy Projects Table. 43
Table 12: Proposed Project Heights Table 48
Table 13: Receptor and KOP Motivation Table. 52
Table 14: Physiographic Landscape Rating Units. 53
Table 15: Scenic Quality and Receptor Sensitivity Rating. 55
Table 16: Contrast Rating Key Observation Points. 65
Table 17. Impact Assessment Table 67
Table 18: VRM Africa Projects Assessments Table. 115
Table 19: Scenic Quality Checklist 120
Table 20: Sensitivity Level Rating Checklist 121
Table 21: VRM Terminology Table 121
Table 22. International best practice guidelines and references. 124
Table 23. Property structure occupancy audit table with the potentially impacted dwelling highlighted in Red. 135

List of Figures

Figure 1. Project locality map. 27
Figure 2. District and Local Governance Planning Map. 31
Figure 3. Proposed wind turbine and infrastructure layout for WEF 1. 36
Figure 4. Proposed combined wind turbine and infrastructure layout for the 3 x WEF projects. 37
Figure 5. Survey points covered during the field study exercise. 39
Figure 6: Photograph of the N14 National Road northbound just before Aggeneys town. 40
Figure 7: Photograph of the typical gravel road located to the west of the study area. 41
Figure 8. Major infrastructure and DEA renewable energy map. 41
Figure 9. ESRI Open Source satellite imagery underlay to the study area depicting an uniform arid environment within the 12km buffer around the footprint. 42
Figure 10. SiVEST Renewable Energy Project in the region map. 43
Figure 11: Photograph typical of the area taken to the northwest of Aggeneys showing the inselbergs and the Bushmanland Arid Grasslands on the flat plains. 44
Figure 12: Vegetation Type Map 45
Figure 13. Regional terrain model depicting distance buffers around the study area and the profile line locality generated from Google Earth. 46
Figure 14. Approximate steeper slopes mapping where landscape scarring or erosion could take place that needs to be confirmed with detail design. 47
Figure 15. Expected WEF1 project viewshed and exposure generated from 300m height above ground from turbine points. 49
Figure 16. Expected combined WEF 1, 2 & 3 viewshed capped at 30km (offset 300m, selective points) 50
Figure 17: WEF1 preliminary Receptor and KOP locality map. 51
Figure 18: WEF1 Site Satellite Image Map depicting uniform terrain and vegetation. 54
Figure 19: WEF1 VRM Class overlay onto satellite imagery. 56

Figure 20: Photographic material used to inform the photomontages was based on photographs of the existing Khobab & Loeriesfontein wind farms as they reflect similar landscape conditions. 59
Figure 21: 3D Model perspective view of the ArcGIS model with WEF1 (Red), WEF2 (Green) and WEF3 (Blue)..60
Figure 22: Local farm access road eastbound as seen from the entrance into the project area..........62
Figure 23: Main access road view east...63
Figure 24: Main access road view east with night-time and Aircraft Warning Lights ***example***. 64
Figure 25. DEA Screening Tool map of relative shadow flicker (wind) theme sensitivity. 87
Figure 26. DEA Screening Tool map of relative landscape (wind) theme sensitivity. 88
Figure 27. Shadow Flicker screening map..90
Figure 28. Image depicting the suns pathway across the sky for mid-winter scenario at the project site..130
Figure 29. Image depicting the suns pathway across the sky for mid-summer scenario at the project site..130
Figure 30. Wind rose generated for the Pofadder WEF provided by the client (Atlantic Renewable Energy Partners, 2022)..131
Figure 31. Expected annual wind speed graph (m/s). 131
Figure 32. 3D generated model of the proposed turbine. 132
Figure 33. 3D model depicting shadow incidence in early morning winter periods. 133
Figure 34. Mapped area for shadow potential that was incorporated into ArcGIS. 133
Figure 35. Shadow Flicker map for Turbines A8 & A9...134
Figure 36. Shadow Flicker map for Turbine A26. 134

List of Appendices

Appendix 1 (or A): Description
Appendix A: Site Sensitivity Verification and Outcomes
Appendix B: Site survey photographs and notes
Appendix C: SiVest EIA Methodology
Appendix D: Specialist Information: Professional Registration Certificate and Curriculum Vitae
Appendix E: VRM Checklists and Terminology

Glossary of Terms

Technical Terms	**Definition** (Oberholzer, 2005)
Degree of Contrast	The measure in terms of the form, line, colour and texture of the existing landscape in relation to the proposed landscape modification in relation to the defined visual resource management objectives.
Visual intrusion	Issues are concerns related to the proposed development, generally phrased as questions, taking the form of “what will the impact of some activity be on some element of the visual, aesthetic or scenic environment”.
Receptors	Individuals, groups or communities who would be subject to the visual influence of a particular project.
Sense of place	The unique quality or character of a place, whether natural, rural or urban.
Scenic corridor	A linear geographic area that contains scenic resources, usually, but not necessarily, defined by a route.
Viewshed	The outer boundary defining a view catchment area, usually along crests and ridgelines. Similar to a watershed. This reflects the area, or the extent thereof, where the landscape modification would probably be seen.

Visual Absorption Capacity	The potential of the landscape to conceal the proposed project.

Technical Term	**Definition** (USDI., 2004)
Key Observation Point	Receptors refer to the people located in the most critical locations, or key observation points, surrounding the landscape modification, who make consistent use of the views associated with the site where the landscape modifications are proposed. KOPs can either be a single point of view that an observer/evaluator uses to rate an area or panorama, or a linear view along a roadway, trail, or river corridor.
Visual Resource Management	A map-based landscape and visual impact assessment method development by the Bureau of Land Management (USA).
Zone of Visual Influence	The ZVI is defined as 'the area within which a proposed development may have an influence or effect on visual amenity.'

List of Abbreviations

APHP	Association of Professional Heritage Practitioners
BLM	Bureau of Land Management (United States)
BPEO	Best Practicable Environmental Option
CALP	Collaborative for Advanced Landscape Planning
DEM	Digital Elevation Model
DoC	Degree of Contrast
EIA	Environmental Impact Assessment
EMPr	*Environmental Management Plan*
GIS	Geographic Information System
GPS	Global Positioning System
IDP	Integrated Development Plan
IEMA	Institute of Environmental Management and Assessment (United Kingdom)
KOP	Key Observation Point
LVIA	Landscape and Visual Impact Assessment
MAMSL	Metres above mean sea level
NELPAG	New England Light Pollution Advisory Group
SDF	Spatial Development Framework
SEA	Strategic Environmental Assessment
VAC	Visual Absorption Capacity
VIA	Visual Impact Assessment
VRMA	Visual Resource Management Africa
ZVI	Zone of Visual Influence

POFADDER WIND FACILITY 1 (PTY) LTD

PROPOSED COMMERICAL WIND ENERGY FACILITY

VISUAL IMPACT ASSESSMENT

1. INTRODUCTION

Visual Resource Management Africa CC (VRMA) was appointed by Pofadder Wind Facility 1(Pty) Ltd to undertake a ***Visual Impact Assessment*** for the proposed Pofadder Wind Energy Facility 1 VIA. The proposed development site is located in the Northern Cape Province, within the Kai !Garib Local Municipality and the Z F Mgcawu District Municipality in the Northern Cape Province (as mapped in Figure *2*). Pofadder Wind Energy 1 (Pty) Ltd. proposes to construct three windfarms and associated infrastructure on a site located 25km southeast of the small town of Pofadder and 162km west of large town of Upington in the Northern Cape Province of South Africa.

1.1 Scope and Objectives

This visual impact report will focus on the Pofadder Wind Energy Facility 1, which includes the application for 28 wind turbines with a combined contracted capacity of up to 224MW.

1.2 Terms of Reference

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

- Collate and analyse all available secondary data relevant to the affected proposed project area. This includes a site visit of the full site extent, as well as of areas where potential impacts may occur beyond the site boundaries.
- Consider all cumulative effects in all impact reports.
- Specific attention is to be given to the following:
  - Quantifying and assessing existing scenic resources/visual characteristics on, and around, the proposed site.
  - Evaluation and classification of the landscape in terms of sensitivity to a changing land use.
  - Determining viewsheds, view corridors and important viewpoints to assess the visual impacts of the proposed project.
  - Determining visual issues, including those identified in the public participation process.
  - Reviewing the legal framework that may have implications for visual/scenic resources.
  - Assessing the significance of potential visual impacts resulting from the proposed project for the construction, operation, and decommissioning phases of the proposed project.
  - Assessing the potential cumulative impacts associated with the visual impact.
  - Identifying possible mitigation measures to reduce negative visual impacts for inclusion into the proposed project design, including input into the Environmental and Social Management Plan (ESMP).

1.3 Specialist Credentials

Full Specialist CV and list of VRM Africa's completed projects can be seen in Appendix C.

Table 1. Specialist declaration of independence.

All intellectual property rights and copyright associated with VRM Africa's services are reserved, and project deliverables, including electronic copies of reports, maps, data, shape files and photographs, may not be modified or incorporated into subsequent reports in any form, or by any means, without the written consent of the author. Reference must be made to this report, should the results, recommendations or conclusions in this report be used in subsequent documentation. Any comments on the draft copy of the Visual Impact Assessment (VIA) must be put in writing. Any recommendations, statements or conclusions drawn from, or based upon, this report, must make reference to it.

This document was completed by Silver Solutions 887 cc trading as VRM Africa, a Visual Impact Study and Mapping organisation located in George, South Africa. VRM Africa cc was appointed as an independent professional visual impact practitioner to facilitate this VIA. I, Stephen Stead, hereby declare that VRM Africa, an independent consulting firm, has no interest or personal gains in this project whatsoever, except receiving fair payment for rendering an independent professional service.

Stephen Stead
APHP accredited VIA Specialist

Contributors to this study are summarised in the table below.

Table 2: Authors and Contributors to this Report.

Aspect	Person	Organisation / Company	Qualifications
Landscape and Visual Assessment (author of this report)	Stephen Stead B.A (Hons) Human Geography, 1991 (UKZN, Pietermaritzburg)	VRMA	• Accredited with the Association of Professional Heritage Practitioners and • 16 years of experience in visual assessments including renewable energy, powerlines, roads, dams across southern Africa. • Registered with the Association of Professional Heritage Practitioners since 2014.

1.4 Assessment Methodology Outline

The process that VRM Africa follows when undertaking a VIA is based on the United States Bureau of Land Management ‘s (BLM) Visual Resource Management method (USDI., 2004). This mapping and GIS-based method of assessing landscape modifications allows for increased objectivity and consistency by using standard assessment criteria.

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

Table 3: Methodology Summary Table

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

Action	Description
	decommissioning phases of the project. The rating of visual significance is based on the methodology provided by the Environmental Assessment Practitioner (EAP).
Formulating Mitigation Measures	Possible mitigation measures are identified to avoid or minimise negative visual impacts of the proposed project. The intention is that these would be included in the project design, the Environmental Management programme (EMPr) and the authorisation conditions.

The process that VRMA followed when determining landscape significance is based on the United States Bureau of Land Management's (BLM) Visual Resource Management method (USDI., 2004). This mapping and Geographic Information System (GIS) based method of assessing landscape modifications allows for increased objectivity and consistency by using standard assessment criteria. The following key factors determine the suitability of landscape change:

- "Different levels of scenic values require different levels of management. For example, management of an area with high scenic value might be focused on preserving the existing character of the landscape, and management of an area with little scenic value might allow for major modifications to the landscape. Determining how an area should be managed first requires an assessment of the area's scenic values".
- "Assessing scenic values and determining visual impacts can be a subjective process. Objectivity and consistency can be greatly increased by using the basic design elements of form, line, colour, and texture, which have often been used to describe and evaluate landscapes, to also describe proposed projects. Projects that repeat these design elements are usually in harmony with their surroundings; those that don't create contrast. By adjusting project designs so the elements are repeated, visual impacts can be minimized" (USDI., 2004).

The assessment comprises two main sections: firstly, the ***Baseline Stage*** to identify the visual resources and key observation locations within the project zone of visual influence; and secondly, the ***Assessment Stage*** which determines the visual impacts and significance of the proposed landscape modifications.

1.5 Baseline Analysis Stage

In terms of VRM methodology, landscape character is derived from a combination of ***scenic quality***, ***receptor sensitivity*** to landscape change and ***distance*** from the proposed landscape change. The objective of the analysis is to compile a mapped inventory of the visual resources found in the receiving landscape, and to derive a mapped Visual Resource sensitivity layer from which to evaluate the suitability of the landscape change.

1.5.1 Scenic Quality

The scenic quality is determined making use of the VRM Scenic Quality Checklist (refer to Annexure D). The checklist identifies seven scenic quality criteria which are rated with 1 (low) to 5 (high) scale. The scores are totalled and assigned an A (High), B (Moderate) or C (low) based on the following split:

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

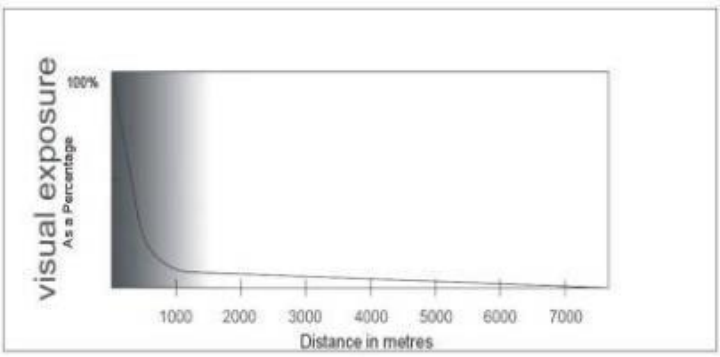
The seven scenic quality criteria are defined below:

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

1.5.2 Receptor Exposure

The area where a landscape modification starts to influence the landscape character is termed the Zone of Visual Influence (ZVI) and is defined by the U.K. Institute of Environmental Management and Assessment's (IEMA) *'Guidelines for Landscape and Visual Impact Assessment'* as 'the area within which a proposed development may have an influence or effect on visual amenity (of the surrounding areas).' The ZVI is strongly influenced by distance or how Exposed the receptor is to the proposed landscape change. The inverse relationship of distance and visual impact is well recognised in visual analysis literature (Hull, R.B. and Bishop, I.E., 1988). According to Hull and Bishop, exposure, or visual impact, tends to diminish exponentially with distance. The areas where most landscape modifications would be visible are located within 2km from the site of the landscape modification. Thus, the potential visual impact of an object diminishes at an exponential rate as the distance between the observer and the object increases due to atmospheric conditions prevalent at a location, which causes the air to appear greyer, thereby diminishing detail. For example, viewed from 1000m from a landscape modification, the impact would be 25% of the impact as viewed from 500m from a landscape modification. At 2000m it would be 10% of the impact at 500m. The relationship is indicated in the following graph generated by Hull and Bishop.

Table 4. Hull and Bishop graphic depicting reducing visibility over distance.



The Visual and Aesthetic Guidelines generated by the Western Cape DEA&DP also refer to Visual Exposure Criteria (Oberholzer, B., 2005)

- ***High*** **:Dominant or clearly noticeable (<2km)**

- ***Moderate*** **:Recognisable to the viewer (2 – 6km)**
- ***Low*** **:Minimally visible areas in the landscape (>6km)**

In order to determine the level of exposure to receptors, the VRM methodology also takes distance from a landscape modification into consideration in terms of understanding visual resource. Three distance categories are defined by the Bureau of Land Management (United States Department of Interior): (USA Bureau of Land Management, 2004). The distance zones that are utilised in the assessment are:

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

1.5.3 Receptor Sensitivity

Receptor Sensitivity levels are a measure of public concern for scenic quality and assessed making use of the Sensitivity Checklist in Annexure D. Receptor sensitivity to landscape change is determined by rating the following factors in terms of Low to High:

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

1.5.4 Visual Resource Management Classes

These findings are then submitted to a VRM Matrix below. The VRM Classes are not prescriptive and are used as a guideline to determine the carrying capacity of a visually preferred landscape as a basis for assessing the suitability of the landscape change associated with the proposed project.

Table 5: VRM Class Matrix Table

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

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

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

- The Class I objective is to preserve the existing character of the landscape, the level of change to the characteristic landscape should be very low and must not attract attention. Class I is assigned when a decision is made to maintain a natural landscape.
- The Class II objective is to retain the existing character of the landscape and the level of change to the characteristic landscape should be low. The proposed development may be seen but should not attract the attention of the casual observer, and should repeat the basic elements of form, line, colour and texture found in the predominant natural features of the characteristic landscape.
- The Class III objective is to partially retain the existing character of the landscape, where the level of change to the characteristic landscape should be moderate. The proposed development may attract attention, but should not dominate the view of the casual observer, and changes should repeat the basic elements found in the predominant natural features of the characteristic landscape; and
- The Class IV objective is to provide for management activities that require major modifications of the existing character of the landscape. The level of change to the landscape can be high, and the proposed development may dominate the view and be the major focus of the viewer's (s') attention without significantly degrading the local landscape character.

1.5.5 Key Observation Points

During the Baseline Inventory Stage, Key Observation Points (KOPs) are identified. KOPs are defined by the Bureau of Land Management as the people (receptors) located in strategic locations surrounding the property that make consistent use of the views associated with the site where the landscape modifications are proposed. These locations are important in terms of the VRM methodology, which requires that the Degree of Contrast (DoC) that the proposed landscape modifications will make to the existing landscape be measured from these most critical locations, or receptors, surrounding the property. To define the KOPs, potential receptor locations were identified in the viewshed analysis, and screened, based on the following criteria:

- Angle of observation.
- Number of viewers.

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

1.6 Assessment and Impact Stage

The analysis stage involves determining whether the potential visual impacts from proposed surface-disturbing activities or developments will meet the management objectives established for the area, or whether design adjustments will be required. This requires a contrast rating to assess the expected DoC the proposed landscape modifications would generate within the receiving landscape in order to define the Magnitude of the impact.

1.6.1 Contrast Rating

The contrast rating is undertaken to determine if the VRM Class Objectives are met. The suitability of landscape modification is assessed by comparing and contrasting existing receiving landscape to the expected contrast that the proposed landscape change will generate. This is done by evaluating the level of change to the existing landscape by assessing the line, colour, texture and form, in relation to the visual objectives defined for the area.

The following criteria are utilised in defining the DoC:

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

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

1.6.2 Photomontages

As a component in this contrast rating process, visual representation, such as photo montages are vital in large-scale modifications, as this serves to inform Interested & Affected Parties and decision-making authorities of the nature and extent of the impact associated with the proposed project/development. There is an ethical obligation in this process, as visualisation can be misleading if not undertaken ethically. In terms of adhering to standards for ethical representation of landscape modifications, VRMA subscribes to the Proposed Interim Code of Ethics for Landscape Visualisation developed by the Collaborative for Advanced Landscape Planning (CALP) (Sheppard, 2000). This code states that professional presenters of realistic landscape visualisations are responsible for promoting full understanding of proposed landscape changes, providing an honest and neutral visual representation of the expected landscape, by seeking to avoid bias in responses and demonstrating the legitimacy of the visualisation process. Presenters of landscape visualisations should adhere to the principles of:

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

The Code of Ethical Conduct states that the presenter should:

- Demonstrate an appropriate level of qualification and experience.
- Use visualisation tools and media that are appropriate to the purpose.
- Choose the appropriate level of realism.
- Identify, collect and document supporting visual data available for, or used in, the visualisation process.
- Conduct an on-site visual analysis to determine important issues and views.
- Seek community input on viewpoints and landscape issues to address in the visualisations.
- Provide the viewer with a reasonable choice of viewpoints, view directions, view angles, viewing conditions and timeframes appropriate to the area being visualised.
- Estimate and disclose the expected degree of uncertainty, indicating areas and possible visual consequences of the uncertainties.
- Use more than one appropriate presentation mode and means of access for the affected public.
- Present important non-visual information at the same time as the visual presentation, using a neutral delivery.
- Avoid the use, or the appearance of, 'sales' techniques or special effects.
- Avoid seeking a particular response from the audience.
- Provide information describing how the visualisation process was conducted and how key decisions were taken (Sheppard, 2000).

1.7 Impact Methodology

SiVest has provided a standardised Environment Impact Assessment (EIA) Methodology to assisting the evaluation of the overall effects of the proposed activity on the environment, determining significance through a systemic analysis. Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale (i.e., site, local, national or global), whereas intensity is defined by the severity of the impact e.g. the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence. For further details of the EIA methodology, refer to Appendix C.

2 ASSUMPTIONS AND LIMITATIONS

- Digital Elevation Models (DEM) and viewsheds were generated using a 30-metre SRTM elevation data provided by NASA Earthdata (https://earthdata.nasa.gov/, n.d.). Although every effort to maintain accuracy was undertaken, as a result of the DEM being generated from satellite imagery and not being a true representation of the earth's surface, the viewshed mapping is approximate and may not represent an exact visibility incidence. Thus, specific features identified from the DEM and derived contours (such as peaks and conical hills) would need to be verified once a detailed survey of the project area took place.

- The use of open-source satellite imagery was utilised for base maps in the report.
- Some of the mapping in this document was created using Bing Maps, Open-Source Map, ArcGIS Online and Google Earth Satellite imagery.
- The project deliverables, including electronic copies of reports, maps, data, shape files and photographs are based on the author's professional knowledge, as well as available information.
- VRM Africa reserves the right to modify aspects of the project deliverables if and when new/additional information may become available from research or further work in the applicable field of practice or pertaining to this study.

3 PROJECT LOCALITY

The applicant, Pofadder Wind Energy Facility 1 (Pty) Ltd, is proposing the development of a commercial Wind Energy Facility (WEF) and associated infrastructure on a site located approximately 20km South East of Pofadder within in the Northern Cape Province as mapped in Figure 1 below.

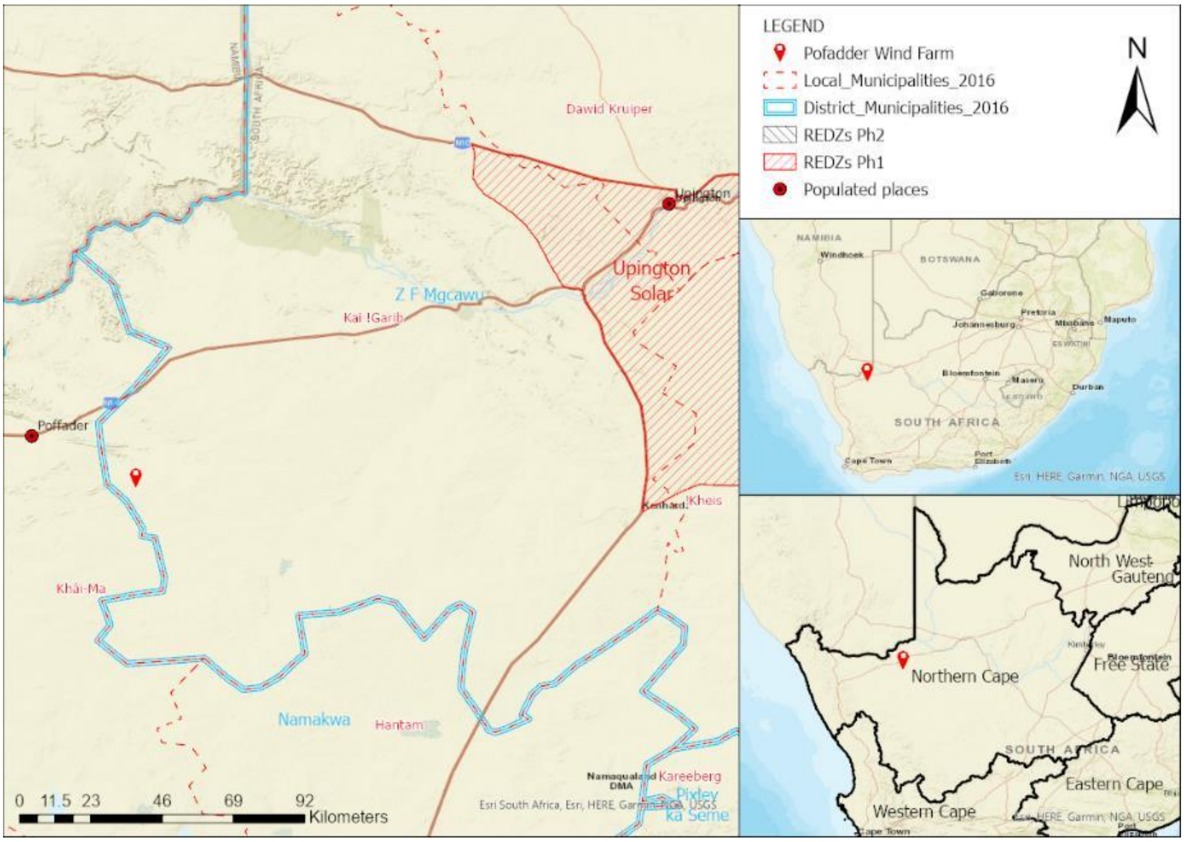


Figure 1. Project locality map.

The project site is located on the following properties:

- The Farm Ganna-Poort 202.
- The Farm Lovedale 201; and
- Portion 3 of the Farm Sand Gat 150.

4 LEGAL REQUIREMENT AND GUIDELINES

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

4.1 Landscape and Visual Impact International and National Good Practice

For cultural landscapes, the following documentation provides good practice guidelines, specifically:

- Guidelines for Landscape and Visual Impact Assessment (GLVIA), Second Edition.
- International Finance Corporation (IFC).
- World Bank Group.
- Millennium Ecosystem Assessment (MEA).
- United Nations Educational, Scientific and Cultural Organisation (UNESCO) World Heritage Convention (WHC).

4.1.1 Guidelines for Landscape and Visual Impact Assessment, Second Edition

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

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

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

4.1.2 International Finance Corporation (IFC)

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

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

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

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

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

4.1.3 World Bank Group

In terms of specific reference to wind farming best practice, the World Bank Group, which is associated with the IFC, generated a guideline for Wind Energy in 2015. The report titled Environmental, Health and Safety Guidelines for Wind Energy makes the following recommendations for Landscape, Seascape and Visual Impacts:

Landscape, Seascape and Visual Impacts

- Depending on the location, a wind energy facility may have an impact on viewscapes, especially if visible from or located near residential areas or tourism sites. Visual impacts associated with wind energy projects typically concern the installed and operational turbines themselves (e.g., colour, height, and number of turbines).
- Impacts may also arise in relation to operational wind facilities' interaction with the character of the surrounding landscape and/or seascape. Impacts on Legally Protected and Internationally Recognized. Areas of importance to biodiversity and cultural heritage features are also a consideration. Preparing zone of visual influence maps and preparing wire-frame

images and photomontages from key viewpoints is recommended to inform both the assessment and the consultation processes.

- Avoidance and minimization measures to address landscape, seascape, and visual impacts are largely associated with the siting and layout of wind turbines and associated infrastructure, such as meteorological towers, onshore access tracks, and substations.
- Consideration should be given to turbine layout, size, and scale in relation to the surrounding landscape and seascape character and surrounding visual receptors (e.g., residential properties, users of recreational areas/routes).
- Consideration should also be given to the proximity of turbines to settlements, residential areas, and other visual receptors to minimize visual impacts and impacts on residential amenity, where possible. All relevant viewing angles should be considered when considering turbine locations, including viewpoints from nearby settlements.
- Other factors can be considered in relation to minimizing visual impacts:
    - Incorporate community input into wind energy facility layout and siting.
    - Maintain a uniform size and design of turbines (e.g., type of turbine and tower, as well as height).
    - Adhere to country-specific standards for marking turbines, including aviation/navigational and environmental requirements (see Community Health and Safety section below), where available.
    - Minimize presence of ancillary structures on the site by minimizing site infrastructure, including the number of roads, as well as by burying collector system power lines, avoiding stockpiling of excavated material or construction debris, and removing inoperative turbines.
    - Erosion measures should be implemented and cleared land should be promptly re-vegetated with local seed stock of native species. (World Bank Group, 2015)

4.1.4 Millennium Ecosystem Assessment

In the Ecosystems and Human Well-being document compiled by the Millennium Ecosystem Assessment in 2005, Ecosystems are defined as being “essential for human well-being through their provisioning, regulating, cultural, and supporting services. Evidence in recent decades of escalating human impacts on ecological systems worldwide raises concerns about the consequences of ecosystem changes for human well-being”. (Millennium Ecosystem Assessment, 2005)

The Millennium Ecosystem Assessment defined the following non-material benefits that can be obtained from ecosystems*:*

- Inspiration: Ecosystems provide a rich source of inspiration for art, folklore, national symbols, architecture, and advertising.
- Aesthetic values: Many people find beauty or aesthetic value in various aspects of ecosystems, as reflected in the support for parks, scenic drives, and the selection of housing locations.
- Sense of place: Many people value the “sense of place” that is associated with recognised features of their environment, including aspects of the ecosystem.
- Cultural heritage values: Many societies place high value on the maintenance of either historically important landscapes (“cultural landscapes”) or culturally significant species; and
- Recreation and ecotourism: People often choose where to spend their leisure time based in part on the characteristics of the natural or cultivated landscapes in a particular area. (Millennium Ecosystem Assessment, 2005)

The Millennium Ecosystem Assessment Ecosystems and Human Well-being: Synthesis report indicates that there has been a “rapid decline in sacred groves and species” in relation to spiritual and religious values, and aesthetic values have seen a "decline in quantity and quality of natural lands". (Millennium Ecosystem Assessment, 2005)

4.2 Landscape and Visual Impact National and Regional Legislation and Policies

To comply with the Visual Resource Management requirements, it is necessary to clarify which National and Regional planning policies govern the proposed development area to ensure that the scale, density and nature of activities or developments are harmonious and in keeping with the sense of place and character of the area.

The following guidelines and policies were identified for this project:

- DEA&DP Visual and Aesthetic Guidelines.
- REDZ status.
- Regional and Local Municipality Planning and Guidelines.

The map below indicates the administrative locality of the proposed development area.

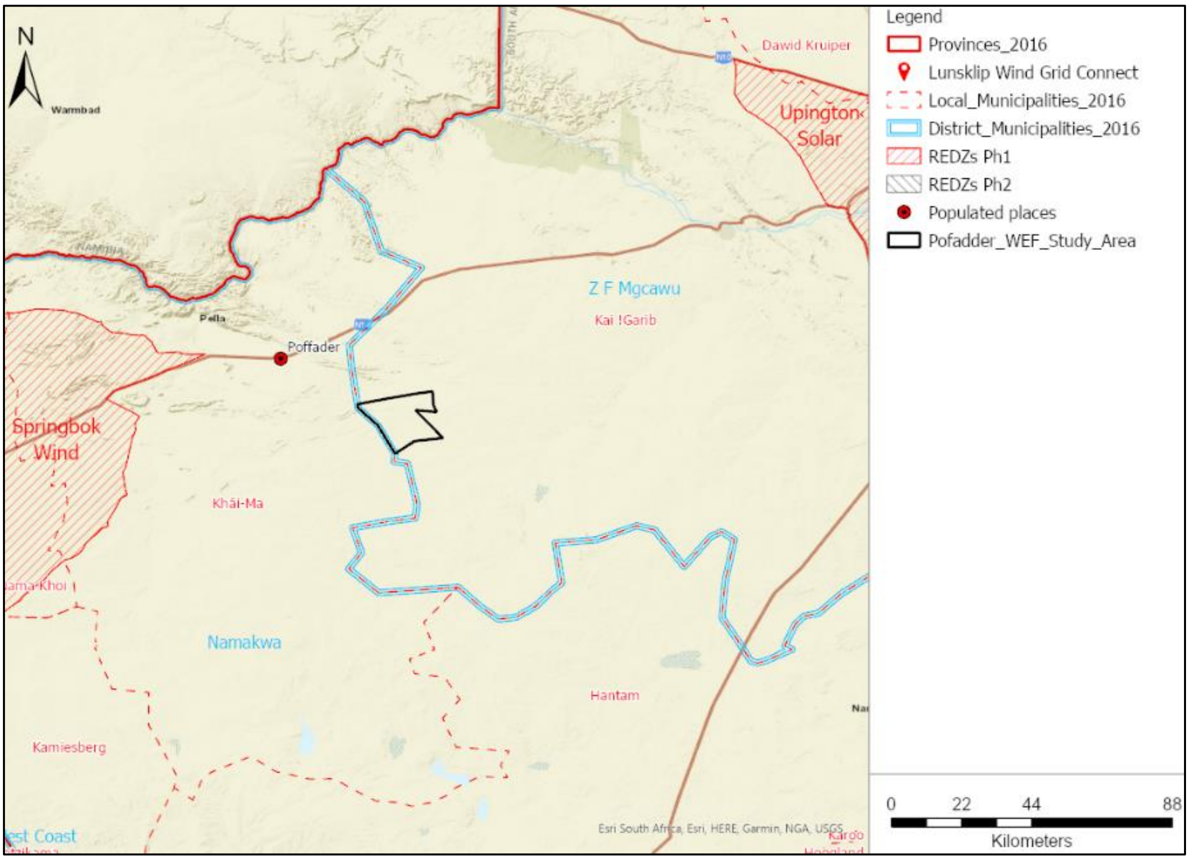


Figure 2. District and Local Governance Planning Map.

4.2.1 DEA&DP Visual and Aesthetic Guidelines

Although not located within the Western Cape, reference to the Western Cape Department of Environmental Affairs and Development Planning (DEA&DP) Guideline for involving visual and aesthetic specialists in Environmental Impact Assessment (EIA) processes is provided in terms of southern African best practice in Visual Impact Assessment. The report compiled by Oberholzer states that the Best Practicable Environmental Option (BPEO) should address the following:

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

Mapping of Visual and Landscape Sensitivity Criteria

Based on the DEA&DP Visual and Aesthetic Guidelines (see Section 4.1.4 DEA&DP Visual and Aesthetic Guidelines) the following broad brush sensitivity buffers are proposed to protect visual resources should they be identified in the landscape / project Zone of Visual Influence.

Table 6: General Guide for Mapping of Visual Buffers for Wind Farms Table.

Landscape features/criteria	**Best practice setbacks**	**Comments**
Project area boundary (internal)		Buffer usually 1 to 1.5 times height of the proposed turbines.
Prominent topographic Features	500 m	Peaks, ridgelines and scarp edges.
Steep slopes	>1:4 and >1:10	Generally, avoid slopes >1:10
Perennial rivers, large dams, wetland features	Perennial rivers: 250 – 500 m.	Buffers also subject to specialist freshwater assessment.
Minor streams (ecological corridors have visual landscape value)	-	Min. 50m (subject to freshwater Assessment).
Minor roads	250 m	
Provincial / arterial roads	1 km	
Scenic routes and passes	1 to 3 km	
Nature reserves / protected areas	3 to 5 km	(Subject to viewshed)
Private nature reserves/ game farms/ guest farms/ resorts (tourism value)	2 to 5 km	(Subject to viewshed)
Farmsteads	1 km	
Towns / settlements	2 to 4 km	Subject to Social and Sound Specialist findings / subject to size of turbine
Cultural landscapes / heritage sites	500 m (subject to viewshed).	Subject to Heritage Specialist findings

* Derived from general recommendations from the DEA&DP Visual and Aesthetic Guidelines (Oberholzer B. , 2005)

4.2.2 Renewable Energy Development Zone Status

The study does not fall within a REDZ area.

4.2.3 Local and Regional Planning.

As indicated in the Figure 2 administrative map on the following page, the property falls within the ZF Mgcawu District Municipality. A review of the local and regional planning found that while tourism is supported due to the unique landscape of this arid region, there is also support for renewable energy development due to the benefits from economic growth and employment. The finding for policy fit relevant to landscape and visual impact is Medium to High +VE. Care would need to be taken to ensure that local tourism activities using landscape resources are not impacted by the proposed wind farm landscape change. The following tables list key regional and local planning that has relevance to the project pertaining to landscape-based tourism, and energy projects.

Table 7: Governance administrative table

Theme	Name
REDZ	No
Province	Northern Cape
District Municipality	ZF Mgcawu District Municipality
Local Municipality	Kai !Garib Local Municipality

Table 8: ZF Mgcawu District Municipality Integrated Development Plan (Namakwa District Municipality)

Theme	Requirements	Page
Economic Development	• Sustainability – the promotion of economic and social development through the sustainable management and utilisation of natural resources and the maintenance of the productive value of the physical environment. • Promoting the growth, diversification, and transformation of the provincial economy	26/27
	• Provincial government must position itself as an enabler of economic growth. Since it cannot bring about increased economic growth and development alone, collaboration with the private sector, the donor community and the relevant national level institutions is essential.	30
Natural Resources	Identify biodiversity offsets to reach conservation targets for industries Integrate the new CBA map into the municipal Environmental Management Framework and Spatial Development Framework and strengthen enforcement regarding prohibition of development in these areas	204
Energy	Produce sufficient energy to support industry at competitive prices, ensuring access for poor households, while reducing carbon emissions per unit of power by about one-third	16
Tourism	Key components of tourism include the need for a tourist-attraction (e.g. eco-scenery, cultural, heritage), good transport routes, safety and, in many instances, high-quality restaurants and hotels	24

Table 9: Kai !Garib Local Municipality Integrated Development Plan Revised 2021 (Kai !Garib Local Municipality)

Theme	Requirements	Page
Economy	Economic diversification is therefore required, and promising opportunity lies in the field of power generation using the area's natural resources, renewable energy sources such as sun, wind and water	80
	The Green Economy has much to offer in terms of job creation, infrastructure development and general economic development	109
Renewable Energy	• Renewable and Gas Energy Business Incubator • Opportunities: Land available for renewable energy plants	78/79
Tourism	Tourism Development plan: The development of eco-tourism packages, a Kokerboom tourism route, Game Reserve, Agro-Tourism	66

5 TECHNICAL DESCRIPTION

The applicant Pofadder Wind Facility 1 (Pty) Ltd is proposing the development of a commercial Wind Energy Facility (WEF) and associated infrastructure on a site located approximately 20km South East of Pofadder within the Kai !Garib Local Municipality and the Z F Mgcawu District Municipality in the Northern Cape Province.

Two additional WEF's are concurrently being considered on the properties and are assessed by way of separate impact assessment processes contained in the 2014 Environmental Impact Assessment Regulations (GN No. R982, as amended) for listed activities contained Listing Notices 1, 2 and 3 (GN R983, R984 and R985, as amended). These projects are known as Pofadder Wind Energy Facility 2 and Pofadder Wind Energy Facility 3.

A preferred project site with an extent of approx. 3 600ha has been identified as a technically suitable area for the development of the Pofadder WEF 3, which will comprise of up to 28 turbines with a combined contracted capacity of up to 224MW. The project site is located on the following properties:

• The Farm Ganna-Poort 202.
• The Farm Lovedale 201; and
• Portion 3 of the Farm Sand Gat 150.

At this stage it is anticipated that the proposed Pofadder 1 WEF will comprise up to twenty eight (28) wind turbines with a maximum total energy generation capacity of up to approximately 240 MW. In summary, the proposed Pofadder WEF 1 development will include the following components:

- Up to 28 wind turbines, each with a maximum of 8 MW output per turbine, with a maximum export capacity of approximately 224 MW. This will be subject to allowable limits in terms of the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP). The final number of turbines and layout of the WEF will, however, be dependent on the outcome of the Specialist Studies conducted during the EIA process.
- Each wind turbine will have a maximum hub height and rotor diameter of up to approximately 200 m.
- Concrete turbine foundations and turbine hardstands.
- Each turbine will have a circular foundation with a diameter of up to 32 m and this will be placed alongside the 45 m wide hardstand resulting in an area of about 45 m x 32 m that will be permanently disturbed for the turbine foundation. The combined permanent footprint for the turbines will be approximately 4.4 ha.

- Each turbine will have a crane hardstand of approximately 70 m x 45 m. The permanent footprint for turbine crane hardstands will be approximately 9.5 ha.
- Each turbine will have a blade hardstand of approximately 80 m x 45 m (3 600 m^2). The combined permanent footprint for blade hardstands will be approximately 10.8 ha.
- One (1) new 33/132 kV on-site substation occupying an area of approximately 1.6 ha.
- The wind turbines will be connected to the proposed on-site substation via medium voltage (33 kV) underground cables, which will mainly run alongside the access roads. Where burying of cables is not possible due to technical, geological, environmental, or topographical constraints, cables will be overhead via 33 kV monopoles.
- The main access road will be between 8 – 12 m wide (to allow vehicles to pass).
- Internal roads with a width of between 6 – 8 m will provide access to each wind turbine. Existing farm roads will be upgraded and used wherever possible, although new site roads will be constructed where necessary.
- A 12 m wide corridor may be temporarily impacted during construction and rehabilitated to 6 m wide corridor after construction. The internal gravel roads will have an approximate 6 – 8 m wide surface and there will be up to 12m wide impacted during the construction phase, with additional space required for cut and fill, side drains and other stormwater control measures, turning areas and vertical and horizontal turning radii to ensure safe delivery of the turbine components.
- Pofadder WEF 1 will have a total road network of approximately 48 km.
- One (1) construction laydown / staging area of up to approximately 7 ha (to be rehabilitated following construction). It should be noted that no on-site labour camps will be required in order to house workers overnight as all workers will be accommodated in the nearby towns and transported daily to site (by bus).
- The gate house and security house will occupy an area of up to 0.5 ha.
- Battery Energy Storage System (BESS) of approx. 3.6 ha.
- One (1) permanent Operation and Maintenance (O&M) building (including offices, warehouses, workshops, canteen, visitors centre and staff lockers) occupying an area of up to 1 ha.
- A temporary site camp establishment and concrete batching plant occupying an area of up to 1.6 ha.
- Galvanized palisade fencing to be used at the substations with the maximum height of the fencing to be up to 3.5 m.

In order to evacuate the energy generated by the WEF's to supplement the national grid, Pofadder Grid (Pty) Ltd is proposing two grid connection alternatives which will be assessed in a separate Integrated Grid BAR (see KMZ):

- Alternative 1: A ~ 47 km new 400/132 kV OH powerline within a 300 m assessment corridor (150 m on either side) from the Switching Station on site to the proposed Korana MTS.
- Alternative 2: A ~ 7 km 132 kV OH powerline within a 300 m assessment corridor (150 m on either side) from the Switching Station on site to a proposed new 400/132 kV MTS located south of the WEF and adjacent to the Aggeneis – Aries 400 kV line. This MTS could serve as a back-up to the planned Korana MTS, in the event that Eskom encounters delays or development issues with that project.

The EA applications for the three wind farm projects and gridline are being undertaken in parallel as they are co-dependent, i.e., one will not be developed without the other.

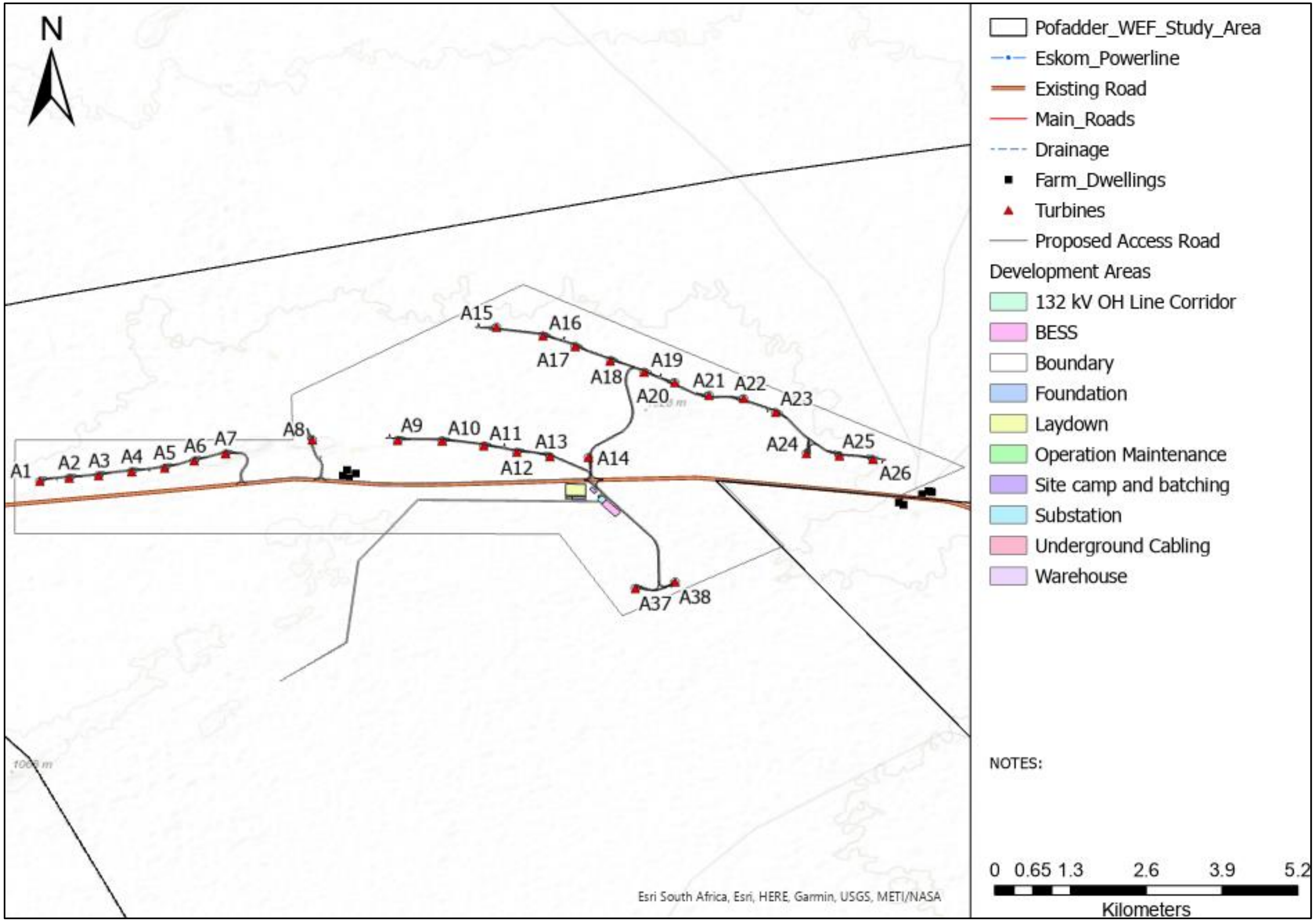


Figure 3. Proposed wind turbine and infrastructure layout for WEF 1.

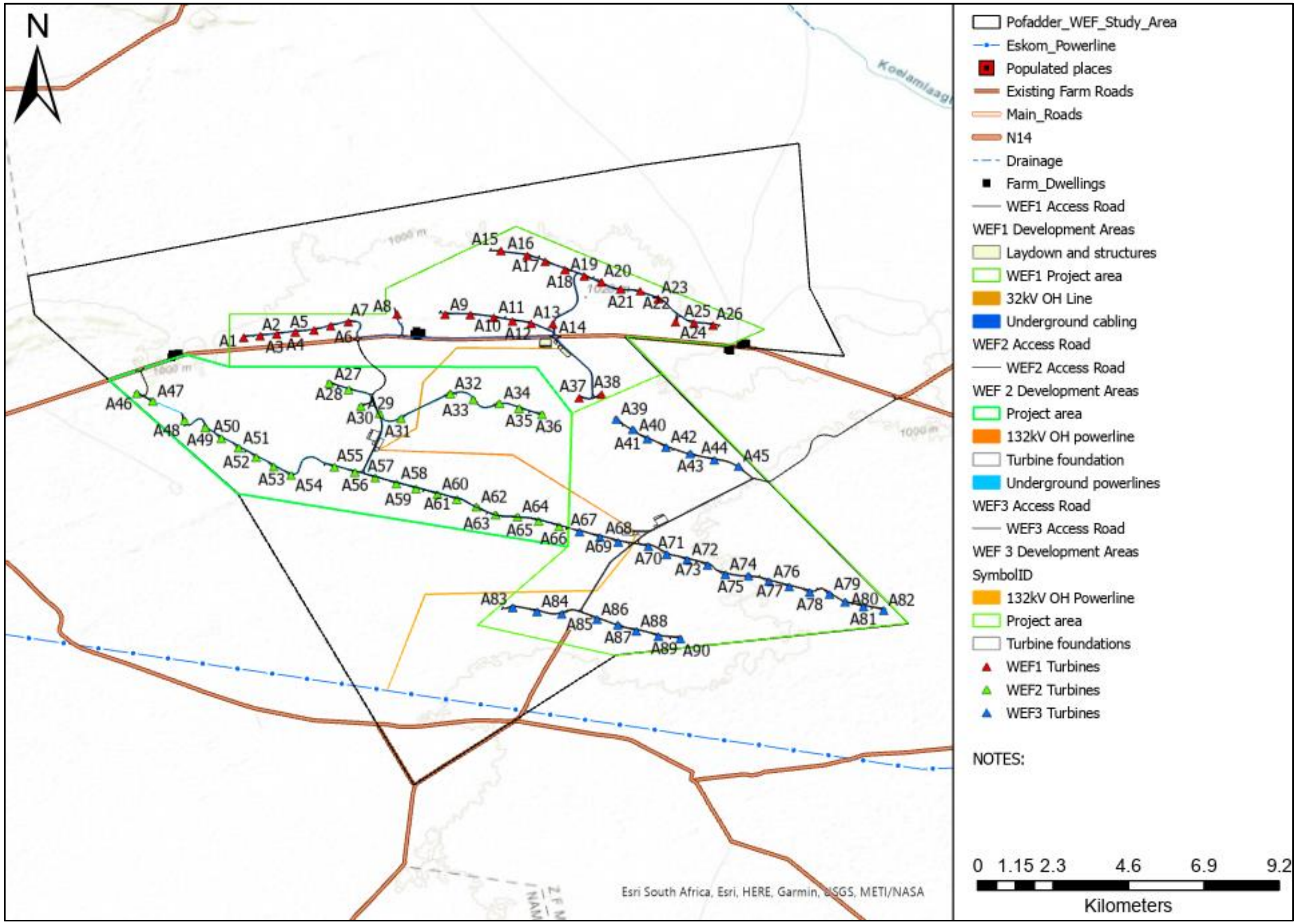


Figure 4. Proposed combined wind turbine and infrastructure layout for the 3 x WEF projects.

6 DESCRIPTION OF THE RECEIVING ENVIRONMENT

Landscape character is defined by the U.K. Institute of Environmental Management and Assessment (IEMA) as the 'distinct and recognisable pattern of elements that occurs consistently in a particular type of landscape, and how this is perceived by people. It reflects combinations of geology, landform, soils, vegetation, land use and human settlement'. It creates the specific sense of place or essential character and 'spirit of the place' (IEMA, 2002). This section of the VIA identified the main landscape features that define the landscape character, as well as the key receptors that make use of the visual resources created by the landscape.

6.1 Site Investigation

A field survey was undertaken on the 1st and 2nd of March 2022 to inform the landscape and visual impact assessment. During the site visit, photographs are to be taken from each viewpoint, and the view direction and GPS location captured. The main land use will be documented as well as the nature of the dominant landscape in the vista. To represent views of the proposed landscape modification by means of photomontages for assessment purposes, panoramic photographs will also be taken from key viewpoints. The following information was captured:

Table 10. Site Investigation Information Description Table.

Attribute	Description
ID	Unique ID assigned numerically for inclusion in the ArcGIS Pro GPS platform.
Name	Name of the landscape or visual issues being recorded.
Direction	Direction of the photograph taken of the issue.
Comment	Description of the landscape or visual issues with motivation.
Photograph	Photograph in the recorded direction.
Lat	GPS locality for latitude
Long	GPS locality for longitude

The above information formed the basis for the Site Sensitivity Verification statement that is located in **Appendix A**.

The above data collect during the site survey is located in **Appendix B**.

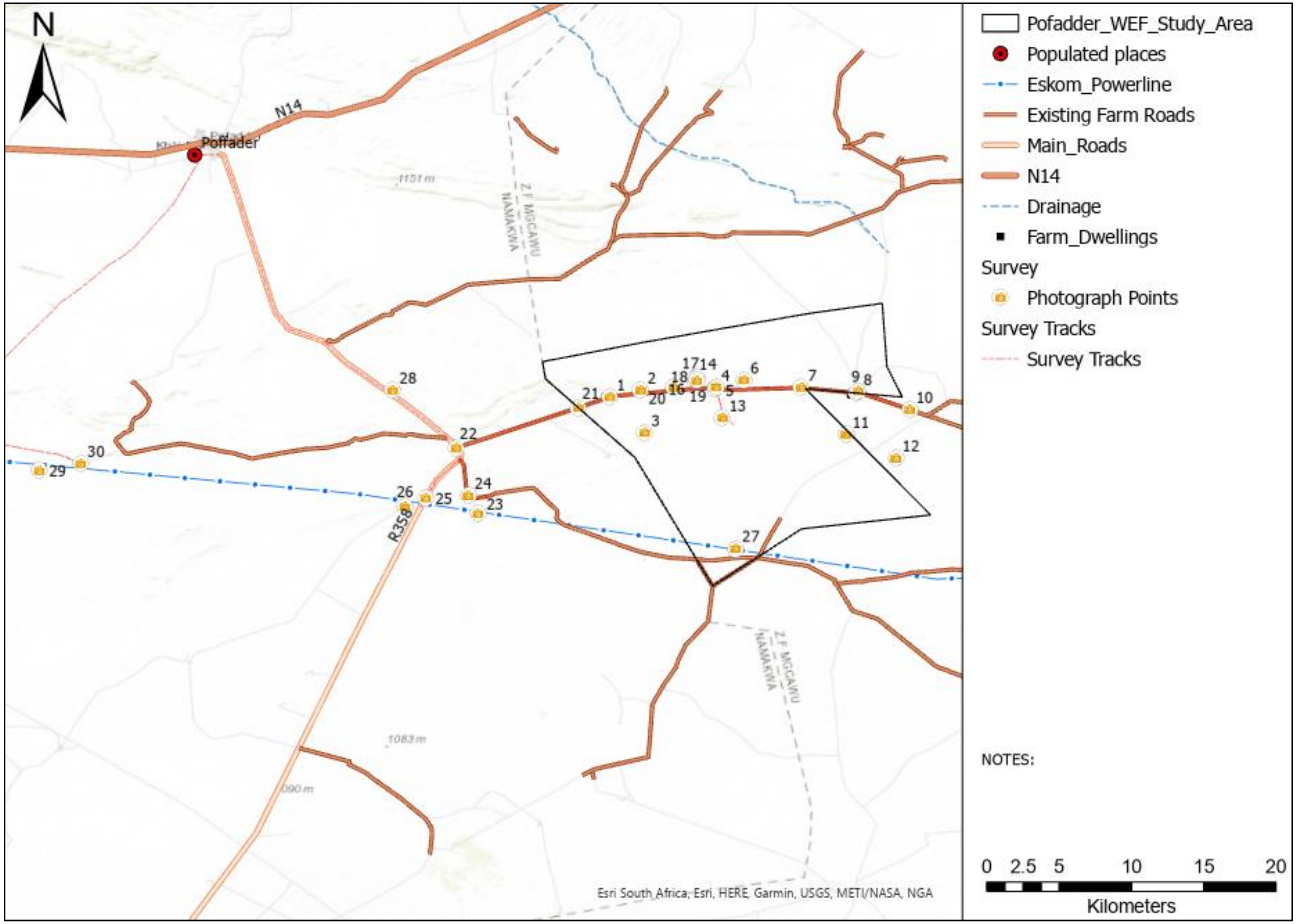


Figure 5. Survey points covered during the field study exercise.

6.2 Landscape Context

6.2.1 Regional Locality

The proposed wind farm is located in the Northern Cape Province, in an arid region climate that lies 50km from the Namibian southern border that is formed by the Orange River. As the area is located within an arid climate zone, it is thus sparsely populated with small agricultural towns sustaining low intensity farming of sheep and goats. The nearest settlement is the small town of Pofadder, located 24km northwest of the site.

6.2.2 Infrastructure and Road Access

The main road located within the region is the N14 National Highway which runs from Upington to Springbok and is located 20km to the north of the site. A minor district road is located 7.2km to the west (R358), as well as a minor farm access road routing through the proposed development area (east to west). These roads are for farming access and are gravel, usually unsuited for tourist related traffic.

In terms of other Renewable Energy projects located within the project ZVI, the figure below depicts the two other wind farm developments which are proposed in the region. Approximately 30km to the west are two Mainstream Wind Farm (Namies and Poortjies), with the Paulputs Wind Farm located 36km to the north. Neither of these wind farm developments will fall within the project ZVI and while authrosied, construction has not commenced.

Located in the southern portion of the study area is an Eskom 400kV Arries/Aggeneis power line. Within the 2km distance from the power line, the landscape character is likely to be strongly defined as a power line corridor with a higher VAC level.

Figure 6: Photograph of the N14 National Road northbound just before Aggeneys town.

Figure 7: Photograph of the typical gravel road located to the west of the study area.

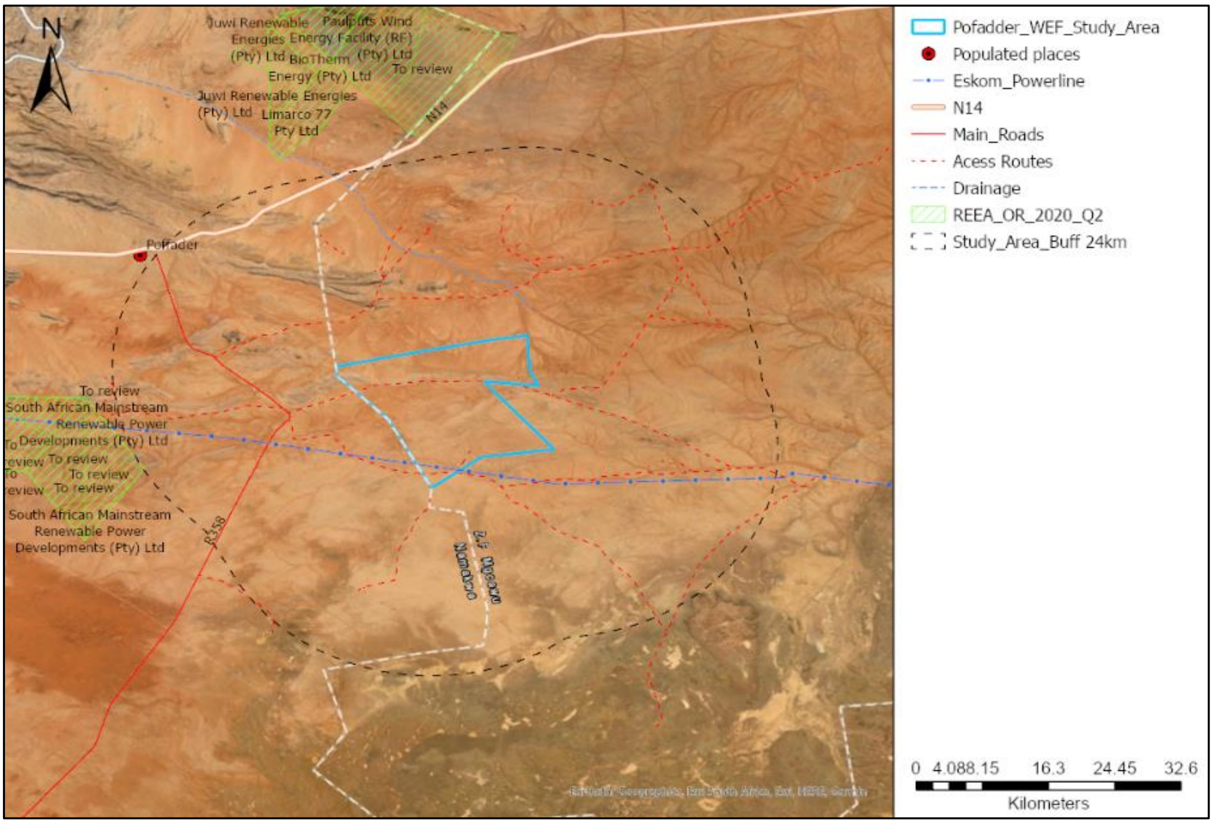


Figure 8. Major infrastructure and DEA renewable energy map.

6.2.3 Landuse

Land use is a crucial factor in determining landscape character, especially regarding the Visual Absorption Capacity (VAC) of the landscapes. Oberholzer defines VAC as the potential of the landscape to conceal the proposed project (Oberholzer, 2005). General land uses of the area are described making use of ArcGIS World Satellite Imagery.

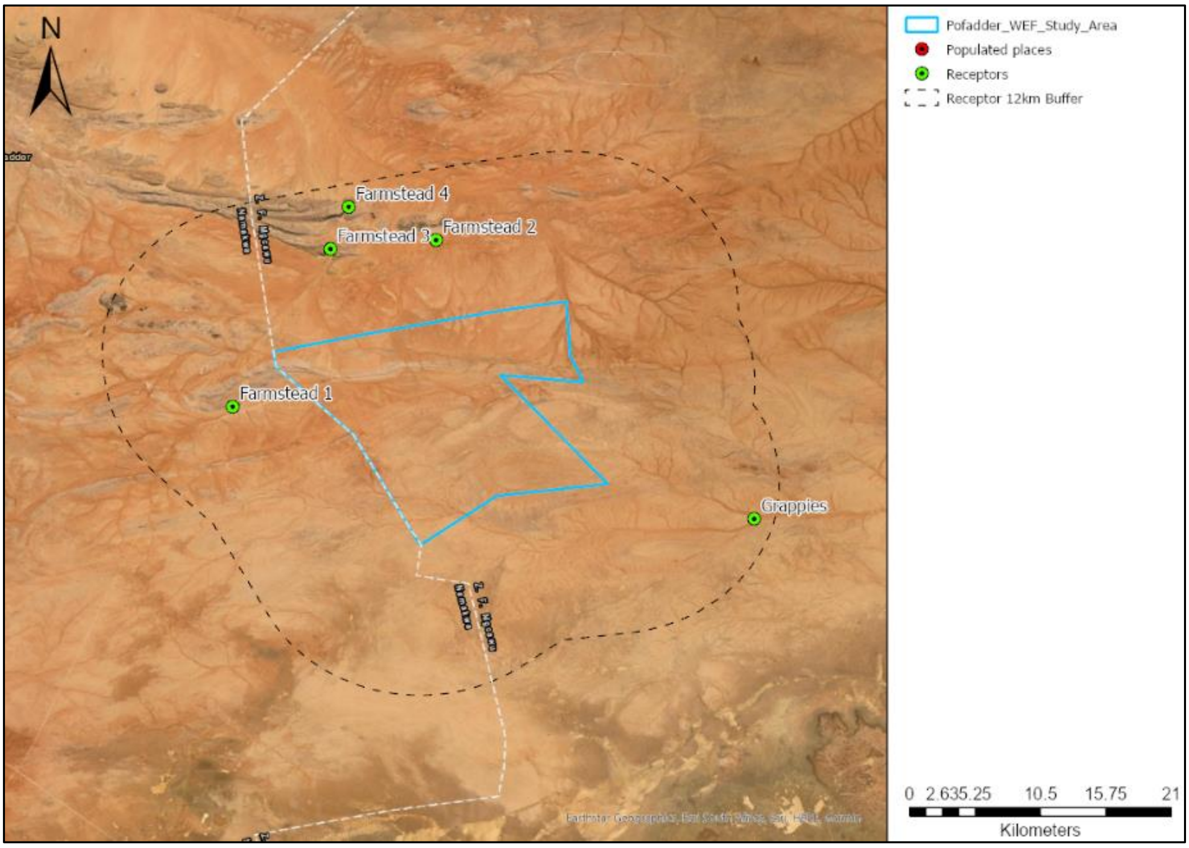


Figure 9. ESRI Open Source satellite imagery underlay to the study area depicting an uniform arid environment within the 12km buffer around the footprint.

The current land use of the proposed properties is an arid agricultural area with sheep and goat farming carried out in this very dry environment. Due to the limited stock carrying capacity, the farms are large in size. Man-made modifications associated with the farming are related to those typical of the low intensity sheep farming but do include some isolated farmsteads. These features are small in scale in the landscape and do not detract from the sense of place.

6.2.4 Conservation

A regional mapping exercise was undertaken to identify conservation protection areas. The desktop survey found that no protected or conservation related activities are located within the project ZVI. Should the Scoping Phase identify eco-tourism related activities associated with conservation projects, these would need to be included in the assessment as Key Observation Points if they are located within the project ZVI.

6.2.5 Other Renewable Energy Projects

In order to better understand cumulative effects that could arise from intervisibility of multiple wind farm projects, or other renewable energy (RE) projects, a survey of other RE within 35km radius was undertaken by SiVEST and mapped in Figure 10 below, with project listing in Table 11. As can be seen from the map, no RE projects are located within 30km from the proposed wind farm, with the nearest other wind farms being Korona 1 WEF and Poortjies and Namies South WEFs. With the large distance between projects, day-time intervisibility is highly unlikely to take place. Without mitigation of Aircraft Warning Lights at night, some low-intensity night-time intervisibility could take place with multiple lights from each of the wind farm clusters creating a flashing glow area. This would be limited to high point areas in the region.

Table 11. SiVEST Renewable Energy Projects Table.

Project Name	Number of turbines	Land parcel area
Paulputs Wind Energy Facility	75	Scuitklip & Lucasvlei Farms 11 813 ha
Korana Wind Energy Facility	70	Poortjies & Nama South Farms 17 393 ha
Khai-Ma Wind Energy facility	42	
Poortjies Wind Energy Facility	24	
Pofadder 2 Wind Energy Facility	37	Gannapoort, Lovedale & Sandgat Farms 22 992 ha
Pofadder 3 Wind Energy Facility	37	
Paulputs PV 1 Solar Energy Facility	n/a	Konkoonsies Farm 1 285 ha
Paulputs PV 2 Solar Energy Facility	n/a	Konkoonsies Farm 3 326 ha
Paulputs PV 3 Solar Energy Facility	n/a	Konkoonsies Farm 3 326 ha

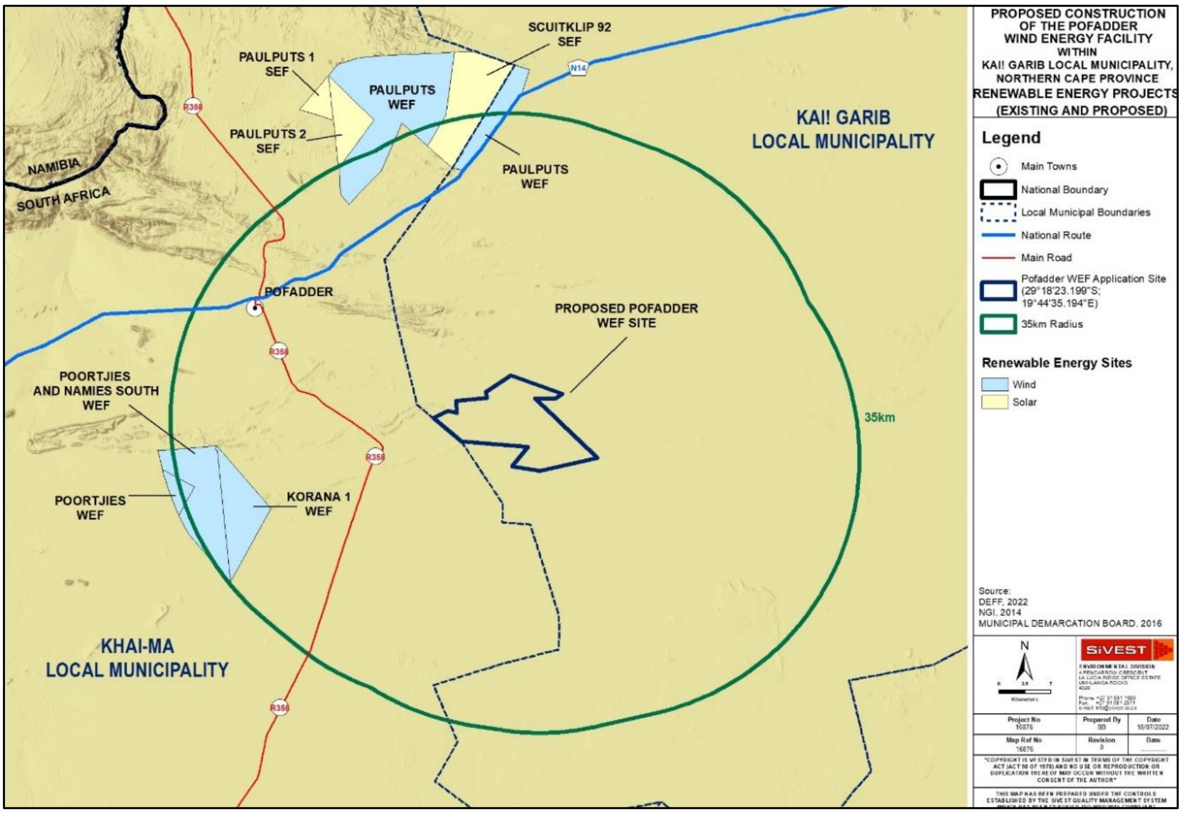


Figure 10. SiVEST Renewable Energy Project in the region map.

6.2.6 *Vegetation*

According to the South African National Biodiversity Institute (SANBI) 2012 Vegetation Map of South Africa, Lesotho and Swaziland (South African National Biodiversity Institute, 2012) the vegetation biome is described as Nama-Karoo. The Nama-Karoo Biome "occurs on the central plateau of the western half of South Africa, at altitudes between 500 and 2000m, with most of the biome falling between 1000m and 1400m. It is the second-largest biome in the region". The SANBI Plantzafrica website indicates that the vegetation distribution of this biome is determined primarily by rainfall where "rain falls in summer and varies between 100 and 520mm per year. This also determines the predominant soil type - over 80% of the area is covered by a lime-rich, weakly developed soil over rock. Although less than 5% of rain reaches the rivers, the high erodibility of soils poses a major problem where overgrazing occurs. The dominant vegetation is a grassy, dwarf shrubland. Grasses tend to be more common in depressions and on sandy soils, and less abundant on clayey soils" (Plantzafrica, n.d.). As indicated in the map below, the two vegetation types characterising this biome are Bushmanland Basin Shrubland and Bushmanland Arid Grassland. The majority of the site is covered by the latter. The other biome that falls within the project area is the Succulent Karoo Biome with the vegetation type described as Bushmanland Inselberg Shrubland. As indicated by the name, this vegetation is found on the rocky outcrops that characterise the northern portions of the study area.

Visual screening from vegetation in both these biomes, is likely to be very limited and would not restrict the proposed project Zone of Visual Influence (ZVI). The use of vegetation as a potential project mitigation screening is limited, as the high temperatures and low rainfall of the area would not be conducive to tree screening growth. The growth of trees would also create contrast, as the trees would look un-characteristic in the Nama-Karoo and Desert cultural landscapes.

Figure 11: Photograph typical of the area taken to the northwest of Aggeneys showing the inselbergs and the Bushmanland Arid Grasslands on the flat plains.

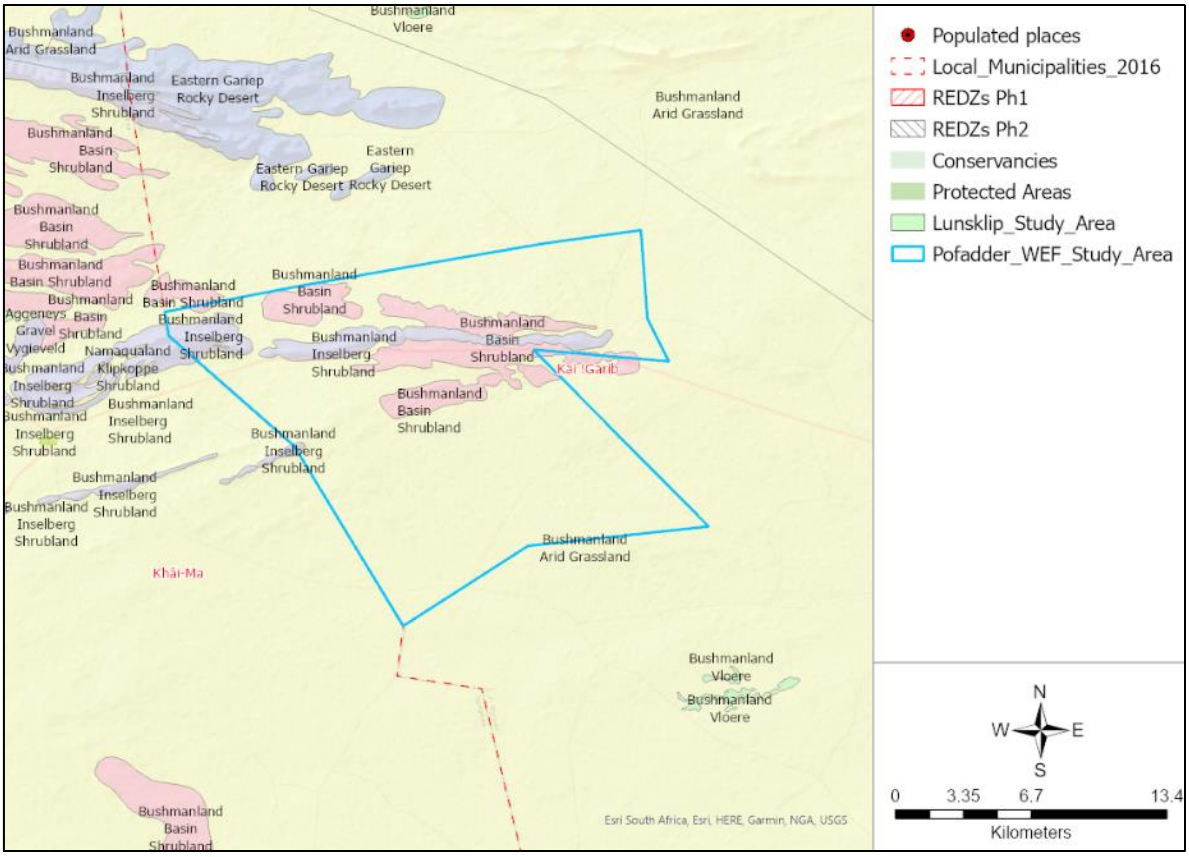
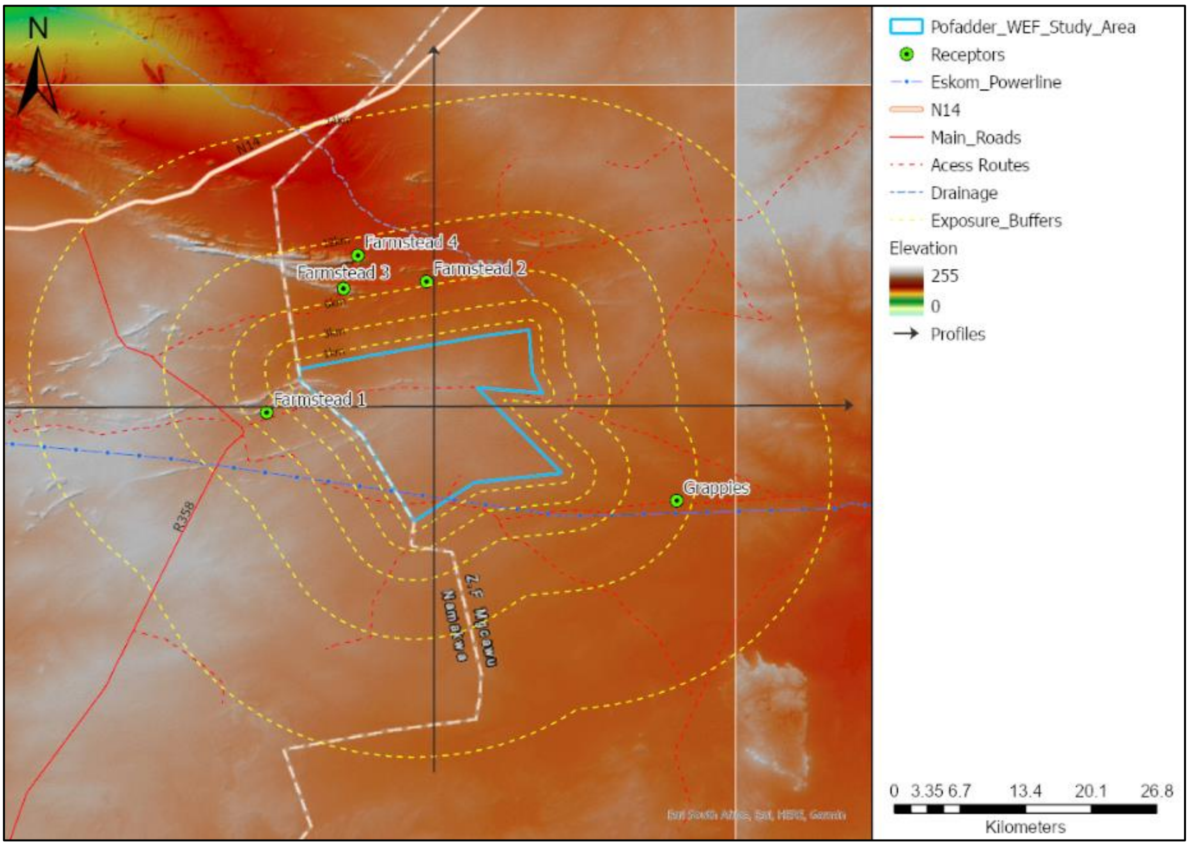


Figure 12: Vegetation Type Map

6.2.7 Regional Topography

Regional and local topography has the potential to strongly influence landscape character, as well as the extent of the Zone of Visual Influence. In order to better understand these aspects of the study, a Digital Elevation Model was generated making use of the NASA STRM digital elevation model.



East to West Profile

North to South Profile

Figure 13. Regional terrain model depicting distance buffers around the study area and the profile line locality generated from Google Earth.

Due to the relatively flat nature of the terrain, the zone of visual influence is likely to be widespread, but with slight undulation creating some visual screening in the background areas. The east to west profile depicts the site as having relative prominence, with low ground of 933m in the east rising to a high of 1058m in the west. Across the 75km length, the total change in elevation is 155m, emphasising the flat nature of the terrain. The north to south profile also reflects a flat terrain, with more undulation to the north. The low drainage point is to the north at 900mamsl, with the project area located on the region high point of 1038m. Due to the flat terrain, topographic screening is likely to be limited given the height of the turbines.

6.2.8 Site Topography

As slopes have a strong influence on landscape character and can also result in large cut and fills from the development of linear features such as roads, and platforms, a slope analysis was undertaken for the study area making use of ArcGIS Open Source terrain data.

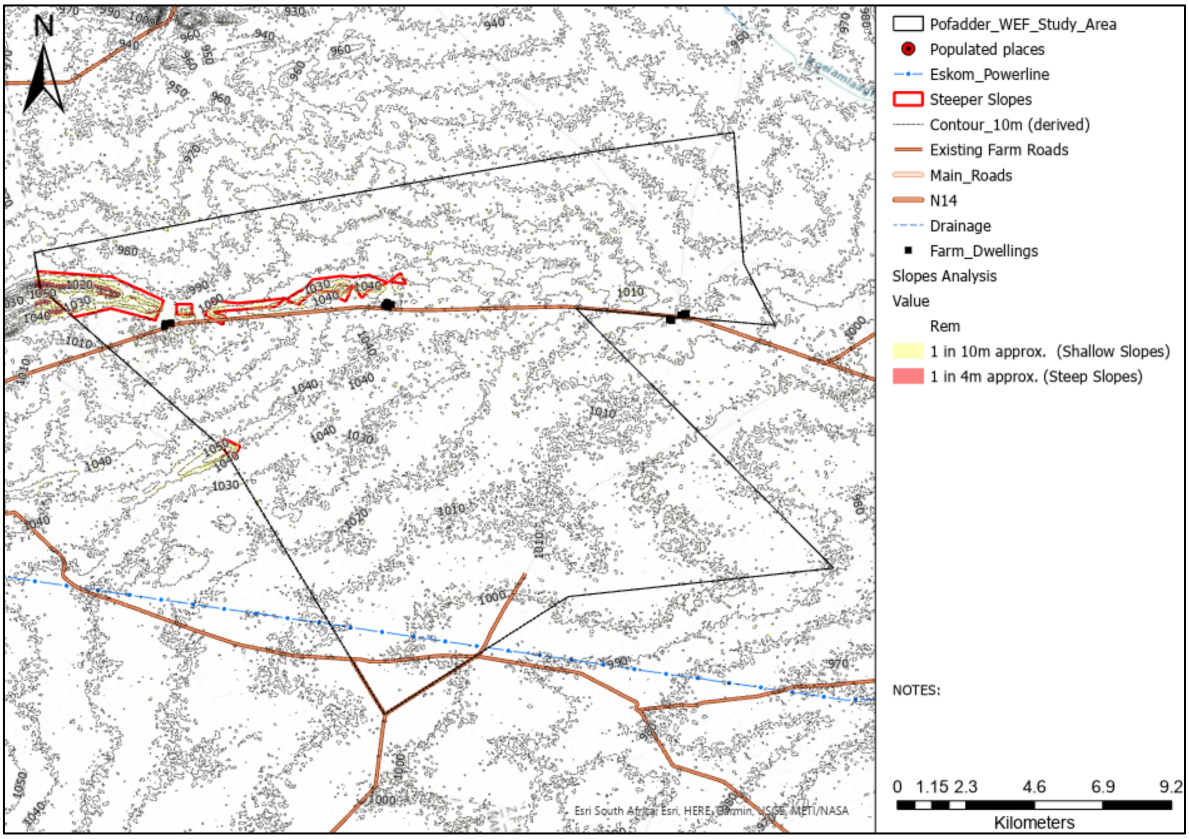


Figure 14. Approximate steeper slopes mapping where landscape scarring or erosion could take place that needs to be confirmed with detail design.

Making use of the slopes analysis function in ArcGIS Pro, approximate steep slopes were generated for Steep Slopes (1 in 4m), Shallow Slopes (1 in 10m.), and flatter terrain areas remaining. could increase risk of visual scarring. Although not depicted in the mapping above, the low ridgeline does extend across the study area to the west. As this is a landform of interest, the steep and shallow slopes that comprise the low ridgeline should be incorporated as a Physiographic Rating Unit for landscape assessment. It must also be noted that as the shallow ridgeline is approximately 20m in height, it is not a significant landform, but does add to the local scenic quality.

6.3 Project Zone of Visual Influence

The visible extent, or viewshed, is “the outer boundary defining a view catchment area, usually along crests and ridgelines” (Oberholzer B. , 2005). In order to define the extent of the possible influence of the proposed project, a viewshed analysis was undertaken from the proposed site at a specified height above ground level as indicated in the Table 12 below, making use of open-source NASA ASTER Digital Elevation Model data (NASA, 2009). The extent of the viewshed analysis was restricted to a defined distance that represents the approximate zone of visual influence (ZVI) of the proposed activities, which takes the scale, and size of the proposed projects into consideration in relation to the natural visual absorption capacity of the receiving environment. The maps are informative only as visibility tends to diminish exponentially with distance, which is well recognised in visual analysis literature (Hull & Bishop, 1988).

6.3.1 Viewshed Analysis

A viewshed analysis was undertaken for the site making use of NASA SRTM 30m Digital Elevation Model data (NASA, 2009). The offset height reflects the height value representing the project height (worst case scenario) of the respective project component. The Capped Extent refers to the limitation placed on the viewshed taking into consideration the expected distance when the proposed landscape change would not be clearly noticeable.

Table 12: Proposed Project Heights Table

Project Component	Offset Height (m)	Capped extent
Turbines Hub (lights at night)	200m	30km
Blade Top Height (movement)	300m	30km

As can be seen in the approximate viewshed depicted in Figure 15, the extent to the zone of visual influence is likely to be widespread across the region. This is due to the large height of the turbines that are positioned on a local high point in the landscape, surrounded by terrain at a relatively uniform elevation. For these reasons, the viewshed is rated as Regional and Extent High as the landscape will extent across a wide landscape area. The Zone of Visual Influence, however, is likely to be localised in extent with clearer visibility of the wind turbines contained with the 12km distance area. Due to the topography that does include some undulating and hill features, there will be localised pockets where limited views of the turbines will take place. Within the 6km distance zone, the visual impacts are probable with Medium to High Exposure. Outside of this distance zone, visual impacts are possible, but unlikely to be experienced as dominating in the Medium to Low Visual Exposure areas beyond 12km.

A combined viewshed analysis was also undertaken making use of 12 points covering the combined turbine area, with offset 300m. As mapped in Figure 16, the intensity of the intervisibility from the combined turbines tends to decrease after 20km, with the outer area less likely to see the combined turbine view as a mass. This viewshed map does not take atmospheric conditions into consideration, and the expected visual clarity zone is expected to be less than displayed, with the estimated combined ZVI related to the 12km distance zone.

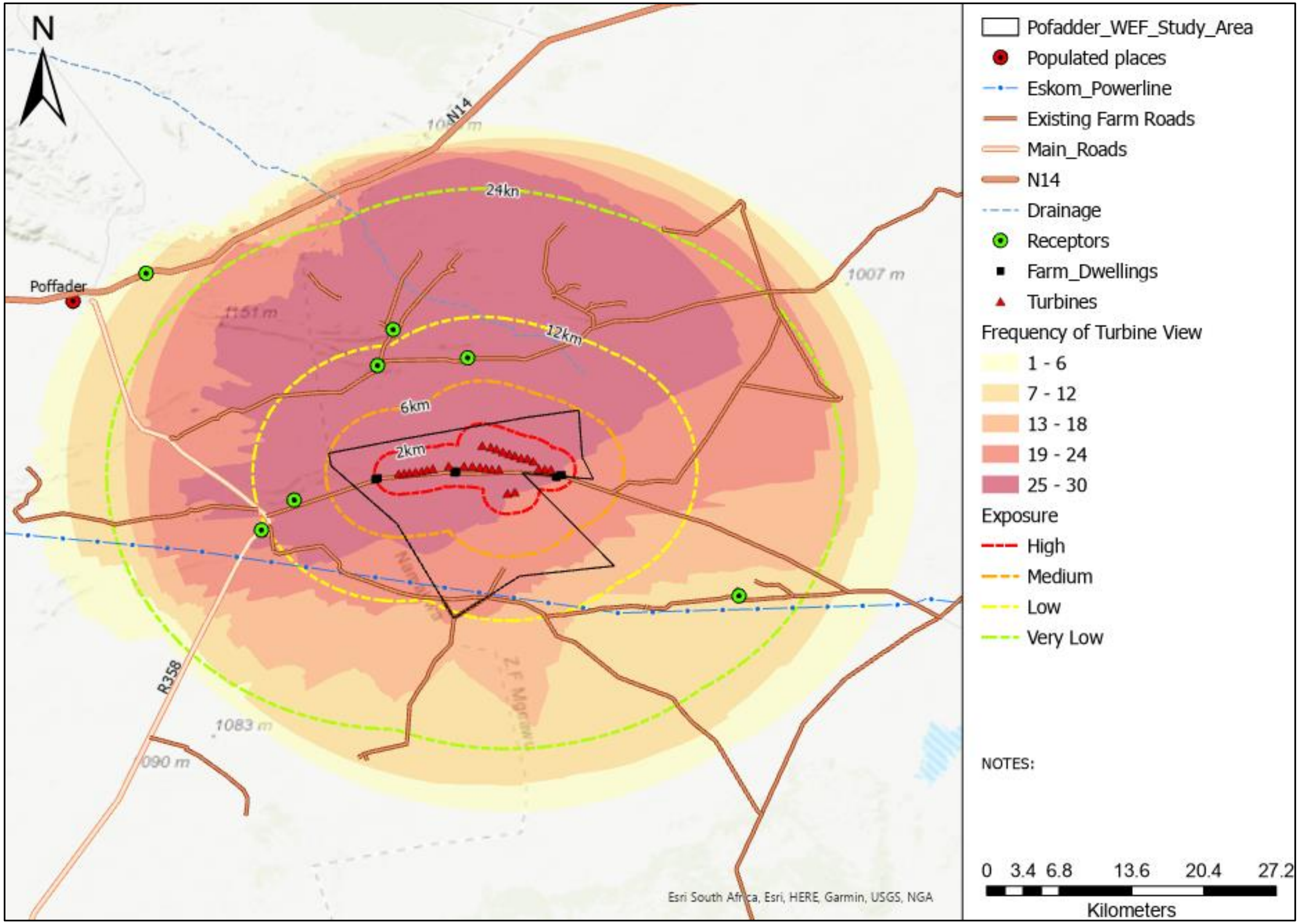


Figure 15. Expected WEF1 project viewshed and exposure generated from 300m height above ground from turbine points.

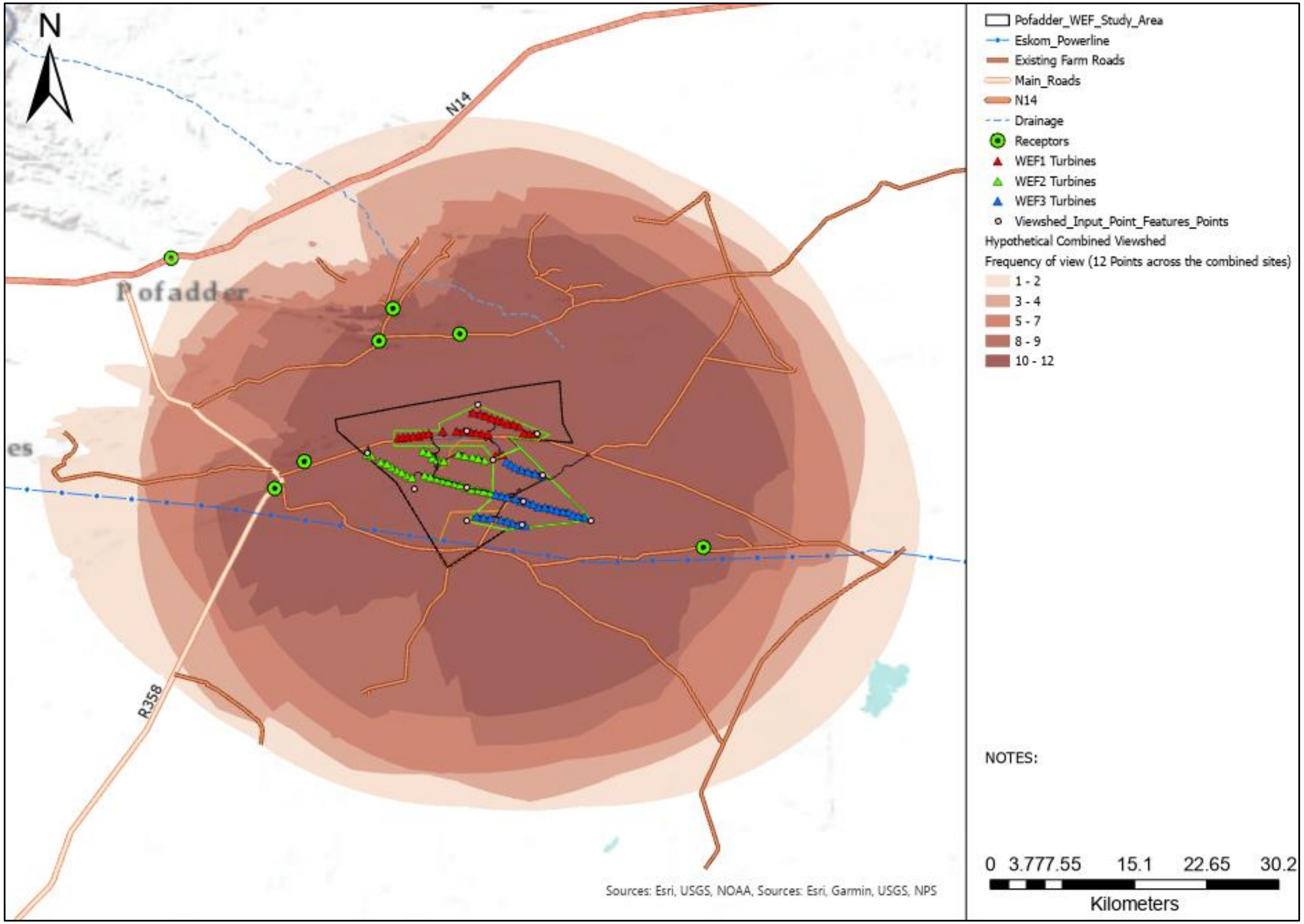


Figure 16. Expected combined WEF 1, 2 & 3 viewshed capped at 30km (offset 300m, selective points).

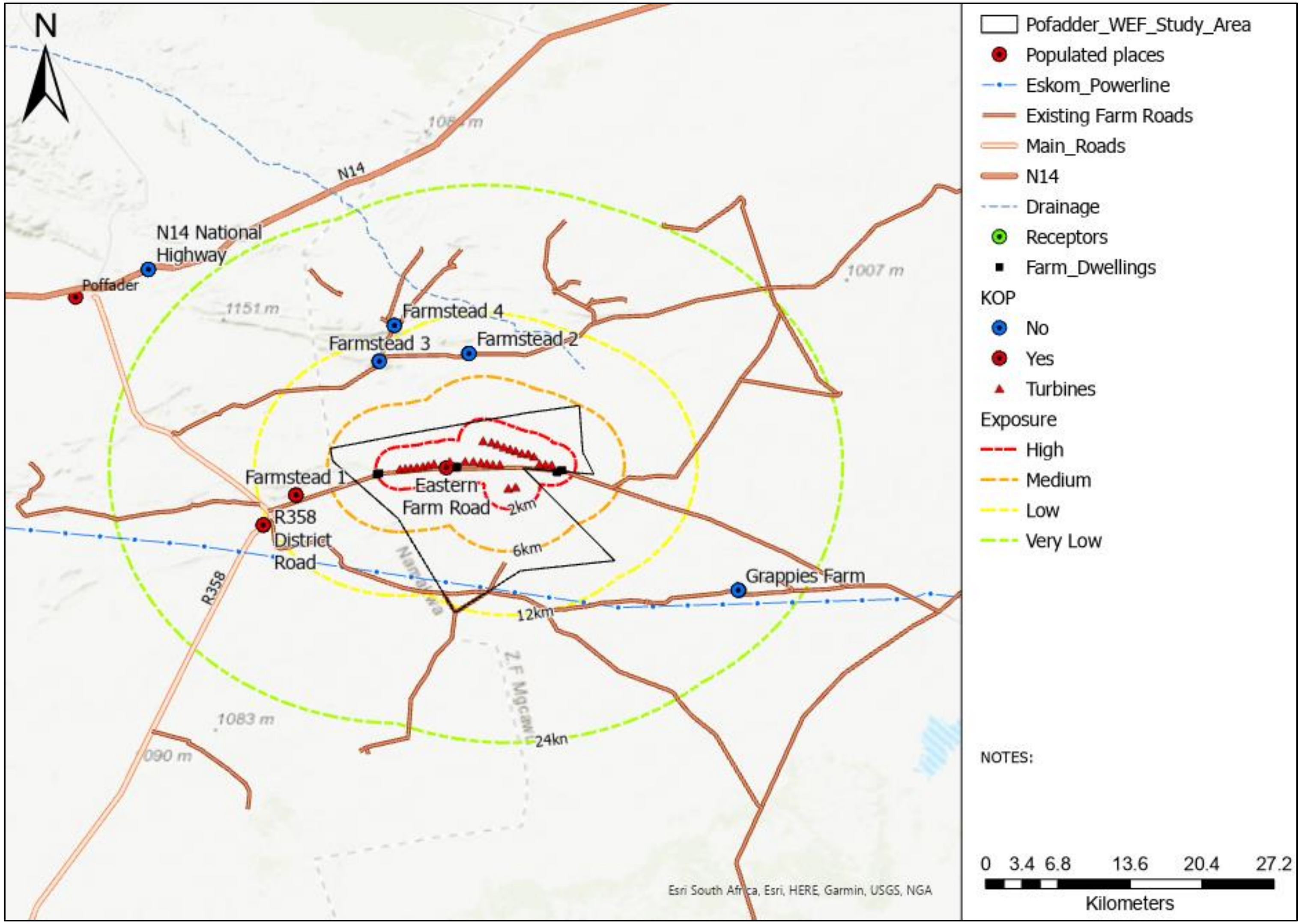


Figure 17: WEF1 preliminary Receptor and KOP locality map.

6.4 Receptors and Key Observation Points

As defined in the methodology, KOPs are defined by the Bureau of Land Management as the people (receptors) located in strategic locations surrounding the property that make consistent use of the views associated with the site where the landscape modifications are proposed. The following table lists the receptors identified within the ZVI and motivates if they have significance and should be defined as KOP for further evaluation in the impact assessment phase. The receptors located within the ZVI and KOPs view lines are mapped on the previous page in Figure 17.

Table 13: Receptor and KOP Motivation Table.

Name	Exposure	Distance	KOP	POINT_X	POINT_Y	Motivation
Farmstead 1	Medium	8.3km	Yes	19.57031	-29.301	Medium Exposure with clear views of the proposed wind farm. Although this dwelling appears un-occupied, it could be used as a dwelling in the future.
Farmstead 2	Medium	10.2km	No	19.71729	-29.1808	Medium Exposure with clear views of the proposed wind farm.
Farmstead 3	Low	10.3km	No	19.64113	-29.1875	Low Exposure.
Farmstead 4	Low	13.3km	No	19.65377	-29.157	Low Exposure.
R358 District Road	Medium	10.5km	Yes	19.54258	-29.3263	Regional access route.
N14 National Highway	Very Low	27.5km	No	19.44507	-29.1094	Important scenic view corridor but with very Low Exposure
Kenhardt Farm Road	High	Less than 1km	Yes	19.84722	-29.2979	High Exposure to road users (very low traffic frequency)
Grappies Farm	Low	22km	No	19.94558	-29.3816	Low Exposure.

6.5 Physiographic Rating Units

The Physiographic Rating Units are the areas within the proposed development area that reflect specific physical and graphic elements that define a particular landscape character. These unique landscapes within the project development areas are rated to assess the scenic quality and receptor sensitivity to landscape change, which is then used to define a Visual Resource Management Class for each of the site's unique landscape/s. The exception is Class I, which is determined based on national and international policy / best practice and landscape significance and as such are not rated for scenic quality and receptor sensitivity to landscape change. The table below lists the Physiographic Rating Units/ unique landscapes that were defined, with motivation in the right column and mapped in in Figure 18 on the following page. Based on the SANBI mapping and the site visit to define key landscape features, the following broad-brush vegetation were tabled.

Table 14: Physiographic Landscape Rating Units.

Landscapes	Motivation
Nama-Karoo with Bushmanland grasslands	Flat terrain with no significant man-made changes to the Nama-Karoo shrubland vegetation.
Farm access road buffer 250m	In terms of meeting best practice as the recommendations derived from the DEA&DP Visual and Aesthetic Guidelines.
Internal dwelling 1km buffer (Cultural settlements)	
Boundary internal 800m buffer	
Low ridgeline with moderate slopes	The low ridgelines to the northwest of the site with medium significance as a landform element that does add to the scenic quality but at a local level.
1 in 4m steep slopes adjacent to the small 'poort' landform not suitable for development	Steep slopes and the small ridgelines they comprise are a key natural feature in the landscape. These areas are also subject to scarring from road and erosion. These areas should be considered as Class I (No-go)
Drainage lines and washes (not assessed)	Drainage lines and significant surface water hydrology areas are protected by law in South Africa. Areas defined as having significance would need to be classified as Class I (No-go). *These area are not mapped as are defined by the relevant specialist*.
Steep sided rocky outcrops	Located to the northwest of the study area is a ridgeline landform defined by moderate hight, steep slopes and some rocky outcropping.

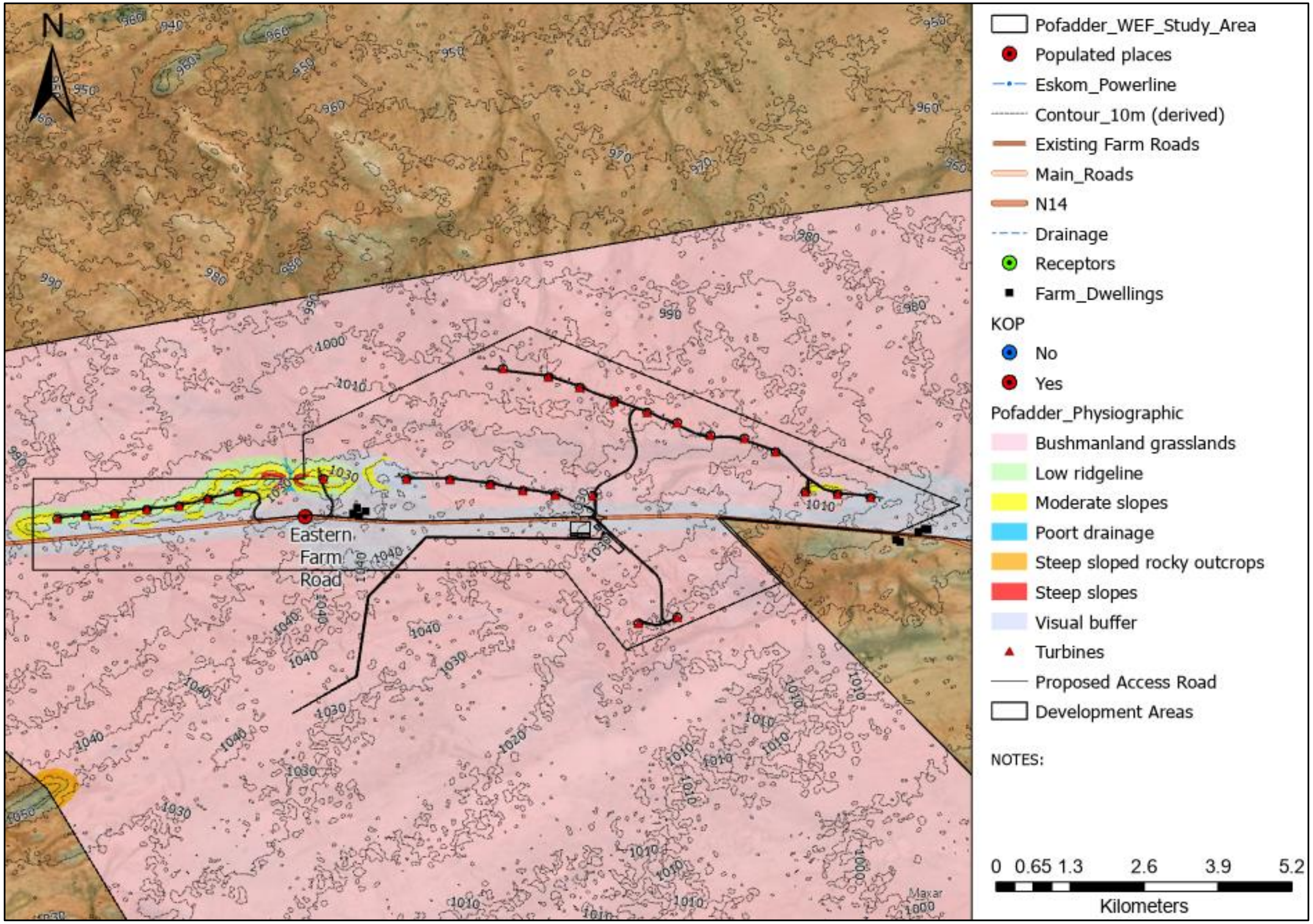


Figure 18: WEF1 Site Satellite Image Map depicting uniform terrain and vegetation.

Table 15: Scenic Quality and Receptor Sensitivity Rating.

Landscape Rating Units	Scenic Quality A= scenic quality rating of ≥19; B = rating of 12 – 18, C= rating of ≤11									Receptor Sensitivity H = High; M = Medium; L = Low						VRM	
Attribute	**Landform**	**Vegetation**	**Water**	**Colour**	**Scarcity**	**Adjacent Landscape**	**Cultural Modifications**	**Sum**	**Rating**	**Type of Users**	**Amount of Use**	**Public Interest**	**Adjacent Land Uses**	**Special Areas**	**Rating**	**Inventory Class**	**Management Class**
Ecologically sensitive areas Hydrologically sensitive areas Heritage sensitive areas Steep sided rocky outcrops 1 in 4 slopes	**(Class I is not rated)**															**I**	**I**
Nama-karoo / Bushmanland grassland	1	2	0	2	1	3	2	**11**	**C**	L	L	L	H	L	**L**	**IV**	**III**
Low Ridgeline, Visual Buffer (Cultural Settlements and road buffer) **Property buffer pending I&AP Comments*	3	2	0	2	1	3	2	**13**	**B**	M	L	L	L	M	**M**	**III**	**II**

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

The ***Scenic Quality*** scores are totalled and assigned an A (High scenic quality), B (Moderate scenic quality) or C (Low scenic quality) category based on the following split: *A= scenic quality rating of ≥19; B = rating of 12 – 18, C= rating of ≤11* (USDI., 2004).
Receptor Sensitivity levels are a measure of public concern for scenic quality. Receptor sensitivity to landscape change is determined by rating the key factors relating to the perception of landscape change in terms of Low to High.

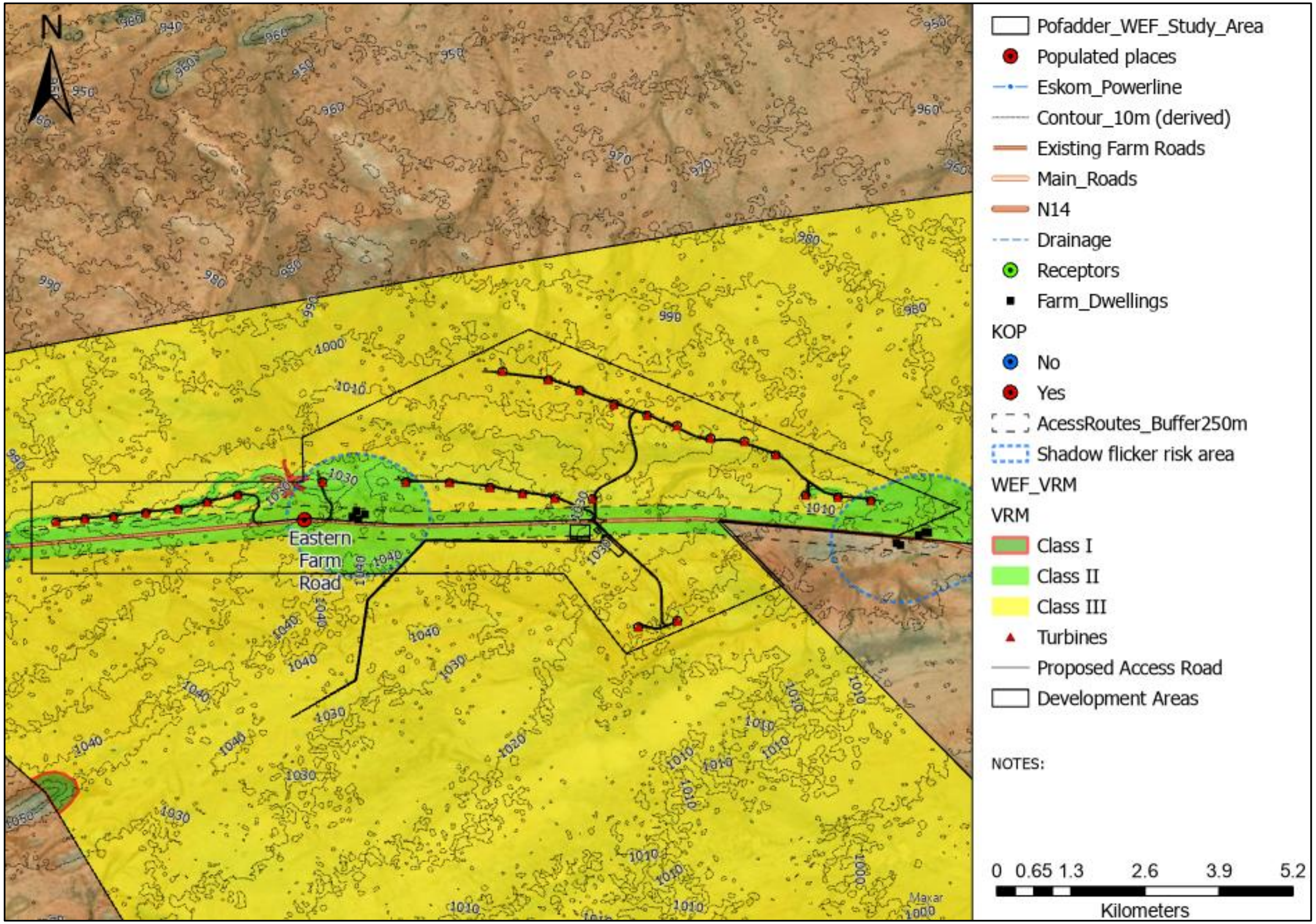


Figure 19: WEF1 VRM Class overlay onto satellite imagery.

6.6 Scenic Quality Assessment

The scenic quality of the portions of the site defined as Bushmanland Arid grassland, which are essentially flat with few landform features, is rated **Low**. This is due to the flat terrain that has no water features, limited vegetation and colour variation and is not a scarce visual resource regionally. The only value element is the Adjacent Scenery which includes the low northern rocky outcrops which do have value and add to the regional landscape character. The overall sense of place is that of a rural, arid agricultural landscape that does not offer much in terms of scenic resources.

The low ridgeline and includes steep slope areas is rated **Medium** as this area is a key landscape element defining the ***local*** sense of place. This area also includes several shallow washes where drainage from the south has incised an opening through the rock creating a 'poort'. These areas have also been used as location points for farming activities and have a cultural value if they are of a scale that can be clearly noticeable. Only one 'poort' has landform value due to the steep sided nature of the adjacent low ridgeline.

6.7 Receptor Sensitivity Assessment

Receptor sensitivity to landscape changes for the flat Nama-karoo biome areas is rated **Low**. As the area is very remote with few, essentially farming related receptors, it is expected that receptor sensitivity to the landscape change would be Low. The area has limited visual resources and the strong presence of the southern Eskom power line does reduce the sensitivity to landscape change on the site due to the existing higher VAC levels generated by the pylons.

The rocky outcrop and visual buffers are likely to have a higher sensitivity to landscape change and are rated **Medium** due to their scenic value and close proximity to human habitat areas. No I&AP comments were made regarding Visual of Landscape issues.

6.8 Visual Resource Management (VRM) Classes

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

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

6.8.1 Class I

Class I is assigned when legislation restricts development in certain areas. The visual objective is to preserve the existing character of the landscape, the level of change to the characteristic landscape should be very low and must not attract attention. A Class I visual objective was assigned to the following features within the proposed development area due to their protected status within the South African legislation:

- Any river / streams and associated flood lines buffers identified as significant in terms of the WULA process.
- Any wetlands identified as significant in terms of the WULA process.
- Any ecological areas (or plant species) identified as having a high significance.
- Any heritage area identified as having a high significance.
- 1 in 4 steep slope areas (subject to confirmation during detail design phase).

While the scoping layout did include turbines that were located within the Class I steep slopes area, recommendations were made for the removal of this section of the development, which were complied with. As such, no turbines are located in Class I No-go areas.

6.8.2 Class II

Class II visual inventory was assigned to the following features:

- Visual buffer from farmstead.
- Moderate slope areas.

Due to Medium levels of Scenic Quality relating to the arid desert landscapes and interesting arid region vegetation of the rock outcrop, but Lower Receptor Sensitivity, these broad landscapes were rated a Visual Inventory Class III. However, due to the importance of maintain landscape integrity around the low ridgeline, the moderate slope areas were assigned a VRM Class II. The Class II objective is to retain the existing character of the landscape and the level of change to the characteristic landscape should be low. Management activities may be seen but should not attract the attention of the casual observer, and should repeat the basic elements of form, line, colour and texture found in the predominant natural features of the characteristic landscape.

Turbines A8, A9 & A26 are located within the Class II Visual Objective area. This area represents a sensitivity buffer around the farmstead. However, these dwellings within the property and the property owners are part of the WEF project and as such they are likely to accept the higher levels of visual intrusion.

6.8.3 Class III

Class III visual inventory were assigned to the following landscape:

- Nama-karoo

Due to Medium to Low levels of Scenic Quality relating to the arid desert landscapes, but Low Receptor Sensitivity, these broad landscapes were rated a Visual Inventory Class IV. As the area is remote rural with existing agricultural taking place, the Class IV would be unsuitable as this class is more associated with industrial type landscapes. For this reason, these areas were changed to a Visual Resource Management Class III in order to partially retain the existing character of these rural landscapes, where the level of change to the characteristic landscape should be moderate.

Management activities may attract attention but should not dominate the view of the casual observer, and changes should repeat the basic elements found in the predominant natural features of the characteristic landscape. As turbines have the potential to add value to arid landscape in remote location, the Class III areas are likely to be acceptable within the grassland areas.

The remainder of the proposed development is located within Class III Visual Objective area, where the landscape change could be accommodated, but would result in some visual intrusion within the Foreground/ Mid Ground distance zone.

6.8.4 Class IV

Due to the visual significance of the remote, rural landscape, **no Class IV visual inventory areas were identified to protect the existing agricultural landscape.**

6.9 Photomontages and Model Proof.

Photomontages were generated for each of the KOPs. Photographs taken during the field survey were modified to reflect the expected landscape, making use of a 3D model generated for the proposed mining landscape modifications. The photomontages are not an exact replication and are ***provided for visualisation purposes only***. The photomontages are based on the maximum tip-height of 300m.

The photomontages can be viewed in the following page.

Proximate view *Distant view*

Figure 20: Photographic material used to inform the photomontages was based on photographs of the existing Khobab & Loeriesfontein wind farms as they reflect similar landscape conditions.

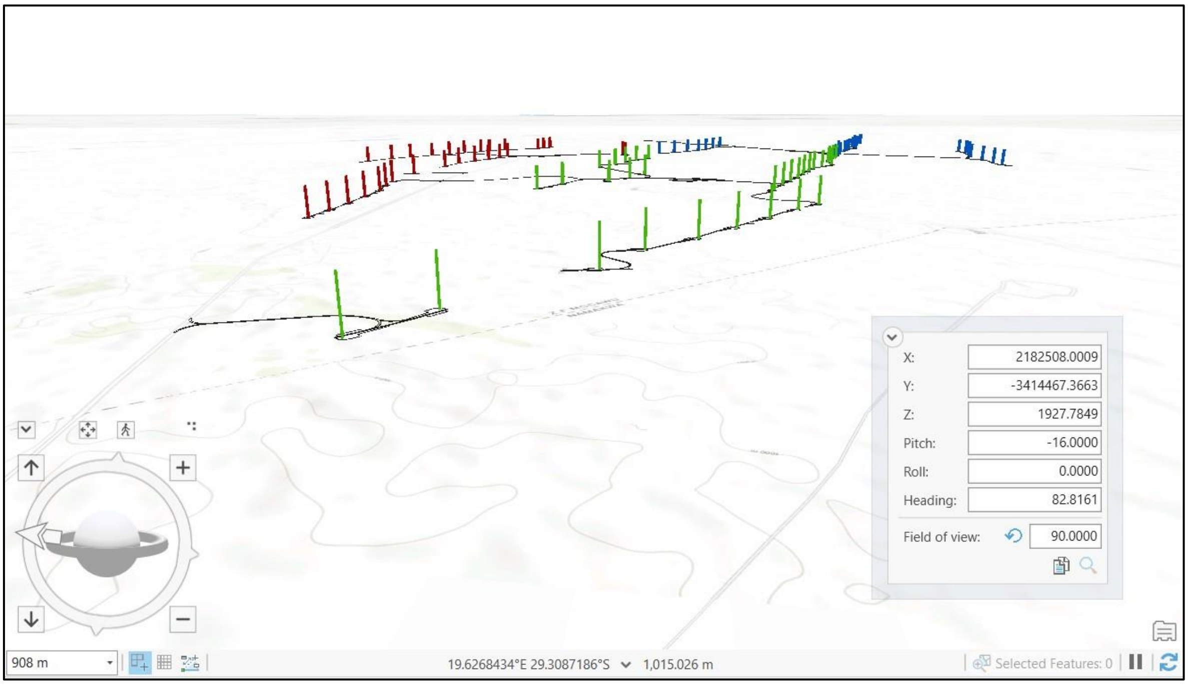


Figure 21: 3D Model perspective view of the ArcGIS model with WEF1 (Red), WEF2 (Green) and WEF3 (Blue)

Existing View

Proposed View ***Approximation: For visualisation purposed only***

View Direction: East **Distance: 3.7km** **Date: 27 April 2021** **Atmospheric Condition: Clear**

Figure 22: Local farm access road eastbound as seen from the entrance into the project area.

Existing View

Proposed View ***Approximation*: *For visualisation purposed only***

View Direction: East **Distance: 7.8 km** **Date: 27 April 2021** **Atmospheric Condition: Clear**

Figure 23: Main access road view east.

Existing Night-time View

Proposed Night-time View ***Approximation: For visualisation purposed only***

View Direction: East **Distance: 3.7km** **Date: 27 April 2021** **Atmospheric Condition: Clear**

Figure 24: Main access road view east with night-time and Aircraft Warning Lights ***example***.

7 IMPACT ASSESSMENT

7.1 Contrast Rating from Key Observation Points.

Impacts are defined in terms of the standardised impact assessment criteria provided by the environmental practitioner. Using the EAP impact assessment criteria, the potential environmental impacts identified for the project were evaluated according to severity, duration, extent, and significance of the impact. The potential occurrence and cumulative impact (as defined in the methodology) were also assessed. To better understand the nature of the severity of the visual impacts, a Contrast Rating exercise was undertaken.

As indicated in the methodology, a contrast rating is undertaken to determine if the VRM Class Objectives are met. The suitability of a landscape modification is assessed by comparing the existing receiving landscape to the expected contrast that the proposed landscape change will generate. This is done by evaluating the level of change to the existing landscape by assessing the line, colour, texture, and form, in relation to the visual objectives defined for the area.

The following criteria are utilised in defining the DoC:

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

As there are limited receptors in this remote locality, the two photomontage views are utilised to provide a generalised reference points from which to assess the close proximity receptor, reflecting those receptors driving through the project area, and the more common distant views as seen from the nearest farmstead receptors located approximately 8 km vista from the wind farm.

Table 16: Contrast Rating Key Observation Points.

	Exposure			Landscape Elements					
Key Observation Point	**Distance**	**Exposure**	**Mitigation**	**Form**	**Line**	**Colour**	**Texture**	**Degree of Contrast**	**Visual Objectives Met?**
Proximity views from the farm road.	380m	Very High	W/Out	W	S	S	S	S	No
			With	W	S	S	S	S	No
Middle distance views from farmstead receptors.	Avg. 8km	Medium to Low	W/Out	N	M	S	M	MS	No
			With	N	M	M	M	M	Yes

** S = Strong, M = Medium, W = Weak, N = None*

For the close proximity views as seen by the receptors using the local farm access road, the wind turbines will appear dominating in the landscape due to the strong line, colour and texture contrast generated by the tower, hub and moving blades. The form contrast is likely to be reduced due to the limited cut/ fill areas, but a long and thin vertical form could be created by the tower in near proximity. Some colour and texture contrast would be created by the white flashing Aircraft Warning Lights (AWL) during the day, but strong red colour contrast would be generated by the night-time AWL. With mitigation, the dominating effect of multiple AWL lights taking place repeatedly during the night, can be reduced by placing the lights only on the strategic corners of the total wind farm. For these receptors, the Class III Visual Objective would not be met, without or with mitigation. However, the road is seldom used, and unlikely to see much night-time traffic. While the Visual Objectives would not be met, this is not a Fatal Flaw given the limited usage of the farm road and the remote location.

For the approximately three farmstead receptors located in the Mid-Ground/ Background interface, with distance ranging from 7.8km to 12km, the Class III Visual Objective would be met with mitigation. At the distance and with arid area atmospheric influences restricting clear view over distance, the Form contrast would not be seen, Line and Texture Contrast would be Moderate to Low, but Colour from the AWL would still be Strong without mitigation. With mitigation, the AWL at night can be reduced to Moderate levels.

For the Class III Visual Objectives to be met, the following mitigations would need to be considered:

- Strategic placement of AWL lights at night on corner areas for total project.
- Effective management of dust from moving vehicles along the project access roads.

7.2 Impact Assessment Ratings

An impact assessment rating was undertaken making use of the SiVest Impact Assessment Criteria. The defined impacts are in the table below, with motivation on the following page.

Table 17. Impact Assessment Table

POFADDER WIND ENERGY FACILITY																				
ENVIRONMENTAL PARAMETER	**ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE**	**ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION**									**RECOMMENDED MITIGATION MEASURES**	**ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION**								
		E	**P**	**R**	**L**	**D**	**I / M**	**TOTAL**	**STATUS (+ OR -)**	**S**		**E**	**P**	**R**	**L**	**D**	**I / M**	**TOTAL**	**STATUS (+ OR -)**	**S**
Construction Phase																				
Wind blown dust	Windblown dust and dust from moving vehicles have the potential to become a significant nuisance factor to local farms around the site and along the access road.	1	4	1	2	1	2	18	-	Low	Should excessive dust be generated from the movement of vehicles on the roads such that the dust becomes visible to the immediate surrounds, dust-retardant measures should be implemented under authorisation of the EPC.	1	2	1	1	1	1	6	-	Low
Topsoil loss	Topsoil loss can reduce the viability of rehabilitation measures and needs to be carefully managed if available.	1	2	2	2	3	2	20	-	Low	Topsoil excavated from the site should be stockpiled and utilised for rehabilitation of the site after construction.	1	1	1	1	1	1	5	-	Low

Dust from moving vehicles	Windblown dust and dust from moving vehicles have the potential to become a significant nuisance factor to local farms around the site and along the access road.	2	4	2	2	1	3	33	-	Medium	Should excessive dust be generated from the movement of vehicles on the roads such that the dust becomes visible to the immediate surrounds, dust-retardant measures should be implemented under authorisation of the EPC. Set up a liaison committee to engage with local farmsteads located within 500m of an access road, with monthly communication with the farm owners on the effectiveness of the dust management procedures.	2	2	1	2	1	1	8	-	Low
Buildings, structures and finishings	Buildings painted bright colours can increase the visual presence of the structures in a rural landscape, creating higher levels of visual contrast and attracting the attention of the causal observer.	1	3	1	2	1	2	16	-	Low	The buildings should be painted a grey-brown colour (or other colour in keeping with the surrounding landscape) to assist in reducing colour contrast. Sheet metal structures should make use of mid-grey colour, and preferable have a rough texture material.	1	2	1	1	1	1	6	-	Low
Litter	Litter has the potential to degrade landscape character and can be contained by fencing around the construction camp/ laydown.	1	2	1	2	1	1	7	-	Low	Littering should be a finable offence. Fencing around the laydown should be diamond shaped to catch wind blown litter. The fences should be routinely checked for the collection of litter caught on the fence.	1	1	1	1	1	1	5	-	Low
Fencing	Long fencing lines has the potential to be visually dominating, degarding the rural landscape sense of place.	2	3	2	2	3	2	24	-	Medium	Fencing should be simple and appear transparent from a distance and located around the construction camp, not encircle the total project area.	1	1	1	1	1	1	5	-	Low
Soil erosion	Soil erosion can result in visual scarring on prominent areas.	1	2	2	2	3	2	20	-	Low	In areas where construction has taken place on steeper slopes, soil erosion measures need to be implemented.	1	1	1	1	1	1	5	-	Low
Cut and Fills	Cut and Fill areas can generate visual scarring in the landscape beyond the locality.	2	3	2	2	3	2	24	-	Medium	Cut & Fill areas should be limited as much as possible, with specific detail placed on prevention of soil erosion. Slopes should not exceed 1 in 6m gradients and need to be	1	2	2	2	2	1	9	-	Low

										rehabilitated to natural vegetation directly post construction.									
Security Light Spillage at night (See Appendix G)	Light spillage from security lighting of structures can significantly increase the visual impact of a project in a rural landscape in a dark-sky context.	2	3	1	2	1	2	18	-	Low	Light spillage mitigation from security lighting should be implemented and monitored by the ECO during construction to ensure that light spillage does not create a glowing effect. No overhead/ flood lighting of structures or areas. No up lighting to be used.	1	2	1	1	1	1	6	-	Low
Un-necessary roads	Un-necessary roads have the potential to create a visual disturbance long after the usage as past.	1	3	2	2	2	2	20	-	Low	Limit road access to an efficient minimum by coordinated planning between the project management and the environmental control officer. •Temporary roads should be well marked and should only cross drainage lines on areas identified as permanent road features where erosion and soil loss management can be contained.Noncompliance with road signage and utilisation of no authorised roads should become a finable offence.	1	1	1	1	1	1	5	-	Low
Operational Phase																				
Soil sterilisation by compaction	Compaction of larger areas can result in soil sterilisation and landscape degradation.	1	4	3	2	3	2	26	-	Medium	Laydown areas and other construction areas no longer needed post construction for operational management, should be ripped (0.5m depth) to restore compacted topsoil, and then rehabilitated to natural vegetation under the supervision of the rehabilitation specialist.	1	2	2	2	2	1	9	-	Low
Aircraft Warning Lights at Night	AWL lights at night have the potential to significantly detract from the 'dark-sky' sense of place of the rural landscape.	3	4	2	3	3	4	60	-	High	Strategic placement of AWL at total project corner turbines. Placement of the AWL in shallow cups such that ground flash incidence is limited.	2	3	2	2	3	2	24	-	Medium

Security Light Spillage at night	Light spillage from security lighting of structures can significantly increase the visual impact of a project in a rural landscape in a dark-sky context.	2	3	1	2	1	2	18	-	Low	Light spillage mitigation from security lighting should be implemented and monitored by the ECO during operational phase to ensure that light spillage does not create a glowing effect. No overhead/ flood lighting of structures or areas. No up lighting to be used.	1	2	1	1	1	1	6	-	Low
Old blade dumping	The dumping of old turbine blades on site have the potential to significantly degrade the local landscape character.	1	2	1	2	3	1	9	-	Low	Old turbines and equipment should be removed from site and recycled/ managed according to the National Environmental Management: Waste Act (Act 59 of 2008) (NEMWA) or deposited at a registered landfill if it cannot be recycled or reused.	1	1	1	1	1	1	5	-	Low
Windblown dust and dust from moving vehicles	Windblown dust and dust from moving vehicles have the potential to become a significant nuisance factor to local farms around the site and along the access road.	2	4	2	2	1	3	33	-	Medium	Should excessive dust be generated from the movement of vehicles on the roads such that the dust becomes visible to the immediate surrounds, dust-retardant measures should be implemented under authorisation of the EPC. Set up a liaison committee to engage with local farmsteads located within 500m of an access road, with monthly communication with the farm owners on the effectiveness of the dust management procedures.	2	2	1	2	1	1	8	-	Low
Soil erosion	Soil erosion can result in visual scarring on prominent areas.	1	2	2	2	3	2	20	-	Low	In areas where construction has taken place on steeper slopes, soil erosion measures need to be implemented.	1	1	1	1	1	1	5	-	Low
Shadow Flicker	Shadow Flicker from the turning turbine blades has the potential to be strong annoyance factor.	1	2	2	2	4	1	11	-	Low	• At commencement of operational phase, the occupants of the structures (Structures 7, 11 & 12) would need to be informed of the potential for SF Impacts and provide an explanation of the possible annoyance factor to the occupants. • At a time when SF impacts are likely to occur, a routine survey needs to be undertaken by the EPC to determine if SF impacts are applicable to the relevant dwellings, and to ascertain if the SF effect is an annoyance to the occupants.	1	1	1	1	1	1	5	-	Low

										• If SF impacts occur such that they are an annoyance to the occupants, the following mitigations should be implemented as per the international best practice recommendations: o Planting vegetation or tree lines, which will block the line of sight to the turbines causing flicker (in locations conducive to tree growth). o Installation of window blinds or awnings at the receptors.									
Decommissioning Phase																				
Abandoning of old structures	Old, unused structures have the potential to significantly degrade the landscape character.	1	2	2	3	3	3	33	-	Medium	All structures not required for agricultural purposes post-closure should be removed and where possible, recycled or reused.Building structures should be broken down (including building foundations but excluding turbine foundations).The rubble should be managed according to the National Environmental Management: Waste Act (Act 59 of 2008) (NEMWA) and deposited at a registered landfill if it cannot be recycled or reused.	1	2	2	2	1	1	8	-	Low
Windblown dust and dust from moving vehicles	Windblown dust and dust from moving vehicles have the potential to become a significant nuisance factor to local farms around the site and along the access road.	2	4	2	2	1	3	33	-	Medium	Should excessive dust be generated from the movement of vehicles on the roads such that the dust becomes visible to the immediate surrounds, dust-retardant measures should be implemented under authorisation of the EPC. Set up a liaison committee to engage with local farmsteads located within 500m of a access road, with monthly communication with the farm owners on the effectiveness of the dust management procedures.	2	2	1	2	1	1	8	-	Low

Abandoning of old towers and blades.	Old towers have the potential to significantly degrade the landscape character.	3	4	3	3	4	3	51	-	High	Should turbine towers be constructed from concrete, the towers need to be demolished, the rubble buried in pits and the area shaped to appear as a low, natural dome. The pit areas would need to be rehabilitated to nature veld vegetation within input from a rehabilitation specialist. Steel towers should be removed from site and managed according to the National Environmental Management: Waste Act (Act 59 of 2008) (NEMWA) and deposited at a registered landfill if it cannot be recycled or reused.	1	3	2	2	4	1	12	-	Low
Cumulative																				
Intervisibility of Wind Farms	AWL at night intervisibility of the Pofadder Wind Farm with the proposed Namies Wind Farm located approximately 30km to the west.	3	2	2	2	3	2	24	-	Low	Strategic placement of AWL at total project corner turbines. Placement of the AWL in shallow cups such that ground flash incidence is limited.	2	1	1	2	3	1	9	-	Low

7.3 Impact Assessment Findings

7.3.1 Status

For all the proposed project impacts assessed, the status would be **Negative** as the wind turbines will dominate the landscape and change the landscape character and surrounding sense of place. The area is currently rural and remote, with limited man-made modifications. While Visual Resources are limited, the proposed landscape change is likely to degrade the limited, local visual resources.

7.3.2 Extent

The extent of the impact is defined as the spatial or geographic area of influence of the visual impact. Due to the mainly flat surrounding terrain in relation to the up to 300m height of the turbines, the expected visible extent is likely to be Regional and the Extent of the visual impact is described as **High**.

7.3.3 Duration

The duration of the impact is defined as the predicted lifespan of the visual impact. The size, scale, white colour and motion of the turbines would result in the visual impact enduring the life of the project and is defined as **Long-term**. The visual impact would start with the construction phase and has the potential to last beyond the life of the project should deconstruction and rehabilitation not take place at closure phase. This issue is addressed in the cumulative visual impacts section.

7.3.4 Magnitude

The magnitude of the impact is the size or degree of scale of the impact to landscape resources, as viewed from the surrounding receptors. While the turbines would be large features in the landscape, the area is remote and has few receptors located in the Mid-Ground distance zones. In these arid environment and common view from background distance zones, atmospheric conditions would reduce the intensity of visual intrusion to some degree. No significant tourist activity or significant landscapes were defined within the project ZVI. Receptors are restricted to local isolated farmsteads mainly located to the north, who are either engaging in low intensity sheep / goat farming, with Medium to Low Visual Exposure. The Magnitude is defined as **Medium**.

7.3.5 Probability

Probability of the impact is defined as the degree of possibility of the visual impact occurring. The movement of the turbines and white colour with red aircraft warning lights at night would **definitely** result in a visual impact being perceived by the casual observer and result in a change to the landscape character of the area.

7.3.6 Confidence

Confidence in the impact findings is defined as the degree of certainty in understanding the environmental factors potentially influencing the impact. Confidence in the impact findings is **High.** An onsite field survey and a full Level 4 Visual Impact assessment, which includes photo montages, were undertaken.

7.3.7 Reversibility

Reversibility of the impact is defined as the possibility of reversing the potential visual impact. The wind energy facility is **Reversible** over time, and once removed with effective rehabilitation and restoration implemented, the change in landscape character could be reversed. This would require the towers to be broken down/ removed.

7.3.8 Visual Impact Significance

The visual impact significance for the wind energy facility is defined as **High** without mitigation, as AWL at night has the potential to be a significant visual limitation to the area. With mitigation and strategic placement of AWL, the visual significance would be reduced to **Moderate.** The area is remote and the change in landscape character would not detract from any significant visual resources or view corridors in the area. Mitigation includes the strategic placement of AWL.

7.3.9 Shadow Flicker Impact Significance

It was found that three labourer dwellings that may be occupied, could fall within the outer extent of the SF Impact Area. Impact Assessment of this effect was undertaken, and the expected SF Impact without mitigation was rated **Low**. This was based on the low probability of the SF impact occurring due to the location of the dwellings on the outer edge of the potential SF Impact Area. Mitigation was proposed, where the SF Impact could be reduced to a **Negligible** effect with simple mitigations. This would require an on-site survey to the dwellings once Operation Phase has commenced to determine if the SF effect was applicable and has the potential to incur a nuisance factor to the occupants.

7.3.10 Cumulative Effects

The main issue associated with negative cumulative effects is intervisibility between renewable energy projects, where the combined views create a massing effect that detracts from the rural sense of place of the locality. The three Pofadder Wind Farms will be viewed as a single entity, and will create a localised massing effect, with strong levels of local contrast generated by the 90 turbines. The key issue at hand is the AWL lights at night, where the collective views of the flashing red light on each turbine hub would significantly detract from the existing dark sky of the rural landscape. Without mitigation, the potential for AWL massing effects taking place to the detriment of the rural landscape is rated as High. Mitigation is provided to reduce this collective effect. In terms of other RE projects, there are other WEF project in the region, with Poortjies and Namies WEF located approximately 30km to the west. With the large distance between projects, intervisibility is unlikely to take place but could result in a low intensity flashing glow without mitigation. With mitigation and a reduction in the number of AWLs, this effect would be limited, and cumulative effects are rated Low.

7.4 Environmental Management Planning

7.4.1 Pre-Construction Phase

Impact/ Aspect	**Mitigation/Management Actions**	***Responsibility***	***Methodology***	**Mitigation/Management Objectives and Outcomes**	***Frequency***
Aircraft Warning Lights (AWL) at night have the potential to significantly extend the project Zone of Visual Influence and can be decreased by reduced number of night-time AWLs, as well as placing the AWL in shallow cups that restrict line of sight to ground areas.	• Application should be made to CAA for ground shielded, strategic lighting for the total wind farm using the outer corners points for night-time AWL.	Project management and EPC	On commencement of Pre-construction planning, CAA need to be contacted by the Project Management Team to verify suitability of the AWL mitigation.	High intensity, combined AWL lighting does not create a glow in the regional landscape.	NA
Large signage on roads, or on turbines, has the potential to create a visual nuisance.	• Signage on the road should be moderated in size and use natural colours, while still providing effective directions. • No large signage on the turbines (hubs or towers).	Project management and EPC	NA	Signage is efficient but not dominating for the causal observers.	NA
Demolition of the concrete towers has the potential to significantly extend the tower impact area and degrade local landscape resources if demolition planning is not properly implemented.	• A detailed Environmental Management Plan needs to be generated to define the demolition impact area, specifying how the rubble will be managed and processed, as the expected demolition (fall area) identified, assessed for vegetation impact and suitability of extraction of the rubble to the bury pits. The plan needs to specify the	Project management and EPC with inputs from demolition and rehabilitation specialist.	To be defined	The landscape remains rural and while some small undulations take place, the effect does not detract from the local landscape character. The bury pits should not be on the rocky outcrops.	Two years prior to closure.

	rehabilitation methodology for the impacted area.				
Un-necessary roads have the potential to create a visual disturbance long after the usage as past.	• Limit road access to an efficient minimum by coordinated planning between the project management and the environmental control officer.	Project management and EPC	Clear pre-planning is carried out with clear routing identification, and consequences for off-road driving.	The surrounding landscape remains rural and agricultural in landscape and land use.	As required.
Long fencing lines has the potential to be visually dominating.	• Fencing should be simple and appear transparent from a distance and located around the construction camp and not encircle the total project area	Project management and EPC	Clear planning of the laydown and construction yards is carried out with security fencing demarcated around the core construction areas.	Security fencing is kept to an effective minimum without jeopardizing security of the project.	At onset of project planning.

7.4.2 Construction Phase

Impact/ Aspect	**Mitigation/Management Actions**	***Responsibility***	***Methodology***	**Mitigation/Management Objectives and Outcomes**	***Frequency***
Topsoil loss can reduce the viability of rehabilitation measures and needs to be carefully managed if available.	• Topsoil excavated from the site should be stockpiled and utilised for rehabilitation of the site after construction.	Project management and EPC	As defined by the rehabilitation specialist.	Topsoil is utilized and no sterilization of topsoil takes place.	As required.
Un-necessary roads have the potential to create a visual disturbance long after the usage as past.	• Limit road access to an efficient minimum by coordinated planning between the project management and the environmental control officer.	Project management and EPC	Temporary roads should be well marked and should only cross drainage lines on areas identified as permanent road features where erosion and soil loss management can be contained.	The surrounding landscape remains rural and agricultural in landscape and land use.	As required.

			Noncompliance with road signage and utilisation of no authorised roads should become a finable offence.		
Windblown dust and dust from moving vehicles have the potential to become a significant nuisance factor to local farms around the site and along the access road.	• Set up a clear management plan with clear accountability structures with set thresholds for triggering of mitigations. • Set up a liaison committee to engage with local farmsteads located within 500m of an access road, with monthly communication with the farm owners on the effectiveness of the dust management procedures.	Project management and EPC (as the issue arises).	Should excessive dust be generated from the movement of vehicles on the roads such that the dust becomes visible to the immediate surrounds, dust-retardant measures should be implemented under authorisation of the EPC.	Dust generated on site as well as on the access road to the site, is well managed and does not become a nuisance factor for the workers or the surrounding farmsteads.	On-going
Buildings painted bright colours can increase the visual presence of the structures in a rural landscape, creating higher levels of visual contrast and attracting the attention of the causal observer.	• The buildings should be painted a grey-brown colour (or other colour in keeping with the surrounding landscape) to assist in reducing colour contrast. • Sheet metal structures should make use of mid-grey colour, and preferable have a rough texture material.	Project management and EPC	At the commencement of construction, purchase order criteria for ordering paints and sheet metals need to be clearly defined.	Colour contrast generated from the buildings as seen from the roads is low and does not attract the attention of the casual observer.	Commencement of construction.
Light spillage from security lighting of structures can significantly increase the visual impact of a project in a rural landscape in a dark-sky context.	• Light spillage mitigation from security lighting should be implemented and monitored by the ECO during construction to ensure that light spillage does not create a glowing effect. • No overhead/ flood lighting of structures or areas.	Project management and EPC	At the commencement of construction, purchase order criteria for ordering of security lighting need to be clearly defined.	Lights contrast generated from the buildings as seen from the roads is low and does not attract the attention of the casual observer.	Commencement of construction.

	• No up lighting to be used.				
Litter has the potential to degrade landscape character and can be contained by fencing around the construction camp/ laydown.	• Littering should be a finable offence. • Fencing around the laydown should be diamond shaped to catch wind blown litter. The fences should be routinely checked for the collection of litter caught on the fence.	Project management and EPC	Littering rules need to be clearly defined and workers effectively informed of the consequences of littering.	Solid waste litter is effectively controlled and does not become a landscape degradation risk.	Checked bi-monthly
Soil erosion can result in visual scarring on prominent areas.	• In areas where construction has taken place on steeper slopes, soil erosion measures need to be implemented.	Project management and EPC (checked monthly)	Clear methodology for rehabilitation and restoration is provided by the rehabilitation specialist. As soon as construction has concluded on the area at hand, rehabilitation processes need to commence.	Soil erosion is limited and effectively managed such that visual scarring does not take place.	Commencement of construction. On-going
Cut and Fill areas can generate visual scarring in the landscape beyond the locality.	• Cut & Fill areas should be limited as much as possible, with specific detail placed on prevention of soil erosion. • Slopes should not exceed 1 in 6m gradients and need to be rehabilitated to natural vegetation directly post construction.	Project management and EPC with inputs from rehabilitation specialist.	Clear methodology for rehabilitation and restoration is provided by the rehabilitation specialist. As soon as construction has concluded on the area at hand, rehabilitation processes need to commence.	Cut/ fill scaring is limited and effectively managed and does not dominate the attention of the casual observer.	Commencement of construction. On-going

7.4.3 Operational Phase

Impact/ Aspect	**Mitigation/Management Actions**	***Responsibility***	***Methodology***	**Mitigation/Management Objectives and Outcomes**	***Frequency***

Compaction of larger areas can result in soil sterilisation and landscape degradation.	• Post construction, the laydown areas and other construction areas no longer needed for operational management, should be ripped (0.5m depth) to restore compacted topsoil, and then rehabilitated to natural vegetation under the supervision of the rehabilitation specialist.	Project management and EPC with inputs from rehabilitation specialist.	As defined by the rehabilitation specialist.	Soil sterilization does not take place and large degraded areas do not occur, with overall landscape integrity maintained.	On completion of construction phase. On-going
AWL lights at night have the potential to significantly detract from the 'dark-sky' sense of place of the rural landscape.	• Strategic placement of AWL at total project corner turbines. • Placement of the AWL in shallow cups such that ground flash incidence is limited.	Project management	As specified by the CAA.	AWL do not become dominating such that a clearly defined glow from multiple AWL at night is clearly visible at a regional level.	Project management team.
Soil erosion can result in visual scarring on prominent areas.	• In areas where construction has taken place on steeper slopes, soil erosion measures need to be implemented.	Project management and EPC	Clear methodology for rehabilitation and restoration is provided by the rehabilitation specialist. As soon as construction has concluded on the area at hand, rehabilitation processes need to commence.	Soil erosion is limited and effectively managed such that visual scarring does not take place.	Bi-annual
Light spillage from security lighting of structures can significantly increase the visual impact of a project in a rural landscape in a dark-sky context.	• Light spillage measures designed during pre-construction phase should be implemented and monitored by the ECO during construction to ensure that light spillage does not create a glowing effect.	Project management and EPC.	A review of the security lights at night is undertaken by the EPC to check that undue light spillage is not taking place without loss of security.	Lights contrast generated from the buildings as seen from the roads is low and does not attract the attention of the casual observer.	At commencement of Operation Phase.

Old turbine blades and equipment have the potential to significantly degrade the local landscape character.	• Old turbines and equipment should be removed from site and recycled/ managed according to the National Environmental Management: Waste Act (Act 59 of 2008) (NEMWA) or deposited at a registered landfill if it cannot be recycled or reused.	Project management and EPC (as the need arises).	Old turbines blades are be removed from site and recycled/ managed according to the National Environmental Management: Waste Act (Act 59 of 2008) (NEMWA) or deposited at a registered landfill if it cannot be recycled or reused.	The project area is not littered with old turbine blades resulting in the management area becoming visually degraded.	On-going
Windblown dust and dust from moving vehicles have the potential to become a significant nuisance factor to local farms around the site and along the access road.	• Should excessive dust be generated from the movement of vehicles on the roads such that the dust becomes visible to the immediate surrounds, dust-retardant measures should be implemented under authorisation of the ECO.	Project management and EPC (as the need arises).	Set up a clear management plan with clear accountability structures with set thresholds for triggering of mitigations.	Dust generated on site as well as on the access road to the site, is well managed and does not become a nuisance factor for the workers or the surrounding farmsteads.	On-going.
Shadow Flicker from the turning turbine blades has the potential to be strong annoyance factors.	• Planting vegetation or tree lines, which will block the line of sight to the turbines causing flicker (in locations conducive to tree growth). • Installation of window blinds or awnings at the receptors.	Project management and EPC.	At commencement of operational phase, the occupants of the structures (Structures 7, 11 & 12) would need to be informed of the potential for SF Impacts and provide an explanation of the possible annoyance factor to the occupants. At a time when SF impacts are likely to occur, a routine survey needs to be undertaken by the EPC to determine if SF impacts are applicable to the relevant dwellings, and to ascertain if	Any potential SF impact to the defined occupants is reduced such that it meets international best practice guidelines, including a theoretical residential exposure limit of less than 30 hours per year, 30 minutes per day for the astronomical maximum possible shadow worst-case and that actual or measured shadow flicker duration should not exceed 10 hours per year.	At commencement of Operational Phase.

			the SF effect is an annoyance to the occupants.		

7.4.4 Decommissioning Phase

Impact/ Aspect	Mitigation/Management Actions	*Responsibility*	*Methodology*	Mitigation/Management Objectives and Outcomes	*Frequency*
Compaction of larger areas can result in soil sterilisation and landscape degradation.	• Post construction, the laydown areas and other construction areas no longer needed for operational management, should be ripped (0.5m depth) to restore compacted topsoil, and then rehabilitated to natural vegetation under the supervision of the rehabilitation specialist.	Project management and EPC with inputs from rehabilitation specialist.	As defined by the rehabilitation specialist.	Soil sterilization does not take place and large degraded areas do not occur, with overall landscape integrity maintained.	Within 1 year of closure.
Old, unused structures have the potential to significantly degrade the landscape character.	• All structures not required for agricultural purposes post-closure should be removed and where possible, recycled or reused. • Building structures should be broken down (including building foundations but excluding turbine foundations). • The rubble should be managed according to the National Environmental Management: Waste Act (Act 59 of 2008) (NEMWA) and deposited at a	Project management and EPC	As defined by the rehabilitation specialist.	The post operation landscape reverts to rural agricultural without landscape degradation created by un-used/ old structures.	Within 1 year of closure.

	registered landfill if it cannot be recycled or reused.				
Old towers have the potential to significantly degrade the landscape character.	• Should turbine towers be constructed from concrete, the towers need to be demolished, the rubble buried in pits and the area shaped to appear as a natural dome. The pit areas would need to be rehabilitated to natural veld vegetation with input from a rehabilitation specialist. • Steel towers should be removed from site and managed according to the National Environmental Management: Waste Act (Act 59 of 2008) (NEMWA) and deposited at a registered landfill if it cannot be recycled or reused.	Project management and EPC (within 1 year of closure).	As defined by the rehabilitation and demolition specialist.	The post operation landscape reverts to rural agricultural without landscape degradation created by un-used/ old structures.	Within 2 years of closure.
Old turbine blades and equipment have the potential to significantly degrade the local landscape character.	• Old turbines and equipment should be removed from site and recycled/ managed according to the National Environmental Management: Waste Act (Act 59 of 2008) (NEMWA) or deposited at a registered landfill if it cannot be recycled or reused.	Project management and EPC (as the need arises).	Old turbines blades are be removed from site and recycled/ managed according to the National Environmental Management: Waste Act (Act 59 of 2008) (NEMWA) or deposited at a registered landfill if it cannot be recycled or reused.	The project area is not littered with old turbine blades resulting in the management area becoming visually degraded.	Within 1 years of closure.
Windblown dust and dust from moving vehicles have the potential to become a significant nuisance factor to	• Set up a clear management plan with clear accountability structures with set thresholds for triggering of mitigations.	Project management and EPC (as the issue arises).	Should excessive dust be generated from the movement of vehicles on the roads such that the dust	Dust generated on site as well as on the access road to the site, is well managed and does not	On-going

local farms around the site and along the access road.	• Set up a liaison committee to engage with local farmsteads located within 500m of an access road, with monthly communication with the farm owners on the effectiveness of the dust management procedures.		becomes visible to the immediate surrounds, dust-retardant measures should be implemented under authorisation of the EPC.	become a nuisance factor for the workers or the surrounding farmsteads.	

8 CONCLUSION

Visual Resource Management Africa CC (VRMA) was appointed by Pofadder Wind Facility 1 (Pty) Ltd (AEP) to undertake a Visual Impact Assessment for the proposed Pofadder Wind Energy Facility 1 VIA.The proposed development site is located in the Northern Cape Province, within the Kai !Garib Local Municipality and the Z F Mgcawu District Municipality in the Northern Cape Province.

A full Level 4 Visual Impact Assessment was undertaken for the proposed Pofadder Wind Energy Facility 1. The finding of the assessment is that the project should be authorised WITH MITIGATION for the following reasons:

- The area is remote, and only four farmstead receptors were located within the project ZVI, with Medium to Low Exposure (approximately 8km).
- No significant landscape resources were identified within the ZVI, and no tourist related activities are making use of the visual resources of the surrounding landscapes.
- As such, Landscape and Visual Impacts can be moderated with mitigation, specifically with regards to the management of night-time AWL.
- The nearest other proposed renewable energy project is Namies Suid and Poortjies WEF (authorised, unbuilt), with location approximately 30km east where intervisibility is highly unlikely and cumulative effects rated Low (with mitigation).
- While the proposed collective views of the combined 90 turbines will be a dominating landscape feature, the effect is limited to the local landscape context. With the arid environment, the atmospheric influences reduce clear visibility during the day to the Mid-ground distance region.
- Shadow Flicker impacts are unlikely to occur, and if they did, they would be low intensity and suitably addressed with mitigation.

Mitigations have been provided and should be implemented as part of authorisation, with special attention to the management of AWL. Clear methodology should also be provided on the demolishing of the concrete towers and associated rehabilitation, should concrete towers be utilised. On condition the above mitigation measures are implemented, the proposed development is acceptable from a visual and landscape perspective and there is no objection to its authorisation.

9 REFERENCES

Atlantic Renewable Energy Partners. (2022).

Bureau of Land Management, U. (2005). *Final Programmatic Environmental Impact Statement on Wind Energy Development.* USA Department of the Interior.

Danish Wind Industry Association. (2010). *http://xn--drmstrre-64ad.dk/wp-content/wind/miller/windpower%20web/en/tour/env/shadow/index.htm* .

Environmental Design & Research. (2017). New York: D.P.C.

EPHC, A. (2010). *National Wind Farm Development Guidelines.* Adelaide: Environment Protection and Heritage Council, Australia.

Erik Koppen, M. G. (2017). *According to the International Legislation and Regulations for Wind Turbine Shadow Flicker Impact.* Rotterdam .

https://earthdata.nasa.gov/. (n.d.).

Hull, R. B., & Bishop, I. E. (1988). *Scenic Impacts of Electricity Power Mine: The Influence of Landscape Type and Observer Distance. Journal of Environmental Management.(27) Pg 99-108.*

IEMA. (2002). *U.K Institute of Environmental Management and Assessment (IEMA). 'Guidelines for Landscape and Visual Impact Assessment' Second Edition, Spon Press. Pg 44.*

IFC. (2007). *Environmental Health and Safety Guidelines for Electric Power Transmission and Distribution.*

IFC. (2012). *International Finance Corporation (IFC) prescribes eight performance standards (PS) on environmental and social sustainability. Millennium Ecosystem Assessment. 2005.*

Immissionsschult, L. f. (2002). *Hinweise our Ermittlung und Beurteilung der optischen immissionen von Windenergieanlagen .* WEA-Schattenwurf-Hinweise.

Kai !Garib Local Municipality. (n.d.).

KhâI-Ma Municipality. (n.d.). *KhâI-Ma-Revised-IDP-2020-21-Simplified-Final.*

Lighting Research Center. (2008). *Mesopic Street Lighting Demonstration and Evaluation Report .* New York.

Millennium Ecosystem Assessment. (2005). *Ecosystems and Human Well-Being: Synthesis.* Washington D.C: Island Press.

Namakwa District Municipality. (n.d.). *Namakwa DM-Council-Approved-IDP-2021-2022.* Namakwa District Municipality.

NASA, A. G. (2009). *Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) Global Digital Elevation Model Version 2 (GDEM V2 2011). Ministry of Economy, Trade, and Industry (METI) of Japan and United States National Aeronauti.*

NatureScot. (2017). *Siting and designing wind farms in the landscape Version 3a.*

NELPAG. (n.d.). *New England Light Pollution Advisory Group (NELPAG) http://cfa/ www.harvard .edu /cfa/ps/nelpag.html) and Sky & Telescope http://SkyandTelescope.com/). NELPAG and Sky & Telescope support the International Dark-Sky Association (IDA) (http://www.darksky.o.*

Oberholzer, B. (2005). *Guideline for involving visual and aesthetic specialists in EIA processes: Edition 1. CSIR Report No ENV-S-C 2005 053 F. Republic of South Africa, Provincial Government of the Western Cape, Department of Environmental Affairs and Deve.*

Oberholzer, B., & Lawson, Q. (2018). *Proposed Highlands Wind Energy Facilities.*

Parsons Brinkerhoff. (2011). *Update of U.K. Shadow Flicker Evidence Base.* London: United Kingdom Department of Energy and Climate Change.

Plantzafrica. (n.d.). Retrieved from http://plantzafrica.com/frames/vegfram.htm

pmrpressrelease.com. (n.d.). *https://pmrpressrelease.com/*. Retrieved from https://pmrpressrelease.com/wind-turbine-lighting-market-global-industry-analysis-size-share-growth-trends/

Sheppard, D. S. (2000). *Guidance for crystal ball gazers: Developing a code of ethics for landscape visualization.* Department of Forest Resources Management and Landscape Architecture Program, University of British Columbia, Vancouver, Canada .

South African National Biodiversity Institute. (2012). *Vegetation Map of South Africa, Lesotho and Swaziland.*

The Landscape Institute. (2003). *Guidelines for Landscape and Visual Impact Assessment* (Second ed.). Spon Press.

USDI., B. (2004). *Bureau of Land Management, U.S. Department of Interior. 2004. Visual Resource Management Manual 8400.*

Western Australia Planning Commission. (2004). *Western Australia Guidelines for Wind Farm Development.* Commonwealth of Australia.

World Bank Group. (2015). *Environmental Health and Safety Guidelines for Wind Energy.*

World Bank Group. (2015). *Environmental, Health and Safety Guidelines Wind Energy.* World Bank Group.

10 APPENDIX A: SITE SENSITIVITY VERIFICATION

(IN TERMS OF PART A OF THE ASSESSMENT PROTOCOLS PUBLISHED IN GN 320 ON 20 MARCH 2020

In terms of the Assessment Protocols published in GN 320 on 20 March 2020, a Site sensitivity verification is required where a specialist assessment is required to verify, with motivation, the relevant themes contained within the DEFF Screening Tool.

10.1 Introduction

In accordance with Appendix 6 of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations of 2014, a site sensitivity verification has been undertaken in order to confirm the current land use and environmental sensitivity of the proposed project area as identified by the National Web-Based Environmental Screening Tool (Screening Tool). The mapping from the screening is provided for Shadow Flicker in Figure 25, and Landscape in Figure 26 below.

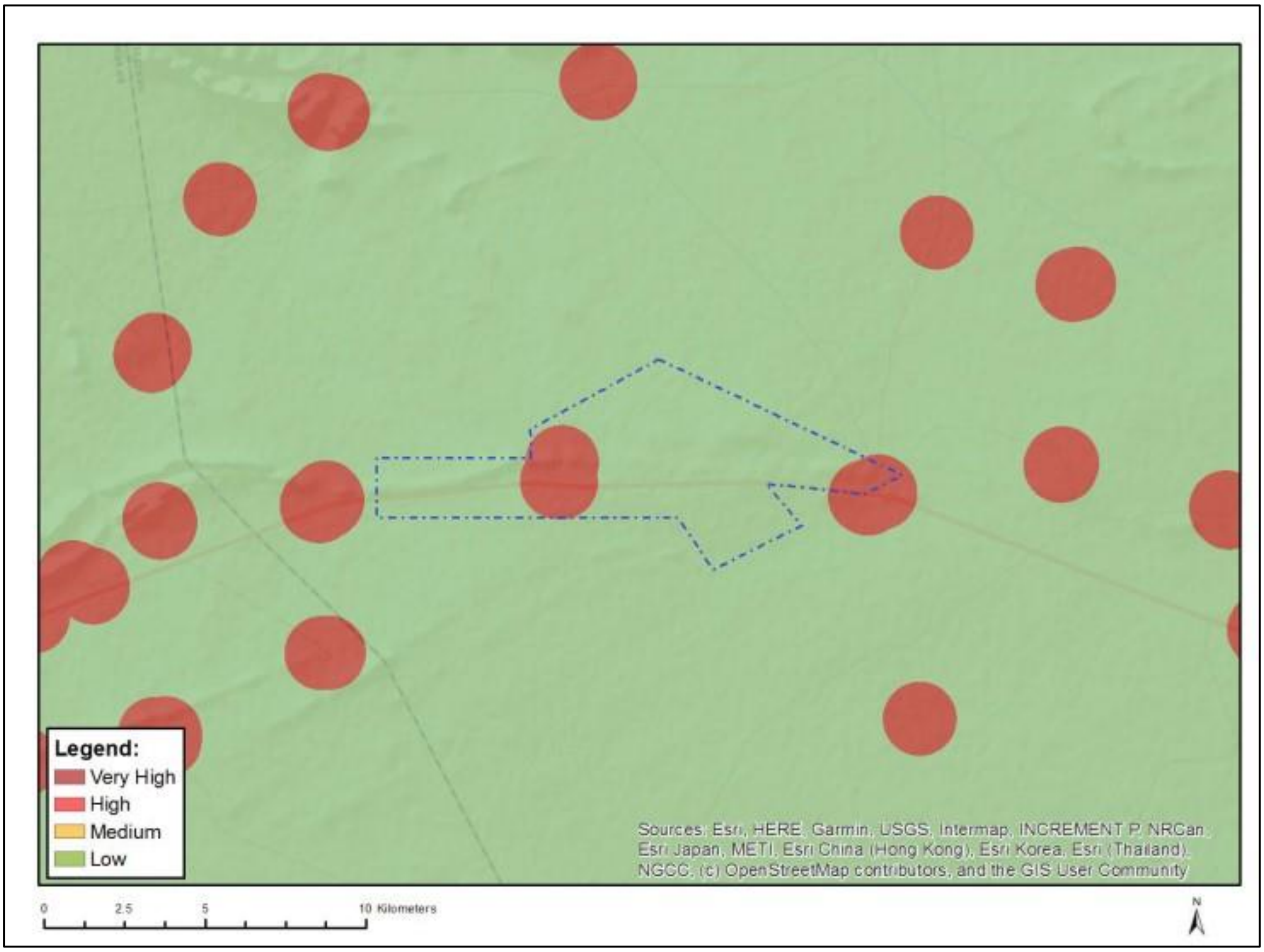
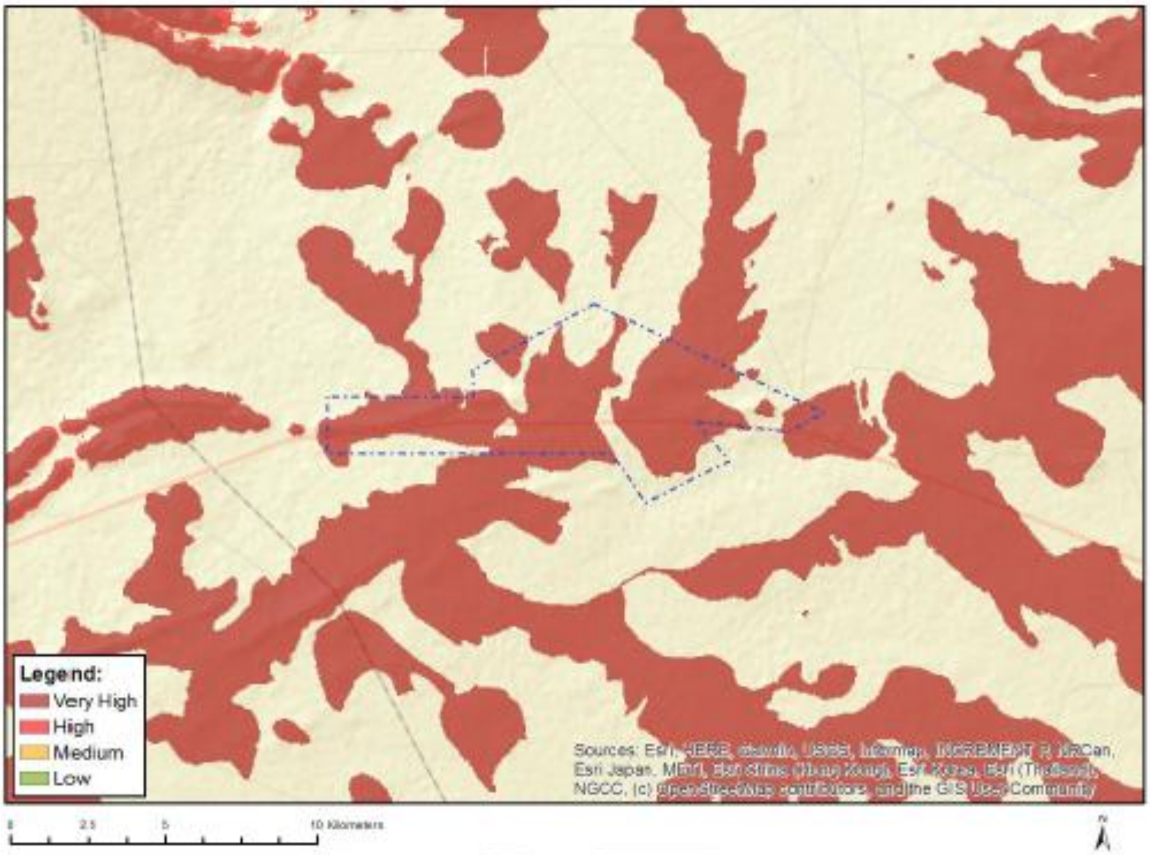


Figure 25. DEA Screening Tool map of relative shadow flicker (wind) theme sensitivity.

MAP OF RELATIVE LANDSCAPE (WIND) THEME SENSITIVITY



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
High	Slope between 1:4 and 1:10
Low	Slope less than 1:10
Very High	Mountain tops and high ridges
Very High	Slope more than 1:4

Figure 26. DEA Screening Tool map of relative landscape (wind) theme sensitivity.

10.2 Landscape Site sensitivity verification

A detailed desktop study was undertaken to determine the nature of the receiving landscape. The desktop study entailed the following:

- Setting up of a GIS platform making use of ArcGIS Pro.

- Using satellite imagery and Open-Source vector data to understand the land uses.
- Using ASTER terrain model data to generate a Digital Elevation Model from which the following was generated.
    - Viewshed analysis.
    - Slopes analysis.
- Using satellite imagery to identify receptors located within the Zone of Visual Influence, analysing the receptors against criteria for their use as Key Observation Points (photomontage viewpoints) from which the suitability of the landscape change would be assessed.
- Mapping of the landscape into Visual Resource Management Classes, taking planning into consideration, to inform the base layer from which the suitability of receiving landscape caring capacity could be evaluated (pending site survey verification).
- Making recommendations to reduce visual intrusion and landscape degradation at Scoping Phase.
- Addressing said landscape and visual issues to ensure that the impacts can be suitably accommodated by the receiving landscape.
- The site survey found that there was a low ridgeline (10m – 15m in height to the north of the access road, and that there were some instances of steeper ground. A slopes analysis was undertaken with recommendation at scoping phase to remove turbine placements from steep slope areas. This was undertaken and incorporated into the impact assessment phase. Sensitivity is thus rated Medium to Low for Landscape Sensitivity.

10.3 Shadow Flicker Site sensitivity verification

In South Africa, there are no specific guidelines as to how to assess shadow flicker generated by wind turbines. However, international guidelines state that the practical extent to which shadow flicker should be assessed is to a distance of 265 times the distance of the blade chord (the widest part of the turbine blade), or approximately 1.1 km.

- A buffer of 1.1km was generated for each of the turbines to determine if any residential structures were located within the potential SF impact area.
- Making use of GIS technology and satellite imagery, confirmed by the site visit, an audit of structures was undertaken to determine if any structures on the property were used for residential purposes.
- If residential structures were identified within the broad brush 1.1km SF buffer, a more detailed analysis of the expected SF impact area was generated making use of 3D model of the turbine using 3D modelling software that allows a location specific representation of the SF impact area. As this is a screening exercise, the probability of the SF impact taking place within the SF impact zone is not assessed (this was also not applicable for this study).

A detailed screening exercise of the expected shadow flicker impact zone was undertaken using 3D modelling and GIS mapping. Two dwellings (Structure 4 & 7) were found to fall marginally within the SF impact areas for Turbines A8 & A9. Of the two, Structure 4 was found to be the property owners dwelling that is occupied on a non-permanent basis. Structure 7 was found to house the farm labourer. As this structure could experience SF effects, impacts were undertaken with mitigation measures defined to reduce the SF effect should it be found to take place at this marginal SF flicker impact locality. As Structure 4 was the property owner, the structure was not included in the SF impact assessment.

For the SF impact area for Turbine A26, two potentially occupied dwellings were in close proximity to the SF impact area (Structures 11 & 12). As this is a screening exercise, the precautionary principle should prevail, and the two structures were included in the impact assessment with mitigations proposed should SF impact occur at this low probability locality. The remaining structures located in close proximity to the A26 SF impact area were either used by the property owner, or ancillary structures for agricultural usage.

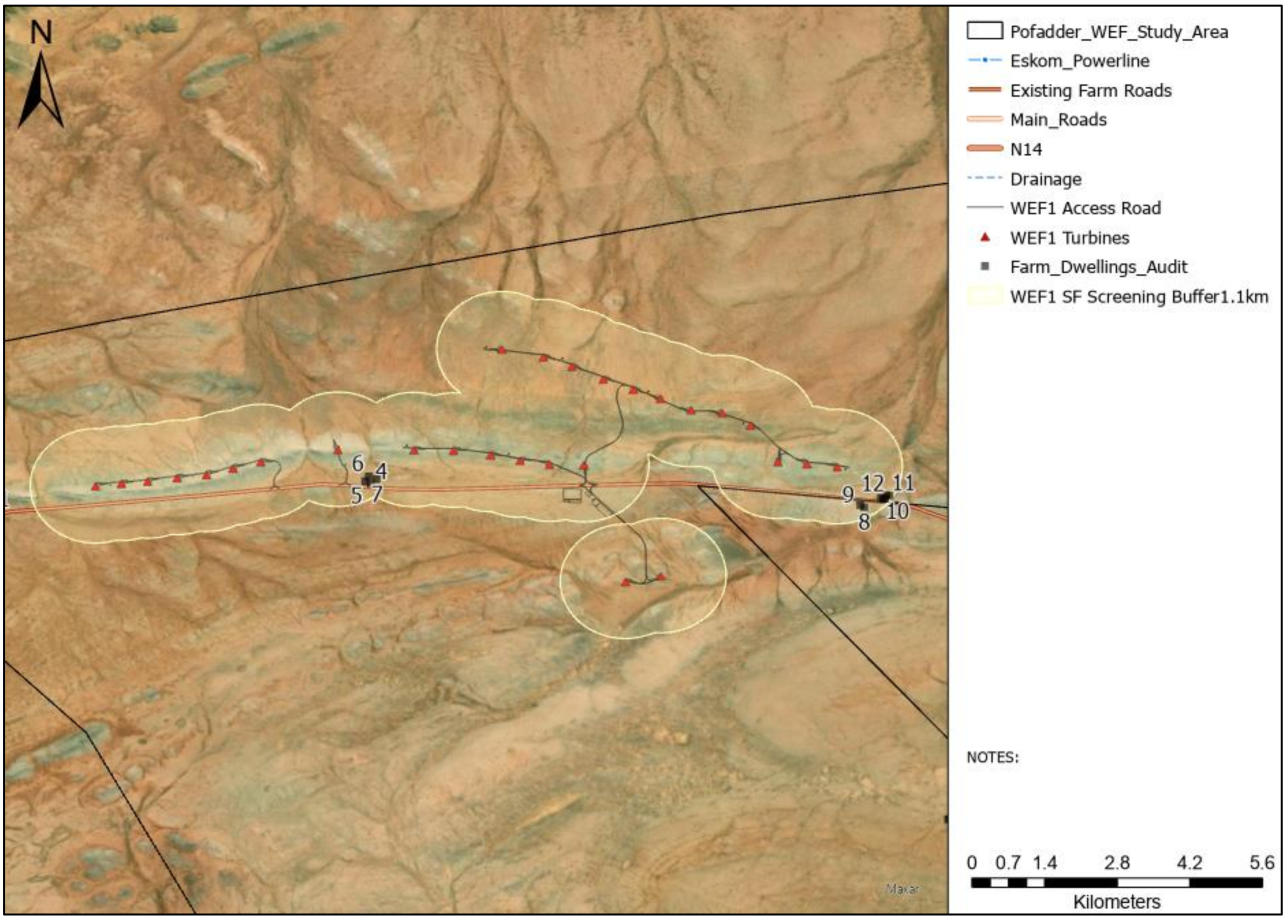


Figure 27. Shadow Flicker screening map.

10.4 National environmental screening tool

As highlighted in the DFFE Shadow Flicker impact table, Very High sensitivity areas are identified where farm settlements are located. The site survey and desktop mapping exercise found four structures located within the vicinity of the project, as indicated in Figure 27 above. As can be seen in the map, nine structures ***were found to be located on the border of the 1.1km*** of buffer turbine. As outlined in Appendix F, nine structures were identified as falling within, or in close proximity to the SF impact area. A detailed structure audit was undertaken to determine how many of these structures were residential in nature, and no structures were found to be permanently inhabited (excluding the property owners). As such, SF impacts were not undertaken, and the impact defined as Null.

As depicted in the Landscape (Wind) Theme impact table, High sensitivity is flagged for slopes between 1:4 and 1:10. The desktop analysis included a slopes analysis confirming the 1 in 10 steep slopes areas but that these areas are suitable for development, and 1 in 4m steep areas have been excluded from the development footprint.

11 APPENDIX B: SITE SURVEY PHOTOGRAPHIC RECORDS

ID	1
NAME	Old farmstead
DIRECTION	Northwest
COMMENTS	Photograph depicting old farmstead now abandoned.

ID	2
NAME	Turbine 2 location
DIRECTION	West
COMMENTS	Photograph of the shallow ridgeline on which the proposed development would be located. The ridgeline is low and no receptors visible so unlikely to generate visual intrusion, but landscape has value and steep slope development should be avoided.

ID	3
NAME	WEF 1 south
DIRECTION	South
COMMENTS	Photo depicting the open and flat plains where turbines 19 to 26 would be placed. No significant visual or landscape risk.

ID	4
NAME	Farmstead 1
DIRECTION	West
COMMENTS	Project property dwelling.

ID	5
NAME	Labourers' cottage
DIRECTION	Northeast
COMMENTS	Farm labourer cottage that could be subject to flicker impact as located within 1km from turbine site.

ID	6
NAME	WEF 2 turbines
DIRECTION	North
COMMENTS	View north towards the shallow highpoint beacon where WEF2 turbines are proposed. No landscape or visual risk.

ID	7
NAME	District road
DIRECTION	East
COMMENTS	Photo depicting the gravel road to Kenhardt that has wide open vistas that add to the Northern Cape sense of place. This locality should be used as a receptor.

ID	8
NAME	Farmstead 2
DIRECTION	Northwest from road
COMMENTS	Farmstead of property owner.

ID	9
NAME	Labourers cottage
DIRECTION	North
COMMENTS	Possibly used labourer dwelling that could be susceptible to shadow flicker impacts.

ID	10
NAME	Kenhardt Road receptor
DIRECTION	West
COMMENTS	View towards southern turbines as seen from the farm road.

ID	11/12
NAME	WEF 3 turbines
DIRECTION	South
COMMENTS	View south towards WEF2 turbines located on open grass covered plain with little landscape visual issues raised.

ID	13
NAME	WEF 2 turbines
DIRECTION	South
COMMENTS	Suitable placement on flat terrain with low landscape significance.

ID	14
NAME	Site steep slopes small poort
DIRECTION	North
COMMENTS	Steep slopes on either side of a river poort not suitable for development on the steep sides.

ID	15
NAME	Steep slopes
DIRECTION	West
COMMENTS	Steep slopes that form a locally aesthetic poort where road access is proposed. Not suitable for development. Relocate to less steep slopes.

ID	16
NAME	Turbine location
DIRECTION	West
COMMENTS	Turbine suitably located on top of low ridgeline.

ID	17
NAME	Laydown
DIRECTION	Northeast
COMMENTS	Laydown extending over steep slopes creating landscape degradation to poort. Relocation of laydown to suitable flat terrain west of turbine required.

ID	18
NAME	Road through small poort
DIRECTION	West
COMMENTS	Road design indicating routing through steep slopes. Cut fill areas need to be shown for impact phase.

ID	19
NAME	Small dam
DIRECTION	West
COMMENTS	Small dam.

ID	20
NAME	Low ridgeline
DIRECTION	Northwest
COMMENTS	Care needs to be made regarding management of erosion from slight cuttings into slightly steeper gradient areas to the north of the slope (pending detail design).

ID	21
NAME	Kenhardt gravel road receptor eastbound
DIRECTION	East
COMMENTS	View from gravel road with low ridgelines centre and slightly undulating grasslands to the right.

ID	22
NAME	Farmstead receptor
DIRECTION	East
COMMENTS	Farmstead located outside of foreground middle ground exposure areas. Not a KOP.

ID	23
NAME	Existing power lines
DIRECTION	South
COMMENTS	Existing 400kv powerline context increases local VAC levels as seen from local gravel road.

ID	24
NAME	Abandoned dwelling
DIRECTION	West
COMMENTS	Not receptors

ID	25
NAME	Gravel Road Transmission line receptor
DIRECTION	Southwest
COMMENTS	View southwest from gravel road of proposed Transmission line crossing aligned with existing Eskom 400kv powerline. Higher VAC levels increase suitability of the proposed routing.

ID	26
NAME	Transmission line receptor
DIRECTION	West
COMMENTS	Photo depicting farmstead receptor located in High exposure area to proposed grid connect. However, the existing power line precedent reduces visual intrusion potential. The ##dweinga are also facing east and not directly facing the proposed grid connection. Pofadder WEF x 3_20220302_134535156.jpg

ID	27
NAME	Eskom 400kv powerline
DIRECTION	West
COMMENTS	Existing powerline corridor line context.

ID	28
NAME	Farmstead distant receptor
DIRECTION	East
COMMENTS	Distance view receptor for displaying long distance views of the proposed wind farm.

ID	29
NAME	Proposed substation
DIRECTION	Southeast
COMMENTS	Substation proposed to be developed adjacent to the 400kv line

ID	30
NAME	Farmstead receptor transmission line
DIRECTION	Southwest
COMMENTS	View of the contained farmstead with limited view south towards the proposed powerline visible in the background.

12 APPENDIX C: SIVEST EIA METHODOLOGY

The following methodology will be utilised in the impact assessment phase.

1 ENVIRONMENTAL IMPACT ASSESSMENT (EIA) METHODOLOGY

The Environmental Impact Assessment (EIA) Methodology assists in evaluating the overall effect of a proposed activity on the environment. Determining of the significance of an environmental impact on an environmental parameter is determined through a systematic analysis.

1.1 Determination of Significance of Impacts

Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale (i.e. site, local, national or global), whereas intensity is defined by the severity of the impact e.g. the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurence. Significance is calculated as shown in **Table 1**.

Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

1.2 Impact Rating System

The impact assessment must take account of the nature, scale and duration of effects on the environment and whether such effects are positive (beneficial) or negative (detrimental). Each issue / impact is also assessed according to the various project stages, as follows:

- Planning;
- Construction;
- Operation; and
- Decommissioning.

Where necessary, the proposal for mitigation or optimisation of an impact should be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance has also been included.

The significance of Cumulative Impacts should also be rated (As per the Excel Spreadsheet Template).

1.2.1 Rating System Used to Classify Impacts

The rating system is applied to the potential impact on the receiving environment and includes an objective evaluation of the possible mitigation of the impact. Impacts have been consolidated into one (1) rating. In assessing the significance of each issue the following criteria (including an allocated point system) is used:

Table 1: Rating of impacts criteria

ENVIRONMENTAL PARAMETER		
A brief description of the environmental aspect likely to be affected by the proposed activity (e.g. Surface Water).		
ISSUE / IMPACT / ENVIRONMENTAL EFFECT / NATURE		
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity (e.g. oil spill in surface water).		
EXTENT (E)		
This is defined as the area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment of a project in terms of further defining the determined.		
1	Site	The impact will only affect the site
2	Local/district	Will affect the local area or district
3	Province/region	Will affect the entire province or region
4	International and National	Will affect the entire country
PROBABILITY (P)		
This describes the chance of occurrence of an impact		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
REVERSIBILITY (R)		
This describes the degree to which an impact on an environmental parameter can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES (L)		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource.	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
DURATION (D)		
This describes the duration of the impacts on the environmental parameter. Duration indicates the lifetime of the impact as a result of the proposed activity.		

1	Short term	The impact and its effects will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (0 – 1 years), or the impact and its effects will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact and its effects will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered transient (indefinite).
INTENSITY / MAGNITUDE (I / M)		
Describes the severity of an impact (i.e. whether the impact has the ability to alter the functionality or quality of a system permanently or temporarily).		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired (system collapse). Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.
SIGNIFICANCE (S)		
Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. This describes the significance of the impact on the environmental parameter. The calculation of the significance of an impact uses the following formula: **Significance = (Extent + probability + reversibility + irreplaceability + duration) x magnitude/intensity.**		

The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.		
Points	**Impact Significance Rating**	**Description**
5 to 23	Negative Low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
5 to 23	Positive Low impact	The anticipated impact will have minor positive effects.
24 to 42	Negative Medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
24 to 42	Positive Medium impact	The anticipated impact will have moderate positive effects.
43 to 61	Negative High impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
43 to 61	Positive High impact	The anticipated impact will have significant positive effects.
62 to 80	Negative Very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
62 to 80	Positive Very high impact	The anticipated impact will have highly significant positive effects.

The table below is to be represented in the Impact Assessment section of the report. The excel spreadsheet template can be used to complete the Impact Assessment.

Operational Phase																				
Fauna	Fauna will be negatively affected by the operation of the wind farm due to the human disturbance, the presence of vehicles on the site and possibly by noise generated by the wind turbines as well.	2	3	2	1	4	3	36	-	Medium	**Outline/explain the mitigation measures to be undertaken to ameliorate the impacts that are likely to arise from the proposed activity. These measures will be detailed in the EMPr.**	2	2	2	1	4	2	22	-	Low
Decommissioning Phase																				
Fauna	Fauna will be negatively affected by the decommissioning of the wind farm due to the human disturbance, the presence and operation of vehicles and heavy machinery on the site and the noise generated.	2	3	2	1	2	3	30	-	Medium	**Outline/explain the mitigation measures to be undertaken to ameliorate the impacts that are likely to arise from the proposed activity. These measures will be detailed in the EMPr.**	2	2	2	1	2	2	18	-	Low

Table 2: Rating of impacts template and example

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Construction Phase																				
Vegetation and protected plant species	Vegetation clearing for access roads, turbines and their service areas and other infrastructure will impact on vegetation and protected plant species.	2	4	2	2	3	3	39	-	Medium	**Outline/explain the mitigation measures to be undertaken to ameliorate the impacts that are likely to arise from the proposed activity. These measures will be detailed in the EMPr.**	2	4	2	1	3	2	24	-	Low
Cumulative																				
Broad-scale ecological processes	Transformation and presence of the facility will contribute to cumulative habitat loss and impacts on broad-scale ecological processes such as fragmentation.	2	4	2	2	3	2	26	-	Medium	**Outline/explain the mitigation measures to be undertaken to ameliorate the impacts that are likely to arise from the proposed activity. These measures will be detailed in the EMPr.**	2	3	2	1	3	2	22	-	Low

13 APPENDIX D: SPECIALIST INFORMATION

13.1 Professional Registration Certificate

APHP

Association of Professional Heritage Practitioners

MEMBERSHIP CERTIFICATE

THIS CERTIFIES THAT

Stephen Stead

MEMBERSHIP NUMBER: 0063

has been awarded membership as a

PROFESSIONAL HERITAGE PRACTITIONER (PHP)

This membership is subject to the *Standards for Membership* and *Code of Conduct*, referred to in Sections 2 and 3 of the APHP Constitution respectively. The definition of a PHP may be found at: www.aphp.org.za/membership

Please contact us via info@aphp.org.za should further information be required.

THIS CERTIFICATE IS VALID FROM 1 JUNE 2022 – 1 JULY 2023

CHAIRPERSON

[Issued by the Association of Professional Heritage Practitioners Executive Committee]
Image Source: Photographer G McLachlan at central Kouga Mountains

Association of Professional Heritage Practitioners
info@aphp.org.za
www.aphp.org.za

13.2 Curriculum Vitae (CV)

1. **Position**: Owner / Director

2. **Name of Firm**: Visual Resource Management Africa cc *(www.vrma.co.za)*

3. **Name of Staff**: Stephen Stead

4. **Date of Birth**: 9 June 1967

5. **Nationality:** South African

6. **Contact Details:** **Tel: +27 (0) 44 876 0020**
   Cell: +27 (0) 83 560 9911
   Email: steve@vrma.co.za

7. **Educational qualifications**:
   - University of Natal (Pietermaritzburg):
   - Bachelor of Arts: Psychology and Geography
   - Bachelor of Arts (Hons): Human Geography and Geographic Information Management Systems

8. **Professional Accreditation**
   - Association of Professional Heritage Practitioners (APHP) Western Cape
     - Accredited VIA practitioner member of the Association (2011)

9. **Association involvement:**
   - International Association of Impact Assessment (IAIA) South African Affiliate
     - Past President (2012 - 2013)
     - President (2012)
     - President-Elect (2011)
     - Conference Co-ordinator (2010)
     - National Executive Committee member (2009)
     - Southern Cape Chairperson (2008)

10. **Conferences Attended:**
    - IAIAsa 2012
    - IAIAsa 2011
    - IAIA International 2011 (Mexico)
    - IAIAsa 2010
    - IAIAsa 2009
    - IAIAsa 2007

11. **Continued Professional Development:**
    - Integrating Sustainability with Environment Assessment in South Africa (IAIAsa Conference, 1 day)
    - Achieving the full potential of SIA (Mexico, IAIA Conference, 2 days 2011)
    - Researching and Assessing Heritage Resources Course (University of Cape Town, 5 days, 2009)

12. **Countries of Work Experience**:
    - South Africa, Mozambique, Malawi, Lesotho, Kenya and Namibia

13. **Relevant Experience:**

Stephen gained six years of experience in the field of Geographic Information Systems mapping and spatial analysis working as a consultant for the KwaZulu-Natal Department of Health and then with an Environmental Impact Assessment company based in the Western Cape. In 2004 he set up the company Visual Resource Management Africa that specializes in visual resource management and visual impact assessments in Africa. The company makes use of the well-documented Visual Resource Management methodology developed by the Bureau of Land Management (USA) for assessing the suitability of landscape modifications. Stephen has assessed of over 150 major landscape modifications throughout southern and eastern Africa. The business has been operating for 18 years and has successfully established and retained a large client base throughout Southern Africa which includes, amongst others, Rio Tinto (Pty) Ltd, Bannerman (Pty) Ltd, Anglo Coal (Pty) Ltd, Eskom (Pty) Ltd, NamPower and Vale (Pty) Ltd, Ariva (Pty) Ltd, Harmony Gold (Pty) Ltd, Millennium Challenge Account (USA), Pretoria Portland Cement (Pty) Ltd

14. Languages:

- English – First Language.
- Afrikaans – fair in speaking, reading, and writing.

15. Projects:

A list of ***some*** of the large-scale projects that VRMA has assessed has been attached below with the client list indicated per project (Refer to www.vrma.co.za for a full list of projects undertaken).

Table 18: VRM Africa Projects Assessments Table.

YEAR	NAME	DESCRIPTION	LOCATION
2022	Sea Vista St Francis Bay	Resort	Eastern Cape (SA)
2022	Hoekplaas Wind	Wind Energy	Western Cape (SA)
2022	Houthaalboomen PV	Solar Energy	North West (SA)
2022	Pofadder Wind	Wind Energy	Northern Cape (SA)
2022	Lunsklip Wind Amend	Wind Energy	Western Cape (SA)
2022	Lunsklip Wind Grid Connect	Power line	Western Cape (SA)
2022	Elandsfontein PV	Solar Energy	North West (SA)
2022	Erf 1713 1717 UISP	Settlement	Western Cape (SA)
2022	Roan PV x 2	Solar Energy	North West (SA)
2021	Unilever PV	Solar Energy	Gauteng (SA)
2021	Newlyn Terminal	Structure	Eastern Cape (SA)
2021	Roggeveld CTM	Structure	Western Cape (SA)
2021	Avondale Gordonia 132kV	Power Line	Northern Cape (SA)
2021	Bulskop PV x 6	Solar Energy	Western Cape (SA)
2021	Bestwood PV x 5	Solar Energy	Northern Cape (SA)
2021	Kokerboom 4	Wind Energy	Northern Cape (SA)
2020	Dysanklip & Re Capital 3C BESS	Battery Storage	Northern Cape (SA)
2020	Hotazel PV 2	Solar Energy	Northern Cape (SA)
2020	Hotazel PV Amend	Solar Energy	Northern Cape (SA)
2020	Penhill Water Reservoir	Infrastructure	Western Cape (SA)
2020	Kenhardt BESS x 6	Battery Storage	Northern Cape (SA)

2020	Humansdorp BESS	Battery Storage	Northern Cape (SA)
2020	Bloemsmond PV BESS x 5	Battery Storage	Northern Cape (SA)
2020	Mulilo Prieska BESS x 5	Battery Storage	Northern Cape (SA)
2020	Mulilo De Arr BESS x 3	Battery Storage	Northern Cape (SA)
2020	Sandpiper Estate	Residential	Western Cape (SA)
2020	Obetsebi Lampley Interchange	Infrastructure	Ghana
2019	Port Barry Residential	Settlement	Western Cape (SA)
2019	Gamsberg Smelter	Plant	Northern Cape (SA)
2019	Sandpiper Nature Reserve Lodge	Residential	Western Cape (SA)
2019	Bloemsmond PV 4 - 5	Solar Energy	Northern Cape (SA)
2019	Mphepo Wind (Scoping Phase)	Wind Energy	Zambia
2018	Mogara PV	Solar Energy	Northern Cape (SA)
2018	Gaetsewe PV	Solar Energy	Northern Cape (SA)
2017	Kalungwishi Hydroelectric (2) and power line	Hydroelectric	Zambia
2017	Mossel Bay UISP (Kwanoqaba)	Settlement	Western Cape (SA)
2017	Pavua Dam and HEP	Hydroelectric	Mozambique (SA)
2017	Penhill UISP Settlement (Cape Town)	Settlement	Western Cape (SA)
2016	Kokerboom WEF * 3	Wind Energy	Northern Cape (SA)
2016	Hotazel PV	Solar Energy	Northern Cape (SA)
2016	Eskom Sekgame Bulkop Power Line	Infrastructure	Northern Cape (SA)
2016	Ngonye Hydroelectric	Hydroelectric	Zambia
2016	Levensdal Infill	Settlement	Western Cape (SA)
2016	Arandis CSP	Solar Energy	Namibia
2016	Bonnievale PV	Solar Energy	Western Cape (SA)
2015	Noblesfontein 2 & 3 WEF (Scoping)	Wind Energy	Eastern Cape (SA)
2015	Ephraim Sun SEF	Solar Energy	Northern Cape (SA)
2015	Dyasonsklip and Sirius Grid TX	Solar Energy	Northern Cape (SA)
2015	Dyasonsklip PV	Solar Energy	Northern Cape (SA)
2015	Zeerust PV and transmission line	Solar Energy	North West (SA)
2015	Bloemsmond SEF	Solar Energy	Northern Cape (SA)
2015	Juwi Copperton PV	Solar Energy	Northern Cape (SA)
2015	Humansrus Capital 14 PV	Solar Energy	Northern Cape (SA)
2015	Humansrus Capital 13 PV	Solar Energy	Northern Cape (SA)
2015	Spitzkop East WEF (Scoping)	Solar Energy	Western Cape (SA)
2015	Lofdal Rare Earth Mine and Infrastructure	Mining	Namibia
2015	AEP Kathu PV	Solar Energy	Northern Cape (SA)
2014	AEP Mogobe SEF	Solar Energy	Northern Cape (SA)
2014	Bonnievale SEF	Solar Energy	Western Cape (SA)
2014	AEP Legoko SEF	Solar Energy	Northern Cape (SA)

2014	Postmasburg PV	Solar Energy	Northern Cape (SA)
2014	Joram Solar	Solar Energy	Northern Cape (SA)
2014	RERE PV Postmasberg	Solar Energy	Northern Cape (SA)
2014	RERE CPV Upington	Solar Energy	Northern Cape (SA)
2014	Rio Tinto RUL Desalinisation Plant	Industrial	Namibia
2014	NamPower PV * 3	Solar Energy	Namibia
2014	Pemba Oil and Gas Port Expansion	Industrial	Mozambique
2014	Brightsource CSP Upington	Solar Energy	Northern Cape (SA)
2014	Witsand WEF (Scoping)	Wind Energy	Western Cape (SA)
2014	Kangnas WEF	Wind Energy	Western Cape (SA)
2013	Cape Winelands DM Regional Landfill	Industrial	Western Cape (SA)
2013	Drennan PV Solar Park	Solar Energy	Eastern Cape (SA)
2013	Eastern Cape Mari-culture	Mari-culture	Eastern Cape (SA)
2013	Eskom Pantom Pass Substation	Substation /Tx lines	Western Cape (SA)
2013	Frankfort Paper Mill	Plant	Free State (SA)
2013	Gibson Bay PV Facility Transmission lines	Transmission lines	Eastern Cape (SA)
2013	Houhoek Eskom Substation	Substation /Tx lines	Western Cape (SA)
2013	Mulilo PV Solar Energy Sites (x4)	Solar Energy	Northern Cape (SA)
2013	Namies Wind Farm	Wind Energy	Northern Cape (SA)
2013	Rossing Z20 Pit and WRD	Mining	Namibia
2013	SAPPI Boiler Upgrade	Plant	Mpumalanga (SA)
2013	Tumela WRD	Mine	North West (SA)
2013	Weskusfleur Substation (Koeburg)	Substation /Tx lines	Western Cape (SA)
2013	Yzermyn coal mine	Mining	Mpumalanga (SA)
2012	Afrisam	Mining	Western Cape (SA)
2012	Bitterfontein	Solar Energy	Northern Cape (SA)
2012	Kangnas PV	Solar Energy	Northern Cape (SA)
2012	Kangnas Wind	Solar Energy	Northern Cape (SA)
2012	Kathu CSP Tower	Solar Energy	Northern Cape (SA)
2012	Kobong Hydro	Hydro & Powerline	Lesotho
2012	Letseng Diamond Mine Upgrade	Mining	Lesotho
2012	Lunsklip Windfarm	Wind Energy	Western Cape (SA)
2012	Mozambique Gas Engine Power Plant	Plant	Mozambique
2012	Ncondezi Thermal Power Station	Substation /Tx lines	Mozambique
2012	Sasol CSP Tower	Solar Power	Free State (SA)
2012	Sasol Upington CSP Tower	Solar Power	Northern Cape (SA)
2011	Beaufort West PV Solar Power Station	Solar Energy	Western Cape (SA)
2011	Beaufort West Wind Farm	Wind Energy	Western Cape (SA)
2011	De Bakke Cell Phone Mast	Structure	Western Cape (SA)

2011	ERF 7288 PV	Solar Energy	Western Cape (SA)
2011	Gecko Industrial park	Industrial	Namibia
2011	Green View Estates	Residential	Western Cape (SA)
2011	Hoodia Solar	Solar Energy	Western Cape (SA)
2011	Kalahari Solar Power Project	Solar Energy	Northern Cape (SA)
2011	Khanyisa Power Station	Power Station	Western Cape (SA)
2011	Olvyn Kolk PV	Solar Energy	Northern Cape (SA)
2011	Otjikoto Gold Mine	Mining	Namibia
2011	PPC Rheebieck West Upgrade	Industrial	Western Cape (SA)
2011	George Southern Arterial	Road	Western Cape (SA)
2010	Bannerman Etango Uranium Mine	Mining	Namibia
2010	Bantamsklip Transmission	Transmission	Eastern Cape (SA)
2010	Beaufort West Urban Edge	Mapping	Western Cape (SA)
2010	Bon Accord Nickel Mine	Mining	Mpumalanga (SA)
2010	Etosha National Park Infrastructure	Housing	Namibia
2010	Herolds Bay N2 Development Baseline	Residential	Western Cape (SA)
2010	MET Housing Etosha	Residential	Namibia
2010	MET Housing Etosha Amended MCDM	Residential	Namibia
2010	MTN Lattice Hub Tower	Structure	Western Cape (SA)
2010	N2 Herolds Bay Residential	Residential	Western Cape (SA)
2010	Onifin(Pty) Ltd Hartenbos Quarry Extension	Mining	Western Cape (SA)
2010	Still Bay East	GIS Mapping	Western Cape (SA)
2010	Vale Moatize Coal Mine and Railway	Mining / Rail	Mozambique
2010	Vodacom Mast	Structure	Western Cape (SA)
2010	Wadrif Dam	Dam	Western Cape (SA)
2009	Asazani Zinyoka UISP Housing	Residential Infill	Western Cape (SA)
2009	Eden Telecommunication Tower	Structure	Western Cape (SA)
2009	George SDF Landscape Characterisation	GIS Mapping	Western Cape (SA)
2009	George SDF Visual Resource Management	GIS Mapping	Western Cape (SA)
2009	George Western Bypass	Road	Western Cape (SA)
2009	Knysna Affordable Housing Heidevallei	Residential Infill	Western Cape (SA)
2009	Knysna Affordable Housing Hornlee Project	Residential Infill	Western Cape (SA)
2009	Rossing Uranium Mine Phase 2	Mining	Namibia
2009	Sun Ray Wind Farm	Wind Energy	Western Cape (SA)
2008	Bantamsklip Transmission Lines Scoping	Transmission	Western Cape (SA)
2008	Erf 251 Damage Assessment	Residential	Western Cape (SA)
2008	Erongo Uranium Rush SEA	GIS Mapping	Namibia
2008	Evander South Gold Mine Preliminary VIA	Mining	Mpumalanga (SA)
2008	George SDF Open Spaces System	GIS Mapping	Western Cape (SA)

2008	Hartenbos River Park	Residential	Western Cape (SA)
2008	Kaaimans Project	Residential	Western Cape (SA)
2008	Lagoon Garden Estate	Residential	Western Cape (SA)
2008	Moquini Beach Hotel	Resort	Western Cape (SA)
2008	NamPower Coal fired Power Station	Power Station	Namibia
2008	Oasis Development	Residential	Western Cape (SA)
2008	RUL Sulphur Handling Facility Walvis Bay	Mining	Namibia
2008	Walvis Bay Power Station	Structure	Namibia
2007	Calitzdorp Retirement Village	Residential	Western Cape (SA)
2007	Calitzdorp Visualisation	Visualisation	Western Cape (SA)
2007	Camdeboo Estate	Residential	Western Cape (SA)
2007	Destiny Africa	Residential	Western Cape (SA)
2007	Droogfontein Farm 245	Residential	Western Cape (SA)
2007	Floating Liquified Natural Gas Facility	Structure tanker	Western Cape (SA)
2007	George SDF Municipality Densification	GIS Mapping	Western Cape (SA)
2007	Kloofsig Development	Residential	Western Cape (SA)
2007	OCGT Power Plant Extension	Structure Power Plant	Western Cape (SA)
2007	Oudtshoorn Municipality SDF	GIS Mapping	Western Cape (SA)
2007	Oudtshoorn Shopping Complex	Structure	Western Cape (SA)
2007	Pezula Infill (Noetzie)	Residential	Western Cape (SA)
2007	Pierpoint Nature Reserve	Residential	Western Cape (SA)
2007	Pinnacle Point Golf Estate	Golf/Residential	Western Cape (SA)
2007	Rheebok Development Erf 252 Appeal	Residential	Western Cape (SA)
2007	Rossing Uranium Mine Phase 1	Mining	Namibia
2007	Ryst Kuil/Riet Kuil Uranium Mine	Mining	Western Cape (SA)
2007	Sedgefield Water Works	Structure	Western Cape (SA)
2007	Sulphur Handling Station Walvis Bay Port	Industrial	Namibia
2007	Trekkopje Uranium Mine	Mining	Namibia
2007	Weldon Kaya	Residential	Western Cape (SA)
2006	Farm Dwarsweg 260	Residential	Western Cape (SA)
2006	Fynboskruin Extension	Residential	Western Cape (SA)
2006	Hanglip Golf and Residential Estate	Residential	Western Cape (SA)
2006	Hansmoeskraal	Slopes Analysis	Western Cape (SA)
2006	Hartenbos Landgoed Phase 2	Residential	Western Cape (SA)
2006	Hersham Security Village	Residential	Western Cape (SA)
2006	Ladywood Farm 437	Residential	Western Cape (SA)
2006	Le Grand Golf and Residential Estate	Residential	Western Cape (SA)
2006	Paradise Coast	Residential	Western Cape (SA)
2006	Paradyskloof Residential Estate	Residential	Western Cape (SA)

2006	Riverhill Residential Estate	Residential	Western Cape (SA)
2006	Wolwe Eiland Access Route	Road	Western Cape (SA)
2005	Harmony Gold Mine	Mining	Mpumalanga (SA)
2005	Knysna River Reserve	Residential	Western Cape (SA)
2005	Lagoon Bay Lifestyle Estate	Residential	Western Cape (SA)
2005	Outeniquabosch Safari Park	Residential	Western Cape (SA)
2005	Proposed Hotel Farm Gansevallei	Resort	Western Cape (SA)
2005	Uitzicht Development	Residential	Western Cape (SA)
2005	West Dunes	Residential	Western Cape (SA)
2005	Wilderness Erf 2278	Residential	Western Cape (SA)
2005	Wolwe Eiland Eco & Nature Estate	Residential	Western Cape (SA)
2005	Zebra Clay Mine	Mining	Western Cape (SA)
2004	Gansevallei Hotel	Residential	Western Cape (SA)
2004	Lakes Eco and Golf Estate	Residential	Western Cape (SA)
2004	Trekkopje Desalination Plant	Structure Plant	Namibia (SA)
1995	Greater Durban Informal Housing Analysis	Photogrammetry	KwaZulu-Natal (SA)

14 APPENDIX E: VRM CHECKLISTS AND TERMINOLOGY

Table 19: Scenic Quality Checklist

KEY FACTORS	**RATING CRITERIA AND SCORE**		
SCORE	**5**	**3**	**1**
Land Form	High vertical relief as expressed in prominent cliffs, spires or massive rock outcrops, or severe surface variation or highly eroded formations or detail features that are dominating and exceptionally striking and intriguing.	Steep-sided river valleys, or interesting erosion patterns or variety in size and shape of landforms; or detail features that are interesting, though not dominant or exceptional.	Low rolling hills, foothills or flat valley bottoms; few or no interesting landscape features.
Vegetation	A variety of vegetative types as expressed in interesting forms, textures and patterns.	Some variety of vegetation, but only one or two major types.	Little or no variety or contrast in vegetation.
Water	Clear and clean appearing, still or cascading white water, any of which are a dominant factor in the landscape.	Flowing, or still, but not dominant in the landscape.	Absent, or present but not noticeable.
Colour	Rich colour combinations, variety or vivid colour: or pleasing contrasts in the soil, rock, vegetation, water.	Some intensity or variety in colours and contrast of the soil, rock and vegetation, but not a dominant scenic element.	Subtle colour variations contrast or interest: generally mute tones.

Adjacent Scenery	Adjacent scenery greatly enhances visual quality.	Adjacent scenery moderately enhances overall visual quality.	Adjacent scenery has little or no influence on overall visual quality.
Scarcity	One of a kind: unusually memorable, or very rare within region. Consistent chance for exceptional wildlife or wildflower viewing etc.	Distinctive, though somewhat similar to others within the region.	Interesting within its setting, but fairly common within the region.
SCORE	**2**	**0**	**-4**
Cultural Modification	Modifications add favourably to visual variety, while promoting visual harmony.	Modifications add little or no visual variety to the area and introduce no discordant elements.	Modifications add variety but are very discordant and promote strong disharmony.

Table 20: Sensitivity Level Rating Checklist

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

Table 21: VRM Terminology Table

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

Simple	Basic, composed of few elements	**Organic**	Derived from nature; occurring or developing gradually and naturally
Complex	Complicated; made up of many interrelated parts	**Structure**	Organised; planned and controlled; with definite shape, form, or pattern
Weak	Lacking strength of character	**Regular**	Repeatedly occurring in an ordered fashion
Strong	Bold, definite, having prominence	**Horizontal**	Parallel to the horizon
Dominant	Controlling, influencing the surrounding environment	**Vertical**	Perpendicular to the horizon; upright
Flat	Level and horizontal without any slope; even and smooth without any bumps or hollows	**Geometric**	Consisting of straight lines and simple shapes
Rolling	Progressive and consistent in form, usually rounded	**Angular**	Sharply defined; used to describe an object identified by angles
Undulating	Moving sinuously like waves; wavy in appearance	**Acute**	Less than 90°; used to describe a sharp angle
Plateau	Uniformly elevated flat to gently undulating land bounded on one or more sides by steep slopes	**Parallel**	Relating to or being lines, planes, or curved surfaces that are always the same distance apart and therefore never meet
Ridge	A narrow landform typical of a highpoint or apex; a long narrow hilltop or range of hills	**Curved**	Rounded or bending in shape
Valley	Low-lying area; a long low area of land, often with a river or stream running through it, that is surrounded by higher ground	**Wavy**	Repeatedly curving forming a series of smooth curves that go in one direction and then another

Plain	A flat expanse of land; fairly flat dry land, usually with few trees	**Feathered**	Layered; consisting of many fine parallel strands
Steep	Sloping sharply often to the extent of being almost vertical	**Indistinct**	Vague; lacking clarity or form
Pro##nt	Noticeable; distinguished, eminent, or well-known	**Patchy**	Irregular and inconsistent;
Solid	Unadulterated or unmixed; made of the same material throughout; uninterrupted	**Even**	Consistent and equal; lacking slope, roughness, and irregularity
Broken	Lacking continuity; having an uneven surface	**Uneven**	Inconsistent and unequal in measurement irregular
Smooth	Consistent in line and form; even textured	**Stark**	Bare and plain; lacking ornament or relieving features
Rough	Bumpy; knobbly; or uneven, coarse in texture	**Clustered**	Densely grouped
Fine	Intricate and refined in nature	**Diffuse**	Spread through; scattered over an area
Coarse	Harsh or rough to the touch; lacking detail	**Diffuse**	To make something less bright or intense

15 APPENDIX F: SHADOW FLICKER SCREENING METHODOLOGY AND FINDINGS.

15.1 Shadow Flicker Background Information

'Shadow flicker' (SF) refers to the shadows that a wind turbine casts over structures and local observers at times of the day when the sun is directly behind the turbine rotor from an observer's position. According to the International Legislation and Regulations for Wind Turbine Shadow Flicker Impact, "Shadow flicker is the flickering effect caused by the rapid periodic occurrence of shadow by the rotating turbine blades. The impacts of shadow flicker impact vary with time and place depending on several factors such as the position and height of the sun relative to the wind turbines and the receptors, the wind turbine hub height and its rotor diameter, cloud cover and wind direction" (Erik Koppen, 2017).

According to Environmental Design and Research (EDR), "the primary concern with shadow flicker is the annoyance it can cause for adjacent homeowners. Annoyance can trigger physiological reactions of the autonomic nervous and/or endocrine systems that increase the risk of cardiovascular disorders. However, it is important to note that annoyance is not a disease or physical illness in of itself; rather it is a variable and subjective response to stimuli that can include many other things besides shadow flicker" (Environmental Design & Research, 2017).

15.2 Shadow Flicker Best International Practice Review

Table 22. International best practice guidelines and references.

Document	Text	Page
Update of U.K. Shadow Flicker Evidence Base. Final Report. Parsons Brinckerhoff for the U.K. Department of Energy and Climate Change (Parsons Brinkerhoff, 2011)	The term "shadow flicker" refers to the flickering effect caused when rotating wind turbine blades periodically cast shadows over neighbouring properties as they turn, through constrained openings such as windows. The magnitude of the shadow flicker varies both spatially and temporally and depends on a number of environmental conditions coinciding at any particular point in time, including, the position and height of the sun, wind speed, direction, cloudiness, and position of the turbine to a sensitive receptor.	Pg 5

Update of U.K. Shadow Flicker Evidence Base. Final Report. (Parsons Brinkerhoff, 2011)	The UK wind industry and UK government consider that a measurement of 10 x rotor diameter is appropriate for the outer margin of discernible effects, which corresponds to approximately 800 to 1,500 m for commonly installed wind turbines on the market currently (which typically have rotor diameters ranging from 80 to 150 m). This study concludes that the shadow flicker effect did not constitute a significant harassment. However, under specific conditions the increased demands on mental and physical energy, indicated that cumulative long-term effects might meet the criteria of a significant nuisance. This demonstrates the need to reduce the impact where possible.	Pg 56
Update of U.K. Shadow Flicker Evidence Base. (Parsons Brinkerhoff, 2011)	Current guidance to assess shadow flicker in the Companion Guide to PPS22 (2004) states that impacts occur within 130 degrees either side of north from a turbine. This has been found to be an acceptable metric. Additionally, the 10-rotor diameter rule has been widely accepted across different European countries, and is deemed to be an appropriate assessment area, although there is potentially a need to differentiate between appropriate assessment areas at different latitudes.	page 56
	Mitigation measures adopted by developers have been successful. Careful site design to eliminate shadow impacts is important, with mitigation measures such as turbine shut down systems being used regularly. These systems are acceptable for all parties considered in this guideline, and by virtue of their success, the issue of shadow flicker appears to be minor. Mitigation measures are often put into planning conditions. Whilst the industry software that we reviewed can only be used to carry out worst case shadow flicker assessments, there is perhaps a need to address worst-case and realistic shadow flicker in assessments.	Page 56

Danish Wind Industry Associations website (Danish Wind Industry Association, 2010)	The Danish Wind Industry Association suggests that at distances greater than 500-1000 metres from a wind turbine, the rotor will not appear to be “chopping" the light, but the turbine will be regarded as an object with the sun behind it, and it is therefore not necessary to consider shadow casting at such distances. “The hub height of a wind turbine is of minor importance for the shadow from the rotor. The same shadow will be spread over a larger area, so in the vicinity of the turbine, say, up to 1,000 m, the number of minutes per year with shadows will actually decrease.” “If you are farther away from a wind turbine rotor than about 500-1000 metres, the rotor of a wind turbine will not appear to be chopping the light, but the turbine will be regarded as an object with the sun behind it. Therefore, it is generally not necessary to consider shadow casting at such distances.”	Web
Australian “National Wind Farm Development Guidelines” (EPHC, 2010)	This document recommends a theoretical residential exposure limit of less than 30 hours per year, and that actual or measured shadow flicker duration should not exceed 10 hours per year. It states that shadow flicker must be considered within a distance from a turbine of 265 times the blade width at its widest part (maximum blade chord).	Pg 169
Australian “National Wind Farm Development Guidelines”. (EPHC, 2010)	The Australian guidelines therefore suggest that for a blade of with a ~4.2m width (as is considered for the current application), the shadow flicker effects will be indiscernible at all dwellings further than 1113 metres from any of the wind turbines.	Pg 169
Western Australia Guidelines for Wind Farm Development. (Western Australia Planning Commission, 2004)	This document states that shadow flicker can affect local amenity but is uncommon in Australia. Relevant text “A wind energy facility can affect local amenity due to: Shadow flicker, which occurs when the sun passes behind the blades and the shadow flicks on and off, although in Australia this is uncommon”.	Pg 4
Final Programmatic Environmental Impact Statement on Wind Energy Development on BLM-Administered Lands in the Western United States. (Bureau of Land Management, 2005)	The U.S. Department of Interior has noted in respect to wind farm planning that at a distance beyond 10 rotor diameters shadow flicker effects are essentially undetectable.	Pg 4

Environmental, Health and Safety Guidelines Wind Energy. (World Bank Group, 2015)	A key finding of this study is that in the UK there have not been extensive issues with shadow flicker…shadow flicker issues were resolved using turbine shut down systems which are the standard mitigation approach adopted across Europe. Current guidance to assess shadow flicker in the Companion Guide to PPS22 (2004) states that impacts occur within 130 degrees either side of north from a turbine.	Page 13
International Legislation and Regulations for Wind Turbine Shadow Flicker Impact. (Erik Koppen, 2017)	Page 1 of this study represents the results of a comparative study into shadow flicker regulations in a number of countries. The results show that not all countries have guidelines or regulations for assessing and limiting shadow flicker impact. This guideline States a limit value of 30 hours per year and 30 minutes per day for the astronomical maximum possible shadow worst-case when the shadow flicker control module is used. The German guidelines states that the real shadow impact must be limited to 8 hours per year. However, there are differences in the exact implementation, such as the consideration of only the worst case only the real case or both the worst and the real case shadow impact. Other common differences are the exact definition of shadow flicker sensitive receptors and the zone of influence which both have to be considered.	Page 1 (Summar y)
Guideline for identification and evaluation of the optical emissions of wind turbines *(translation).* (Immissionsschult, 2002)	Germany has a detailed Shadow Flicker guideline which states that shadow flicker must be considered up to the distance where at least 20% of the Sun disk is covered by the rotor blade. At larger distances the shadow flicker will be too diffused to cause an annoyance. Further the shadow flicker is assessed only for sun angles over the horizon of at least 3 degrees. For lower angles the shadow flicker is neglected due to the less bright sunlight and screening for vegetation and building. The German guideline considers the following as sensitive rooms: 1. living rooms including lounges 2. bedrooms 3. classrooms 4. offices and workplaces Outdoor areas such as terraces and balconies adjacent to building are considered sensitive areas between 6 a.m. and 10 p.m. The limit values for the worst-case - the astronomical maximum possible - is a shadow flicker impact of 30 minutes per day and 30 hours per year.	Pg 10

1.8 Best Practice Recommendations Summary

In summary, the following best practice guidelines are recommended, and have been incorporated into this assessment into shadow flicker:

- The 10-rotor diameter rule has been widely accepted across different European countries, and is deemed to be an appropriate assessment area. Based on the rotor blade defined for the project as 180m diameter, a distance buffer of 2km from turbine locations should be used to determine receptors
- If a receptor falls within the shadow flicker impact zone, the following rooms should be considered sensitive:
  - Living rooms including lounges
  - Bedrooms
  - Classrooms
  - Offices and workplaces
- A theoretical residential exposure limit of less than 30 hours per year, 30 minutes per day for the astronomical maximum possible shadow worst-case and that actual or measured shadow flicker duration should not exceed 10 hours per year.
- In terms of best practice in mitigation, the following mitigations could be used to reduce shadow flicker impact:
  - Planting vegetation or tree lines, which will block the line of sight to the turbines causing flicker (in locations conducive to tree growth).
  - Installation of window blinds or awnings at the receptors.
  - Payments to affected parties (in extreme circumstances if other mitigations are not possible).
  - In high impact scenarios, a more technical mitigation measure is to shut down the turbines which are known to cause problematic flicker. An annual shutdown schedule that can be paired with a sunlight detection system, such that the identified turbines which may cause shadow flicker are only shut down when sufficient sunlight is present to cause discernible shadow flicker.

15.3 Shadow Flicker Screening Methodology

In South Africa, there are no specific guidelines as to how to assess shadow flicker generated by wind turbines. However, international guidelines state that the practical extent to which shadow flicker should be assessed is to a distance of 265 times the distance of the blade chord (the widest part of the turbine blade), or approximately 1.1 km. A buffer of 1.1km was generated for each of the turbines to determine if any residential structures were located within the potential SF impact area. If residential structures were identified within the broad brush 1.1km SF buffer, a more detailed analysis of the expected SF impact area was generated making use of 3D model of the turbine using 3D modelling software that allows a location specific representation of the SF impact area. As this is a screening exercise, the probability of the SF impact taking place within the SF impact zone is not assessed (this was also not applicable for this study). The following information was used in the defining of the SF impact area:

- Distance of the observer from the turbine.
- Orientation of the observer relative to the turbine.
- Height and rotor diameter of the turbine.
- Location, time of day and time of year.
- Prevailing wind direction.
- Weather conditions (cloud cover reduces the occurrence of shadow flicker).
- Screening impacts of vegetation, structures, and terrain.

Distance of the Observer and Nature of the Structure

The distance to the observer is determined by GIS mapping making use of ESRI ArcGIS software. Dwellings were digitised from satellite imagery, with the site visit confirming the structure. Occupancy of the dwelling was determined by survey, with confirmation of the occupancy provided by the farm owner/ and confirmed by the development team.

Orientation of the observer

The orientation of the observer refers to the direction the dwelling is facing, as this influences the extent to which the light reflected from the moving turbines will enter into the dwelling. The second criteria relating to this category, is if there are windows facing towards the turbines. The assessment takes into consideration worst case scenario, and the assumption that windows are always open. As no occupied dwellings were located within the SF high impact area, this aspect of the assessment was not required.

Height and rotor diameter

The height and rotor diameter of the turbine influence the length of the shadows generated. The taller and wider the object is, the longer and wider the reflected shadow would be. A smaller turbine, with a shorter blade diameter, would create a smaller and more narrow shadow than a larger turbine with a long blade diameter. A hub height of 200m with 100m blade length was used to determine the SF impact area.

The terrain relationship between the receptor and turbine influences the shadow length. The shadow generated from a turbine located on high ground would be longer than the same height turbine located at the same height as the receptor. As the wind turbines that were located within the SF impact area were on slightly raised ground, height data from ESRI World Digital Elevation Model indicated that 10m height in elevation between the turbine and the receptors, 10m was added to the hub height to take the increased turbine into consideration.

Location, time of day and time of year

Depending on the location, the time of day and time of year directly influence the length and orientation of the shadow. Early morning and late evening shadows are longer due to the lower angle of the sun on the horizon. At mid-day, the shadow would be limited in extent due to the location of the sun directly above the turbine. In winter in the southern hemisphere, the sun is further to the north, resulting in shadows that extend further to the south. As depicted in Figure 28, the sun rises in the north-east and sets in the north-west in winter. Mid-day shadows will be longer, as depicted on the graphic, as the sun is located north of the equator. As depicted in Figure 29, the sun rises in the south-east and sets in the south-west. Mid-day shadows will be shorter, as depicted on the graphic, as the sun is located closer to site to the south of the equator.

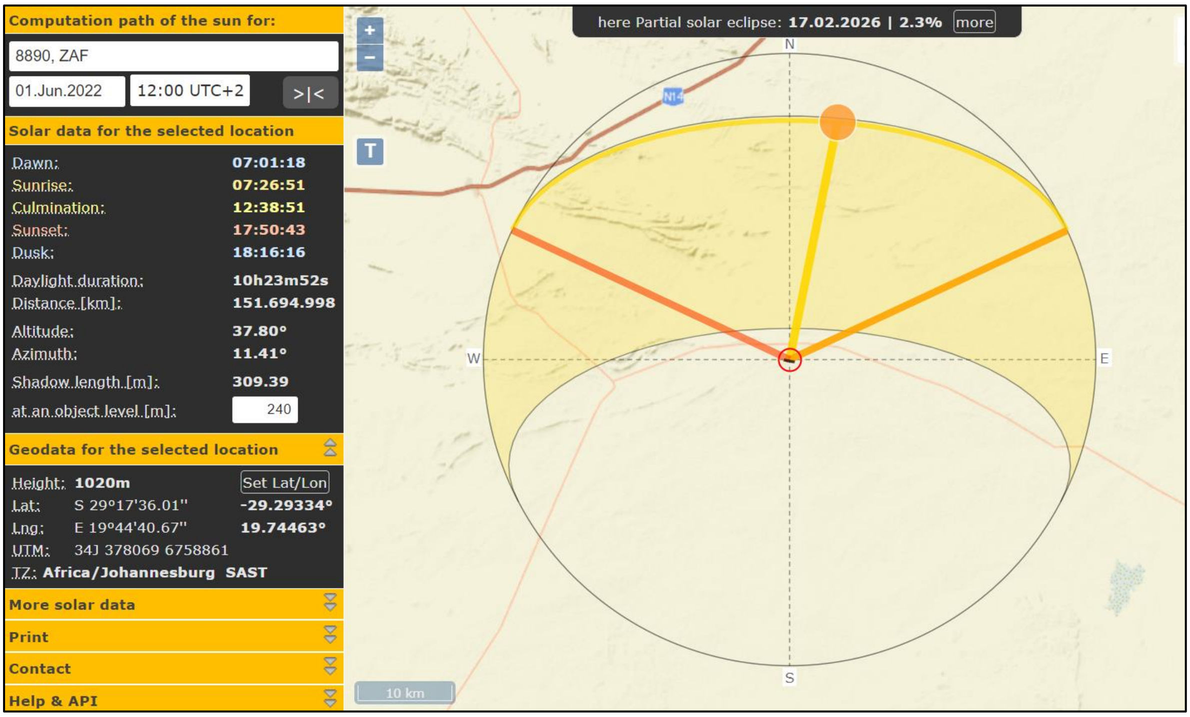


Figure 28. Image depicting the suns pathway across the sky for mid-winter scenario at the project site.

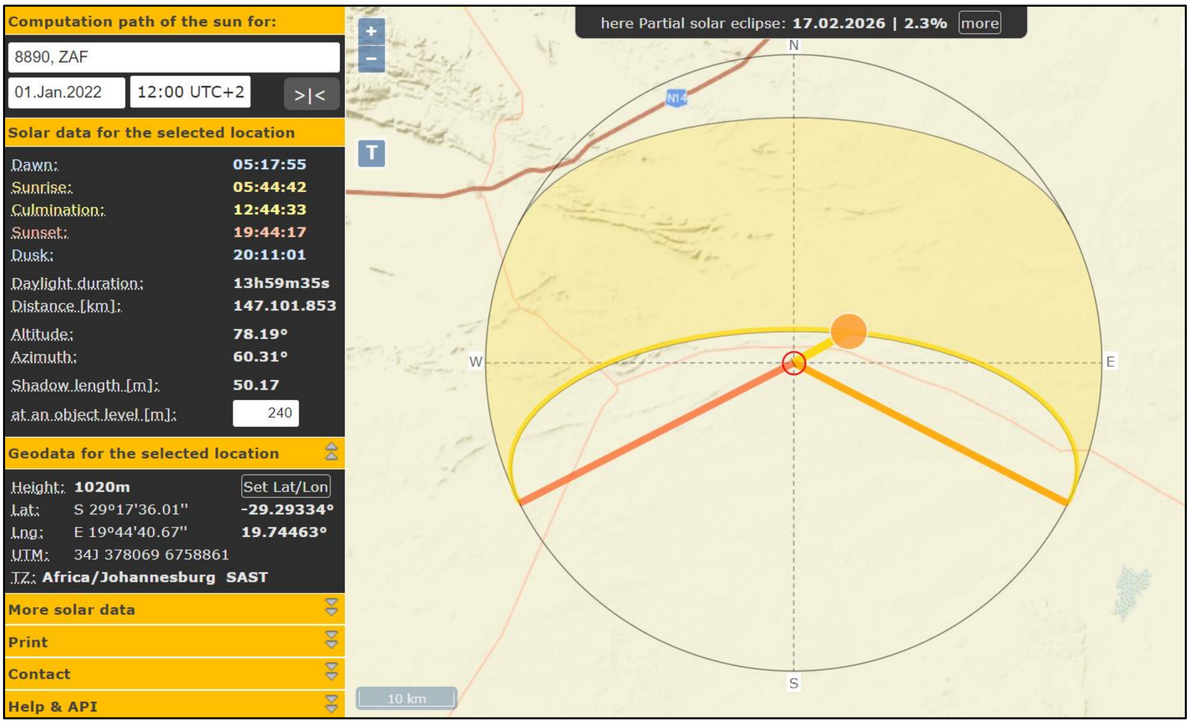


Figure 29. Image depicting the suns pathway across the sky for mid-summer scenario at the project site.

Prevailing wind direction

The prevailing wind direction influences the direction that the wind turbine is most likely to be facing. This in turn influences the flicker effect generated by the moving blades. If the turbine is facing directly towards the receptors located within the shadow area, the shadow of the turbines would move across the location. If the turbine is facing 90 degrees to the receptors, the turbine shadow would reflect a straight ling without creating a flicker effect. The first scenario creates a flicker effect, the second scenario essentially creates a static shadow event with limited flicker. The wind rose provided by the client indicates a prevalence for north-south turbine orientation.

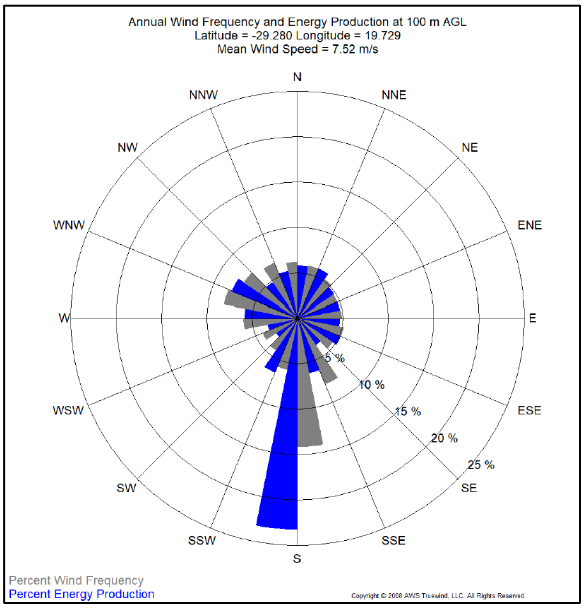


Figure 30. Wind rose generated for the Pofadder WEF provided by the client *(Atlantic Renewable Energy Partners, 2022)*

Weather conditions

Shadow is an effect of the sun and is influenced by the clarity of the sunlight. Intense sunlight creates a more defined shadow, with reduced sunlight creating a more diffuse shadow. Cloud cover is a key factor in influencing the intensity of sunlight and as such cloud cover reduces the occurrence of shadow flicker. As the Pofadder WEF is located in a semidesert area in the Northern Cape, cloud cover was accepted as a minimal effect, with screening vegetation also a minimal effect. As graphically represented in Figure 31 below, wind is also expected to take place most days, and as such, a worst-case scenario was evaluated.

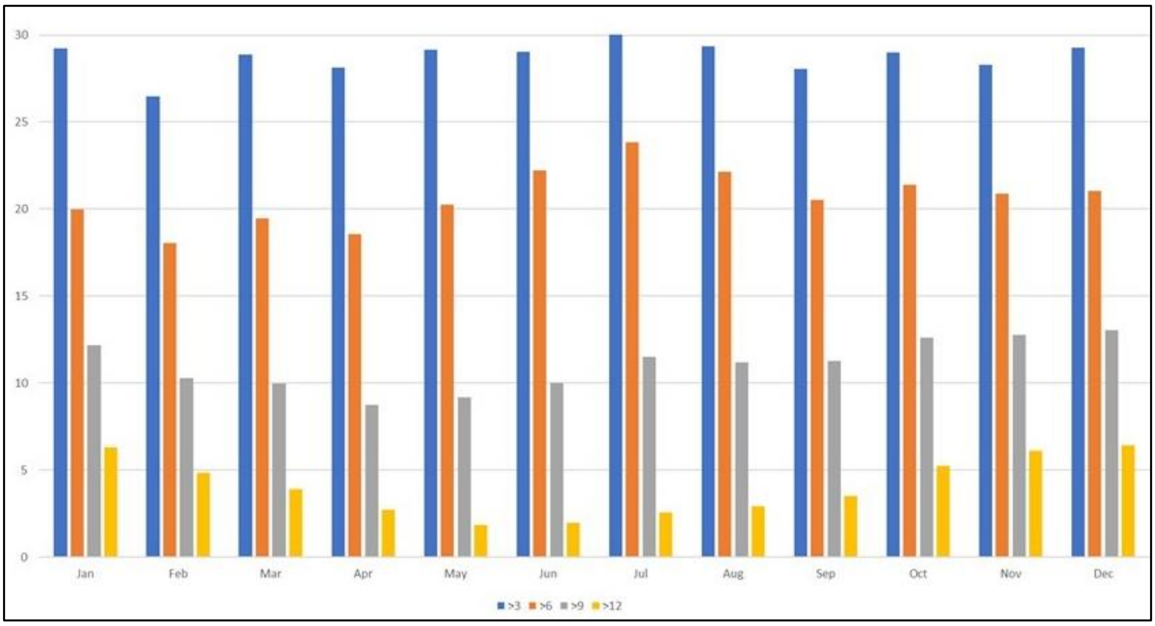


Figure 31. Expected annual wind speed graph (m/s).

Screening impacts of vegetation, structures, and terrain.
Screening by means of shadow and structure can block the shadow falling on a residence. If there are many large trees located between the turbine and the receptor location, with the trees located close the receptor, the shadow of the turbine would be blocked by the trees/ structures. With the region being semi-arid, vegetation was limited.

15.4 Shadow Flicker Screening

The mapping for the shadow area for the project made use of Sketch-up software to generate a 3D model based on the provided specifications: based on the following criteria:

- Hub height (200m plus 10m) – 210m.
- Blade length 100m radius angled north south.

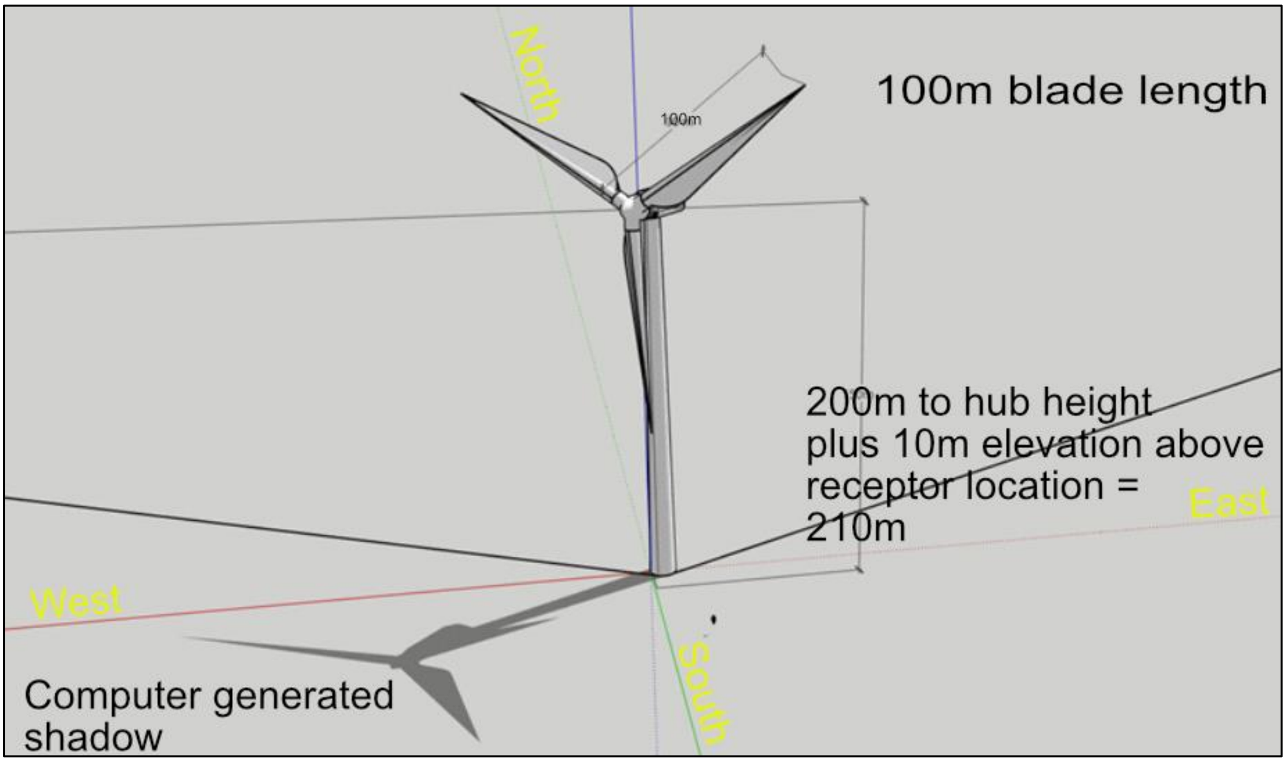


Figure 32. 3D generated model of the proposed turbine.

As depicted in the image above, a 3D model of the proposed turbine was generated in Sketchup, to reflect the scale model of the structure as per the specified dimensions. The model is a generic design and only has relevance to the project in terms of depicting the approximate structure size, and associated shadow. In Sketch-up 3D model, an area depicting a one-kilometre area was demarcated in the surface, with the turbine in the centre. The site location, date and time variables provided in the software were then used to depict where the shadow would fall during the year based on early morning and late afternoon shadows.

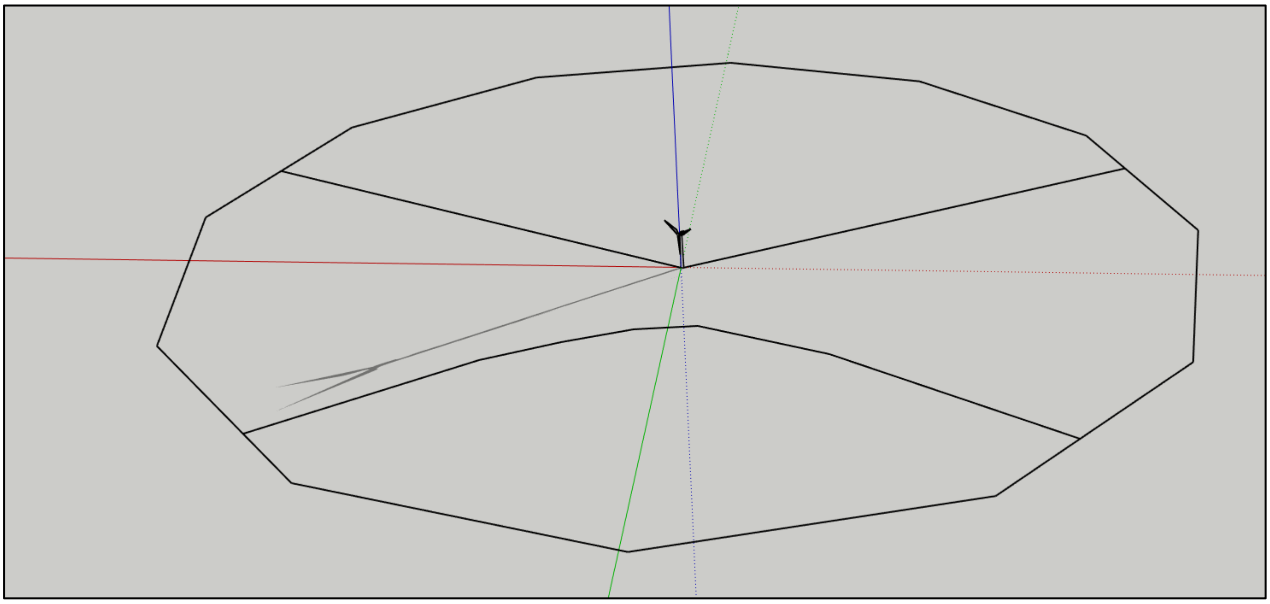


Figure 33. 3D model depicting shadow incidence in early morning winter periods.

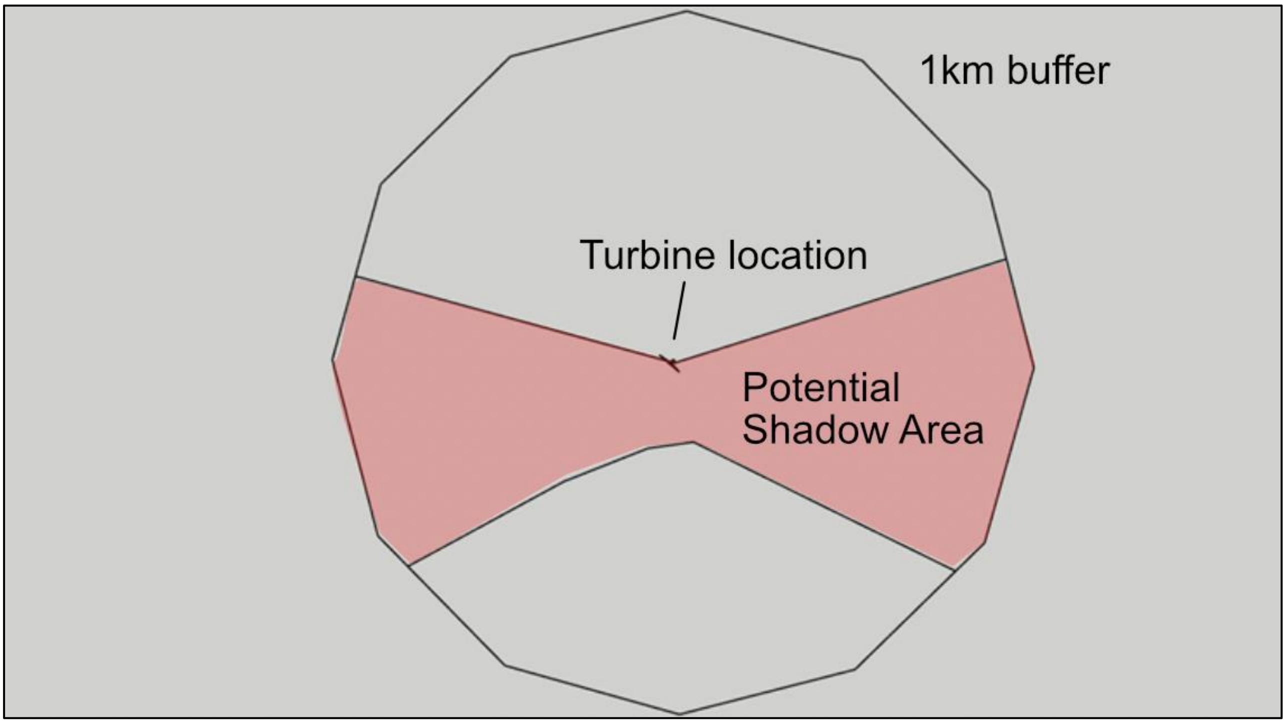


Figure 34. Mapped area for shadow potential that was incorporated into ArcGIS.

This area was then mapped to the turbine locations in ArcGIS mapping software to evaluate the extent to which the potential shadow impact zone related to the identified receptors.

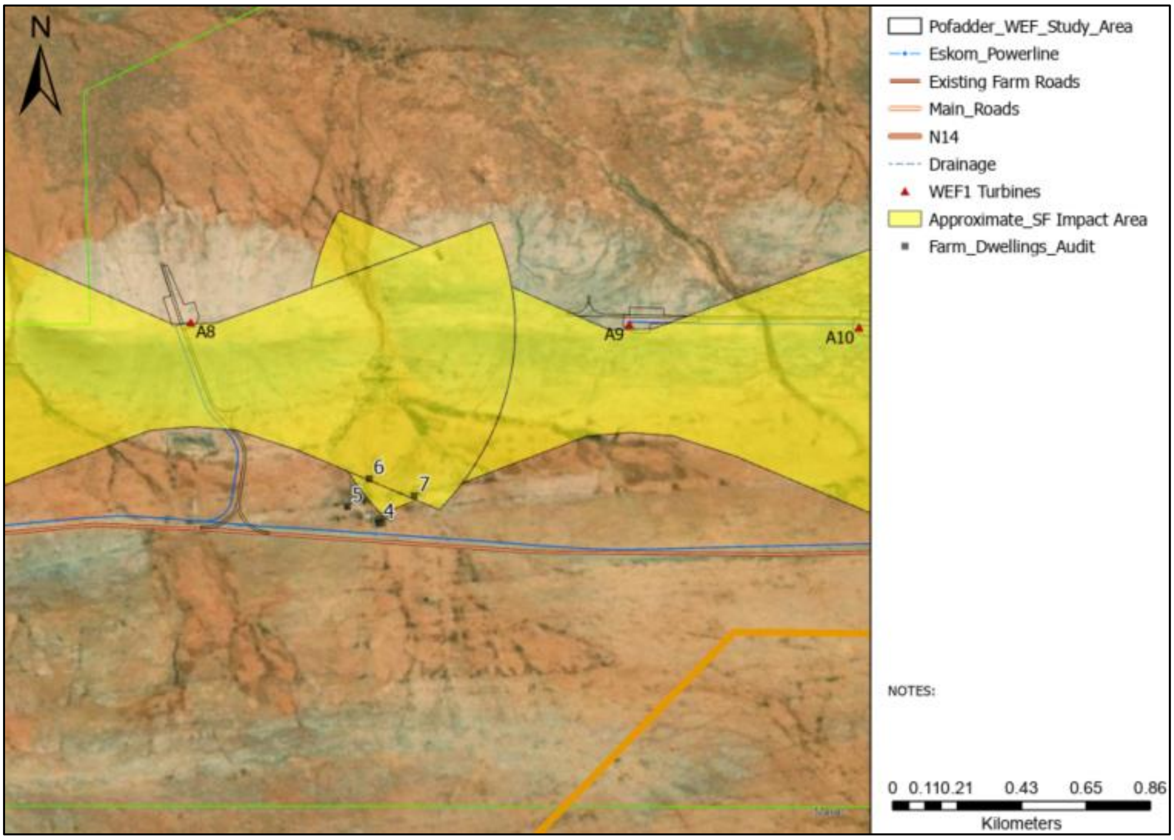


Figure 35. Shadow Flicker map for Turbines A8 & A9.

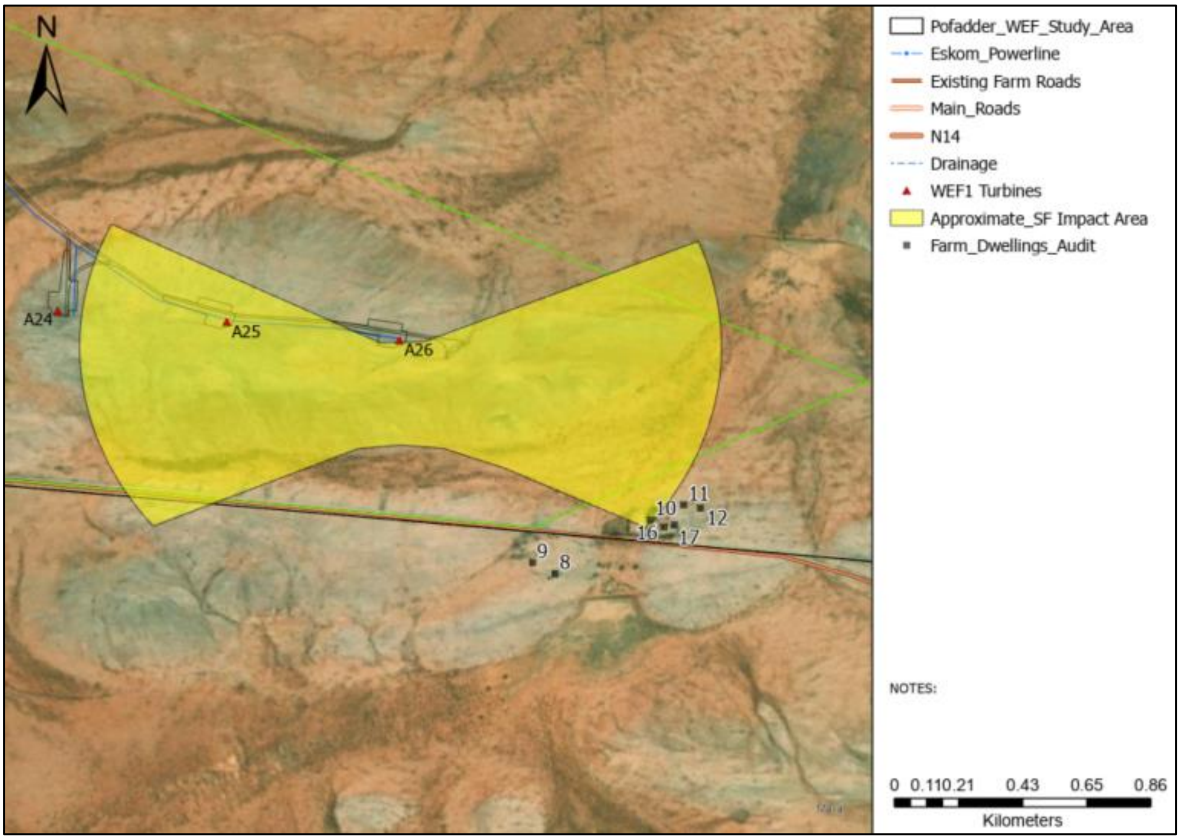


Figure 36. Shadow Flicker map for Turbine A26.

The following table depicts the structure occupancy audit for structures within the SF impact area.

Table 23. Property structure occupancy audit table with the potentially impacted dwelling highlighted in Red.

ID	POINT_X	POINT_Y	SF Incidence	Farm Owner	Occupied	Occup Ref	Notes
4	19.70639847	-29.27782005	Possible	Willem Van Niekerk	Yes	Owner	Not permanent
5	19.70544811	-29.27732254	Possible	Willem Van Niekerk	No	NA	Shed
6	19.70610507	-29.27648698	Likely	Willem Van Niekerk	No	NA	Pump housing
7	19.70745089	-29.27699725	Likely	Willem Van Niekerk	Yes	Labourer	
10	19.79486483	-29.28021778	Likely	Gerhard Visser	No	Owner	Not currently the landowner would like to fix it up for construction workers during the construction phase of the WEF.
11	19.79586495	-29.27976467	Unlikely	Gerhard Visser	Yes	Labourer	Possible occupancy
12	19.79637113	-29.27985447	Unlikely	Gerhard Visser	Yes	Labourer	Possible occupancy
16	19.79527704	-29.28042982	Possible	Gerhard Visser	No	NA	Shed
17	19.79558598	-29.28036361	Possible	Gerhard Visser	No	NA	Shed

15.5 Shadow Flicker Findings

A detailed screening exercise of the expected shadow flicker impact zone was undertaken using 3D modelling and GIS mapping. Two dwellings (Structure 4 & 7) were found to fall marginally within the SF impact areas for Turbines A8 & A9. Of the two, Structure 4 was found to be the property owners dwelling that is occupied on a non-permanent basis. Structure 7 was found to house the farm labourer. As this structure could experience SF effects, impacts were undertaken with mitigation measures defined to reduce the SF effect should it be found to take place at this marginal SF flicker impact locality. As Structure 4 was the property owner, the structure was not included in the SF impact assessment.

For the SF impact area for Turbine A26, two potentially occupied dwellings were in close proximity to the SF impact area (Structures 11 & 12). As this is a screening exercise, the precautionary principle should prevail, and the two structures were included in the impact assessment with mitigations proposed should SF impact occur at this low probability locality. The remaining structures located in close proximity to the A26 SF impact area were either used by the property owner, or ancillary structures for agricultural usage.

The following SF abatement methodology is proposed:

- At commencement of operational phase, the occupants of the structures (Structures 7, 11 & 12) would need to be informed of the potential for SF Impacts and provide an explanation of the possible annoyance factor to the occupants.

- At a time when SF impacts are likely to occur, a routine survey needs to be undertaken by the EPC to determine if SF impacts are applicable to the relevant dwellings, and to ascertain if the SF effect is an annoyance to the occupants.
- If SF impacts occur such that they are an annoyance to the occupants, the following mitigations should be implemented as per the international best practice recommendations:
  - Planting vegetation or tree lines, which will block the line of sight to the turbines causing flicker (in locations conducive to tree growth).
  - Installation of window blinds or awnings at the receptors.

15.6 Shadow Flicker Conclusion

A Shadow Flicker screening process was implemented making use of 3D modelling to determine the approximate extent of the proposed Pofadder WEF turbines. It was found that three labourer dwellings that may be occupied, could fall within the outer extent of the SF Impact Area. Impact Assessment of this effect was undertaken, and the expected SF Impact without mitigation was rated Low. This was based on the low probability of the SF impact occurring due to the location of the dwellings on the outer edge of the potential SF Impact Area. Mitigation was proposed, where the SF Impact could be reduced to a Negligible effect with simple mitigations. This would require an on-site survey to the dwellings once Operation Phase has commenced to determine if the SF effect was applicable and has the potential to incur a nuisance factor to the occupants.

16 APPENDIX G: GENERIC LIGHTS AT NIGHT MITIGATION GUIDELINES

Mitigation Context

- Effective light management needs to be incorporated into the design of the lighting to ensure that the visual influence is limited to the mine, without jeopardising project operational safety and security (See lighting mitigations by The New England Light Pollution Advisory Group (NELPAG) and Sky Publishing Corp in 14.2).
- Utilisation of specific frequency LED lighting with a green hue on perimeter security fencing.
- Directional lighting on the more exposed areas of operation, where point light source is an issue.
- No use of overhead lighting and, if possible, locate the light source closer to the operation.

Mesopic Lighting

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

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

'Good Neighbour – Outdoor Lighting'

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

(NELPAG)

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

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

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

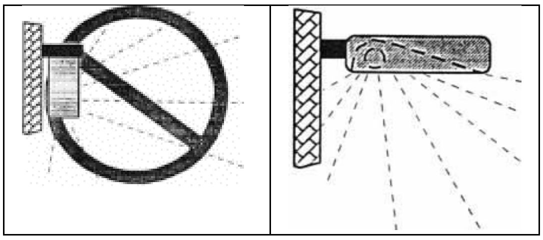
Light Trespass Poor outdoor lighting shines onto neighbours' properties and into bedroom windows, reducing privacy, hindering sleep, and giving the area an unattractive, trashy look.

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

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

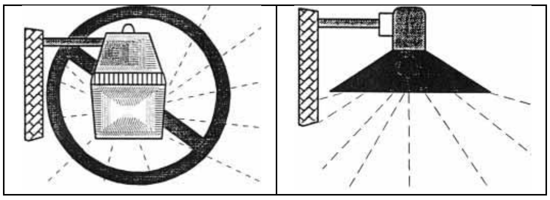
Good and Bad Light Fixtures

Typical "Wall Pack" | **Typical "Shoe Box" (forward throw)**



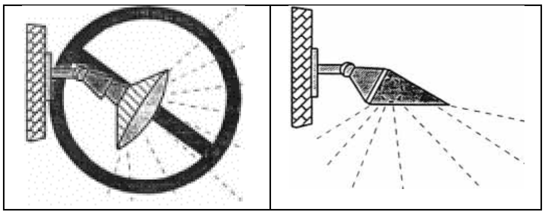
BAD Waste light goes up and sideways | **GOOD** Directs all light down

Typical "Yard Light" | **Opaque Reflector (lamp inside)**



BAD Waste light goes up and sideways | **GOOD** Directs all light down

Area Flood Light | **Area Flood Light with Hood**



BAD Waste light goes up and sideways | **GOOD** Directs all light down

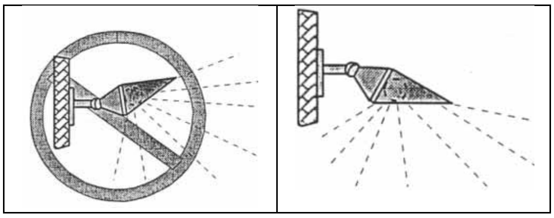
How do I switch to good lighting?

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

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

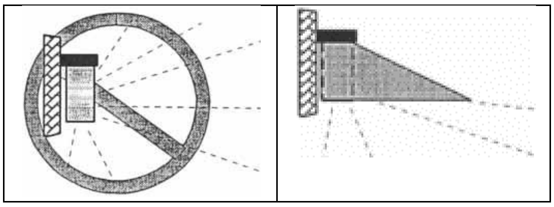
What You Can Do To Modify Existing Fixtures

Change this . . . to this (aim downward)



Floodlight:

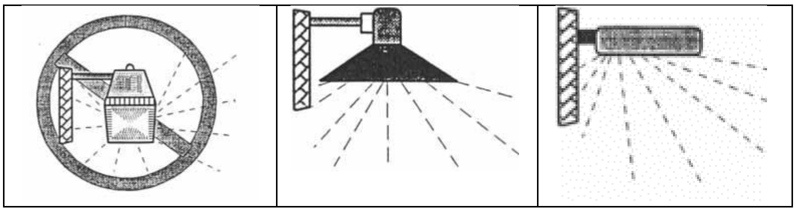
Change this . . . to this (aim downward)



Wall Pack

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

Change this . . . to this or this



Yard Light Opaque Reflector Show Box

Replace bad lights with good lights. You’ll save energy and money. You’ll be a good neighbour. And you’ll help preserve our view of the stars.