THE PROPOSED MERCURY CLUSTER PROJECT (NORTHERN PV FARMS) AND ASSOCIATED INFRASTRUCTURE, FREE STATE PROVINCE SOUTH AFRICA

Visual Impact Assessment Report

Final v_3

DATE: 5 May 2023

Document prepared for Landscape Dynamics (Pty) Ltd
On behalf of Mulilo Renewable Project Developments (Pty) Ltd

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

TABLE OF CONTENTS

TABLE OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS

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
PNR	Private Nature Reserve
SDF	Spatial Development Framework
SEA	Strategic Environmental Assessment
VAC	Visual Absorption Capacity
VIA	Visual Impact Assessment
VRM	Visual Resource Management
VRMA	Visual Resource Management Africa
ZVI	Zone of Visual Influence

GLOSSARY OF TECHNICAL TERMS

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

Technical Term	**Definition** (USDI., 2004)

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

Table 1. Specialist declaration of independence.

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

Table 2 Specialist report requirements in terms of Appendix 6 of the EIA Regulations (2014), as amended in 2017.

A specialist report prepared in terms of the Environmental Impact Regulations of 2014 (as amended in 2017) must contain:	**Relevant section in report**
Details of the specialist who prepared the report	Stephen Stead, owner / director of Visual Resource Management Africa. steve@vrma.co.za Cell: 0835609911
The expertise of that person to compile a specialist report including a curriculum vitae	Registration with Association of Professional Heritage Practitioners
A declaration that the person is independent in a form as may be specified by the competent authority	Table 1. Specialist declaration of independence.
An indication of the scope of, and the purpose for which, the report was prepared	Terms of Reference
A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Visual Resource Management (VRM) Classes
The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	NA
A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Methodology
Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternative;	Baseline Visual Inventory
An identification of any areas to be avoided, including buffers	Figure 21
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 22
A description of any assumptions made and any uncertainties or gaps in knowledge;	Assumptions and Limitations
A description of the findings and potential implications of such findings on the impact of the proposed activity or activities	Visual Resource Management Classes
Any mitigation measures for inclusion in the EMPr	Environmental Management Plan
Any conditions for inclusion in the environmental authorisation	NA
Any monitoring requirements for inclusion in the EMPr or	NA

A specialist report prepared in terms of the Environmental Impact Regulations of 2014 (as amended in 2017) must contain:	**Relevant section in report**
environmental authorisation	
A reasoned opinion as to whether the proposed activity or portions thereof should be authorised	Conclusion
Regarding the acceptability of the proposed activity or activities; and	Conclusion
If the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	***The finding of this assessment is that the proposed project should be authorised with mitigation. No significant landscape or visual resources were located within the project zone of visual influence, with receiving landscape partially degraded by large substation and background views of degraded mining landscapes. No receptors sensitive to landscape change were identified.***
A description of any consultation process that was undertaken while carrying out the study	A Draft Basic Assessment Report containing this VIA will be subjected to a consultative process as required in terms of regulation 56 of the NEMA 2014 EIA Regulations.
A summary and copies if any comments that were received during any consultation process	No comments regarding landscape or visual issues were received.
Any other information requested by the competent authority.	None.

1 EXECUTIVE SUMMARY

Visual Resource Management Africa CC (VRMA) was appointed by Landscape Dynamics (Pty) Ltd (hereafter referred to as EAP) to undertake a ***Visual Impact Assessment*** on the proposed Mercury Cluster Project (Northern PV Farms) PV Facility and Associated Infrastructure, on behalf of Mulilo Renewable Project Developments (Pty) Ltd. (Proponent).

POLICY FIT	**MEDIUM – HIGH**

In terms of the local planning, there is a clear emphasis in support of renewable energy that aligns with the project planning. There is also a focus on tourism and growth of tourist related resources. As there are no significant landscape resources being utilised for tourism within the project zone of visual influence, the ***expected visual/ landscape policy fit of the landscape change is rated Medium to High.***

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	**Local**

The visible extent, or viewshed, is "the outer boundary defining a view catchment area, usually along crests and ridgelines" (Oberholzer, 2005). In order to define the extent of the possible influence of the proposed project, a viewshed analysis was undertaken from the proposed site at a specified height above ground level. No significant landform features were identified on the sites. Zaaiplaats PV1 site does have a shallow drainage line where wetland features are likely. These areas are key features in the landscape and as such would need to be excluded as defined in the Surface Water Hydrologist specifications. Given the fairly contained viewshed around the development area, the ZVI is defined as Local.

RECEPTORS AND KEY OBSERVATION POINTS	**11 receptor locations and three 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. A number of potentially sensitive receptors are located within the high frequency viewshed and within 6km of the site,

notably: a short stretch of the R76 Highway; two gravel district roads and two farmsteads. The Wawielpark Holiday Resort on the Vaal River is in the viewshed, however, this is in a low view frequency zone and located within the Vaal River Valley with views focused towards the river landscape away from the proposed PV development.

SCENIC QUALITY **Medium**

The scenic quality of the proposed development site is rated Medium as landform includes interesting undulations but not visually dominating scenic elements. Landscape Scarcity is rated Low for the entire area as, even though it is interesting within its setting, it is common within the region. Adjacent landscape is rated Medium to Low for the whole area as while the rural agrarian landscape does have value, the proximity to the substation and mining landscapes does degrade the overall scenic quality. Cultural modification is indicated as neutral as the existing manmade modifications in the landscape neither add nor detract from the visual harmony.

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

Receptor sensitivity to landscape changes is rated Medium for the sensitivity buffers and local prominent topographic areas, and Low for the undulating grasslands and cultivated lands. The maintenance of visual quality to sustain adjacent land use objectives is moderate, as the area is located within an agricultural land use and also in close proximity to mining landscapes. The area also falls within a REDZ area, and there are no tourist related activities making use of the landscape resources. The Vaal River receptors are in background distance zones and valley located with no clear views to the proposed development site.

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.
Class II (Not recommended)	• Visual sensitivity and massing buffers, and SSV setbacks for ridgelines and steep slopes
Class III (suitable with	• Lower lying topographic areas defined as

mitigation)	grasslands.
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

Medium *(without mitigation)*	Without mitigation that proposed development is likely to result in Strong levels of visual contrast and will exceed the carrying capacity of the rural landscape, degrading the Medium levels of Scenic Quality. The PV projects would be viewed in conjunction with the Mercury Substation/ mining context, or high intensity beef farming where the rural landscape is compromised to some degree.
Low *(with mitigation)*	To ensure that higher levels of visual intrusion to rural receptors does not take place, mitigation is required as a condition of authorisation. With mitigation, and the retaining a 15m buffer along farm roads and retaining existing medium sized trees, will assist in reducing the visual intrusion.

PRELIMINARY MITIGATIONS MEASURES

Landscape Element	Mitigation	Motivation
Proximity to ridgelines features and areas of prominence	None	Not applicable.
Neighbours who are sensitivity to landscape change.	None	Not applicable.
Risks to rural landscape character that has Medium or High levels of scenic quality.	15m buffer on farm roads	To prevent degradation of the rural agricultural landscape, a 15m buffer along the farm roads are proposed, retaining of existing medium sized vegetation. The larger, visual contrast generating PV panels would be internally buffered by an access road, creating a larger 30m (approx.) buffer from the road receptors.
PV Panel High Restriction	5m	The proposed development areas are located within the existing mining and substation zone of visual influence. This does result in partial degradation of the existing rural agricultural landscapes. As such, PV panels should not exceed the proposed 5m above ground height.

CUMULATIVE RISKS **Medium to Low**

The regional mapping depicts that numerous solar PV projects are proposed within the 30km buffer to the north and northwest of the projects. Proposed projects include the Vaal River Solar, Buffels Solar, numerous Kabi Solar, and closer to the proposed project in the northwest are Sivanda Solar and Paleso Solar.

While this intensity of development could influence the local landscape character, there area two factors that mitigate the negative intervisibility effects. The first factor pertains to distance where the nearest project is six kilometres distant. This places the other projects outside of the Foreground/ Mid Ground where landscape changes are most likely to influence the landscape character. The second factor pertains to the existing land use in the vicinity of the proposed Vaal River/ Kabi Solar cluster, where they are all in very close proximity to existing mine landscapes where the landscape character is already degraded. There are also sufficient spaces between the Mercury PV projects where local vegetation and topographic screening would also reduce intervisibility, and the local landscape is also degraded to some degree from the Mercury Substation and background views of the north-western mine dumps. In conclusion, the potential for negative cumulative effects to arise from intervisibility such that landscape resources around the Mercury solar projects would be degraded, is rated as Medium to Low.

IMPACT ASSESSMENT CONCLUSION **Authorisation with mitigation**

The conclusion of this Visual Impact Assessment is that the proposed development should be authorised WITH MITIGATION. While landscape resources are not significant such that a fatal flaw is proposed, risks to landscape integrity of a rural area that has medium levels of scenic quality could take place. Mitigation would reduce the visual intrusion of the PV project and retain the rural sense of place along the narrow farm roads such that the defined Class III Visual Objectives are met i.e., partially retain the existing character of the landscape, where the level of change to the characteristic landscape should be moderate.

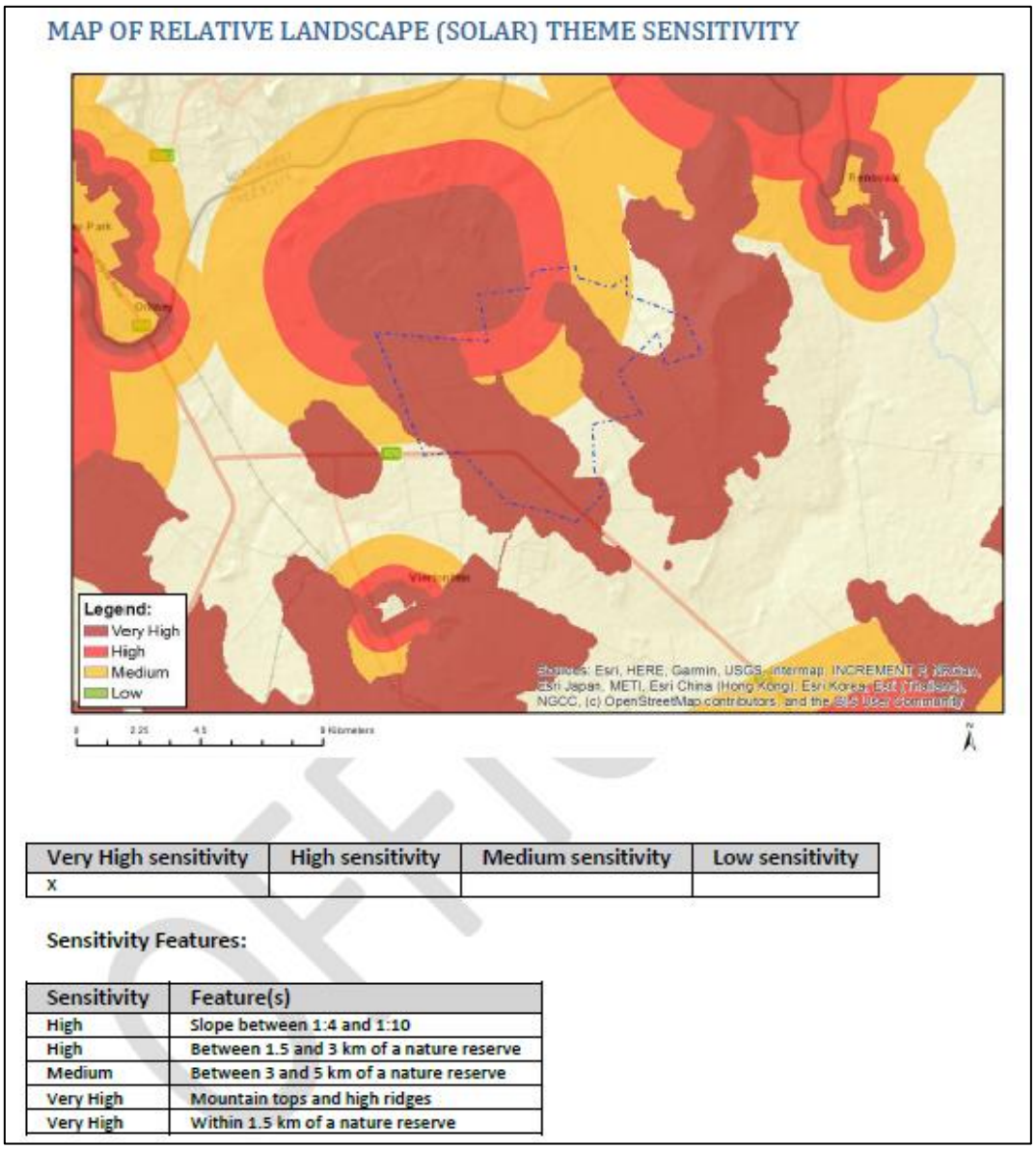
2 SITE SENSITIVITY VERIFICATION

In terms of Part A of the Assessment Protocols published in GN 320 on 20 March 2020, site sensitivity verification is required relevant to the DFFE Screening Tool as mapped below. The following table outlines the relevance of the risks raised in the SSV as informed by the site visit.

A field survey was undertaken on 04 March 2022 to inform the landscape and visual impact assessment. During the site visit, photographs were taken from each viewpoint, and the view direction and GPS location captured (refer to Annexure A). The main land use was 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 were also taken from key viewpoints.

The site investigation flagged landscape features and receptors that should be taken into consideration, and that were communicated to the EAP for early planning. The following landscape value issues were flagged:

- Wetland features within the proposed development site.
- Partially degraded rural agricultural landscapes due to proximity to large Eskom substations, multiple power lines as well as mining landscapes.
- Rural agrarian landscapes with Medium Scenic Quality in areas that were not exposed to the landscape-detracting visual elements related to mining and substations.



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
High	Slope between 1:4 and 1:10
High	Between 1.5 and 3 km of a nature reserve
Medium	Between 3 and 5 km of a nature reserve
Very High	Mountain tops and high ridges
Very High	Within 1.5 km of a nature reserve

Figure 1. DFFE Screening Tool map for Relative Landscape (Solar) for combined project area provided by the EAP.

Table 3. DFFE SSV PV and Landscape Risk table.

DFFE Feature	DFFE Sensitivity	Risk Verification	Motivation
Slope between 1:4 and 1:10	*High*	**Low**	No steep slope areas were identified on the project sites.
Between 1.5 and 3km of a nature reserve	*High*	**Low**	While the sites are defined as Private Nature Reserves, the landscape of both reserves are strongly defined by mining landforms located directly adjacent to the reserves. The more proximate reserve, Mispah Game Farm, incorporates a Tailing Storage Facility and as such is not a conservation area.
Between 3 and 5km of a nature reserve	*Medium*	**Low**	
Within 1.5km of a Nature Reserve	*Very High*	**Low**	
Mountain tops and High Ridgelines	*Very High*	**Medium to Low**	While regionally prominent in terms of elevation, the site comprises a wide spur landform and does not have any Mountain Tops and High Ridgelines. While the viewshed is likely to be widespread, no loss of Mountain or Ridgeline landscape features would be incurred.

3 INTRODUCTION

Visual Resource Management Africa CC (VRMA) was appointed by Landscape Dynamics (Pty) Ltd (hereafter referred to as EAP) to undertake a ***Visual Impact Assessment*** on the proposed Mercury Cluster Project (Northern PV Farms) PV Facility and Associated Infrastructure, on behalf of Mulilo Renewable Project Developments (Pty) Ltd. (Proponent).

The proposed development site is in the Free State Province, Fezile Dabi District Municipality and within the Moqhaka Local Municipality. The Proponent proposes to construct a cluster of Photovoltaic (PV) solar energy facilities and associated infrastructure known as Mercury Cluster Project (Northern PV Farms) which is made up of the following:

1. Mercury Cluster Project (Northern PV Farms)
    - Zaaiplaats Solar PV1
    - Kleinfontein Solar PV1
    - Vlakfontein Solar PV1

The proposed development will also comprise of one other PV Cluster projects and the Grid Connection Assessment. All clusters and the grid application will be subject to separate environmental applications. To ensure that cumulative visual impacts are assessed, mapping does include the other PV projects proposed on the property.

2. Mercury Cluster PV Project (Southern PV Farms) **(Separate VIA)**
    - Hormah PV Solar PV1
    - Ratpan PV1

3. Entire Grid Connection (300m corridor to investigate) **(Separate VIA)**
    - Zaaiplaats Solar PV1 Grid Connection
    - Kleinfontein Solar PV1 Grid Connection
    - Vlakfontein Solar PV1 Grid Connection
    - Hormah PV Solar PV1 Grid Connection
    - Ratpan PV1 Grid Connection

The different project components are unpacked in the Opportunities and Constraints section, with recommendation on alternative preference.

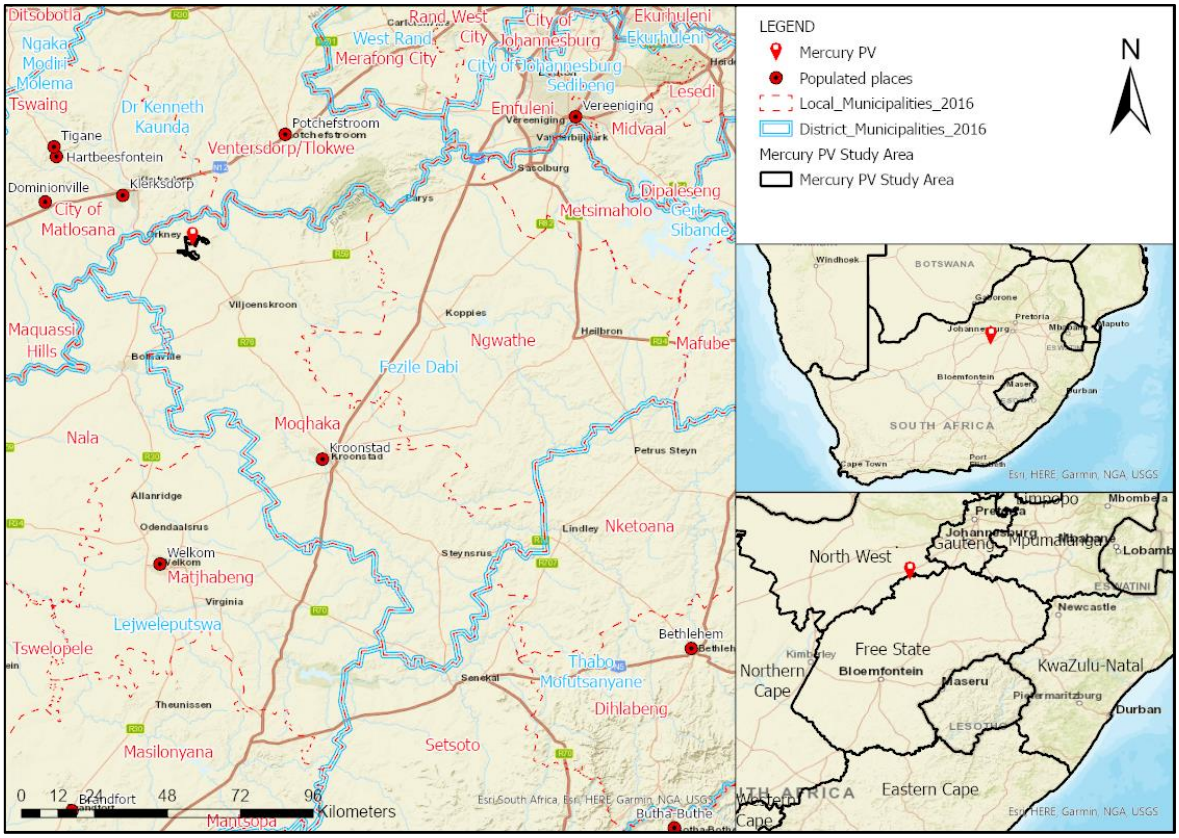


Figure 2. National locality map with the project location identified.

3.1 Terms of Reference

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

- Collate and analyse all available secondary data relevant to the affected proposed project area. This includes a site visit of the full site extent, as well as of areas where potential impacts may occur beyond the site boundaries.
- Specific attention is to be given to the following:
  - Quantifying and assessing existing scenic resources/visual characteristics on, and around, the proposed site.
  - Evaluation and classification of the landscape in terms of sensitivity to a changing land use.
  - Determining viewsheds, view corridors and important viewpoints in order to assess the visual impacts of the proposed project.
  - Determining visual issues, including those identified in the public participation process.
  - Reviewing the legal framework that may have implications for visual/scenic resources.
  - Assessing the significance of potential visual impacts resulting from the proposed project for the construction, operation and decommissioning phases of the proposed project.
  - Assessing the potential cumulative impacts associated with the visual impact.
  - Generate photomontages of the proposed landscape modification.

- Identifying possible mitigation measures to reduce negative visual impacts for inclusion into the proposed project design, including input into the Environmental Management Programme (EMPr).

3.2 Study Team

Contributors to this study are summarised in the table below.

Table 4: 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 Practitioner and • 16 years of experience in visual assessments including renewable energy, power lines, roads, dams across southern Africa. • Registered with the Association of Professional Heritage Practitioners since 2014.

3.3 Visual Assessment Approach

The full methodology used in the assessment can be found in Annexure B, with this section outlining the key elements of the assessment process. The process that VRM Africa follows when undertaking a VIA is based on the United States Bureau of Land Management's (BLM) Visual Resource Management method (USDI., 2004). This mapping and GIS-based method of assessing landscape modifications allows for increased objectivity and consistency by using standard assessment criteria.

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

Baseline Phase Summary

The VRM process involves the systematic classification of the broad-brush landscape types within the receiving environment into one of four VRM Classes. Each VRM Class is associated with management objectives that serve to guide the degree of modification of the proposed site. The Classes are derived by means of a simple matrix with the three variables being the scenic quality, the expected receptor sensitivity to landscape change,

and the distance of the proposed landscape modification from key receptor points. The Classes are not prescriptive and are utilised as a guideline to determine visual carrying capacity, where they represent the relative value of the visual resources of an area. Classes I and II are the most valued, Class III represents a moderate value; and Class IV is of least value. The VRM Classes are not prescriptive and are used as a guideline to determine the carrying capacity of a visually preferred landscape as a basis for assessing the suitability of the landscape change associated with the proposed project.

Table 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.

Impact Phase Summary

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

Assessment Approach

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 6: Approach 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 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.

3.4 Impact Assessment Methodology

The following impact criteria were used to assess visual impacts. The Impact criteria were provided by Landscape Dynamics and Landscape and Visual Impacts are evaluated and assessed in terms of the following criteria.

Extent of impact	***Explanation of extent***
Site	*Impacts limited to construction site and direct surrounding area*
Local	*Impacts affecting environmental elements within the local area / district*
Regional	*Impacts affecting environmental elements within the province*
National	*Impacts affecting environmental elements on a national level*

Duration of impact	***Explanation of duration***
Short term	*0 - 5 years. The impact is reversible in less than 5 years.*
Medium term	*5 - 15 years. The impact is reversible in less than 15 years.*
Long term	*>15 years, but where the impacts will cease if the project is decommissioned*
Permanent	*The impact will continue indefinitely and is irreversible.*

Probability of impact	***Explanation of Probability***
Unlikely	*The chance of the impact occurring is extremely low*
Possible	*The impact may occur*
Probable	*The impact will very likely occur*
Definite	*Impact will certainly occur*

Reversibility of impact	***Explanation of Reversibility Ratings***
Low	*The affected environment will not be able to recover from the impact - permanently modified*
Medium	*The affected environment will only recover from the impact with significant intervention*
High	*The affected environmental will be able to recover from the impact*

Significance of impact	***Explanation of Significance***
None	*There is no impact at all*
Low	*Impact is negligible or is of a low order and is likely to have little real effect*
Moderate	*Impact is real but not substantial*
High	*Impact is substantial*
Very high	*Impact is very high and can therefore influence the viability of the project*

3.5 Assumptions and Uncertainties

- Digital Elevation Models (DEM) and viewsheds were generated using ASTER elevation data (NASA, 2009). Although every effort to maintain accuracy was undertaken, as a result of the DEM being generated from satellite imagery and not being a true representation of the earth's surface, the viewshed mapping is approximate and may not represent an exact visibility incidence. Thus, specific features identified from the DEM and derive contours (such as peaks and conical

hills) would need to be verified once a detailed survey of the project area 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.

4 PROJECT DESCRIPTION

The following table outlines the project information that was provided by the client that will be incorporated into the assessment and proposed infrastructure relating to the project. Information provided by the client regarding the total Mulilo Mercury Cluster would include the following:

- Solar PV Farm (5m height max)
- 132kV Grid Connections with switching station/substations for each PV facility (Approx. 32m in height monopoles)
- Battery Energy Storage Systems (BESS) (Approx. 3m in height)
- Laydown area for the construction period
- Diesel storage facility of less than 500m3
- Operational & Maintenance Buildings
- Auxiliary Generator Set (GENSET) (To be confirmed)
- Additional infrastructure (Access Roads - new and/or upgrade; stormwater; water pipelines, etc.)

Other background to the project includes:

> *"The majority of the total assessment area of the 3 400 hectares site has a high agricultural sensitivity according to the Screening Tool of the Department of Forestry, Fisheries and the Environment (DFFE). The Subdivision of Agricultural Land Act (Act 70 of 1970) (SALA) requires that any long term lease or a change of land use on agricultural land be approved by the Department of Agriculture, Land Reform and Rural Development (DALRRD)"* (Landscape Dynamic Background Information Document).

Table 7: Project Information Table

PROJECT SPECIFICATIONS	
Applicant Details	**Description**
Applicant Name:	Mulilo Renewable Project Developments (Pty) Ltd
Project Name:	Kleinfontein Solar PV1, Vlakfontein Solar PV1, Zaaiplaats Solar PV1
PROPONENT SPECIFICATIONS	
Up to 100MW Vlakfontein	The Registered Landowner of the Farm Jackalsfontein

Solar PV1	No 443, Portion 1, Gregory Gossayn Trust, care of John Gossayn
	The Registered Landowner of the Farm Vlakfontein Nr 15, Alic Gossayn Pty Ltd, care of John Gossayn
Up to 120MW Kleinfontein Solar PV1	The Registered Landowner of the Portion 1 of the Farm Kleinfontein No 369, Gossayns Beleggings Pty Ltd, care of Beverley Gossayn
Up to 120MW Zaaiplaats Solar PV1	The Registered Landowner Peet Botha Familie Trust: • the Remainder of the Farm Zaaiplaats No 190 • Portion 2 of the Farm Fraai Uitzicht No 189
	The Registered Landowner of the Remainder of the Farm Fraai Uitzicht 189, Alic Gossayn (Pty) Ltd, Care of John Gossayn

Figure 3: Photographic Example of Rows of PV panels (www.hawaiirenewableenergy.org/Villamesias2, n.d.)

Figure 4: Photographic Example of Single portrait tracker PV (Photo – Cape EAPrac, 2019)

(Source: Jawatha, India. www.nccprojects.com)

Figure 5: Monopole photographic examples

Figure 6. Artist's impression of a Tesla Battery Energy Storage System (BESS) in landscape.

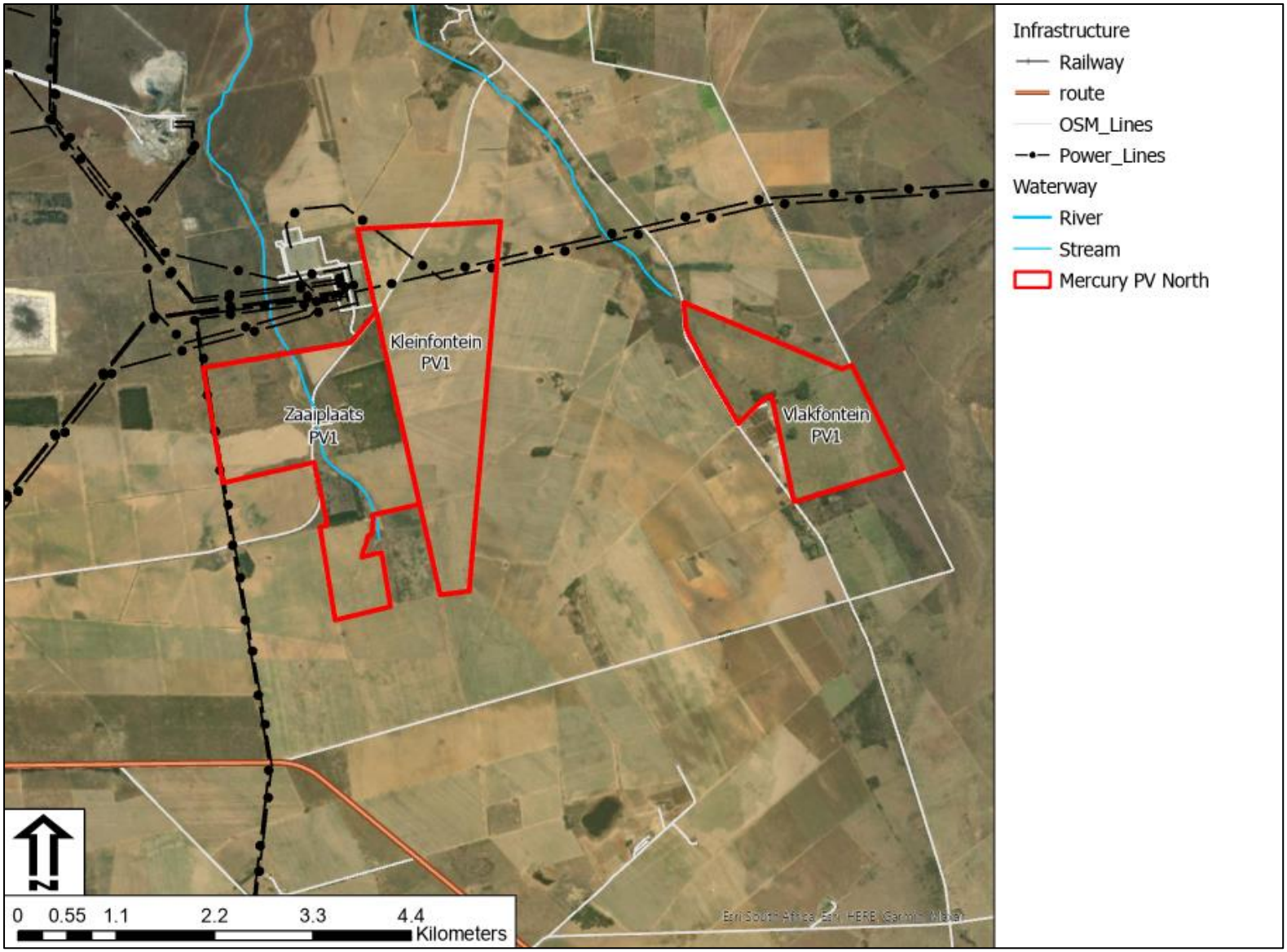


Figure 7: Proposed layout map depicting the proposed three projects of the Northern Cluster.

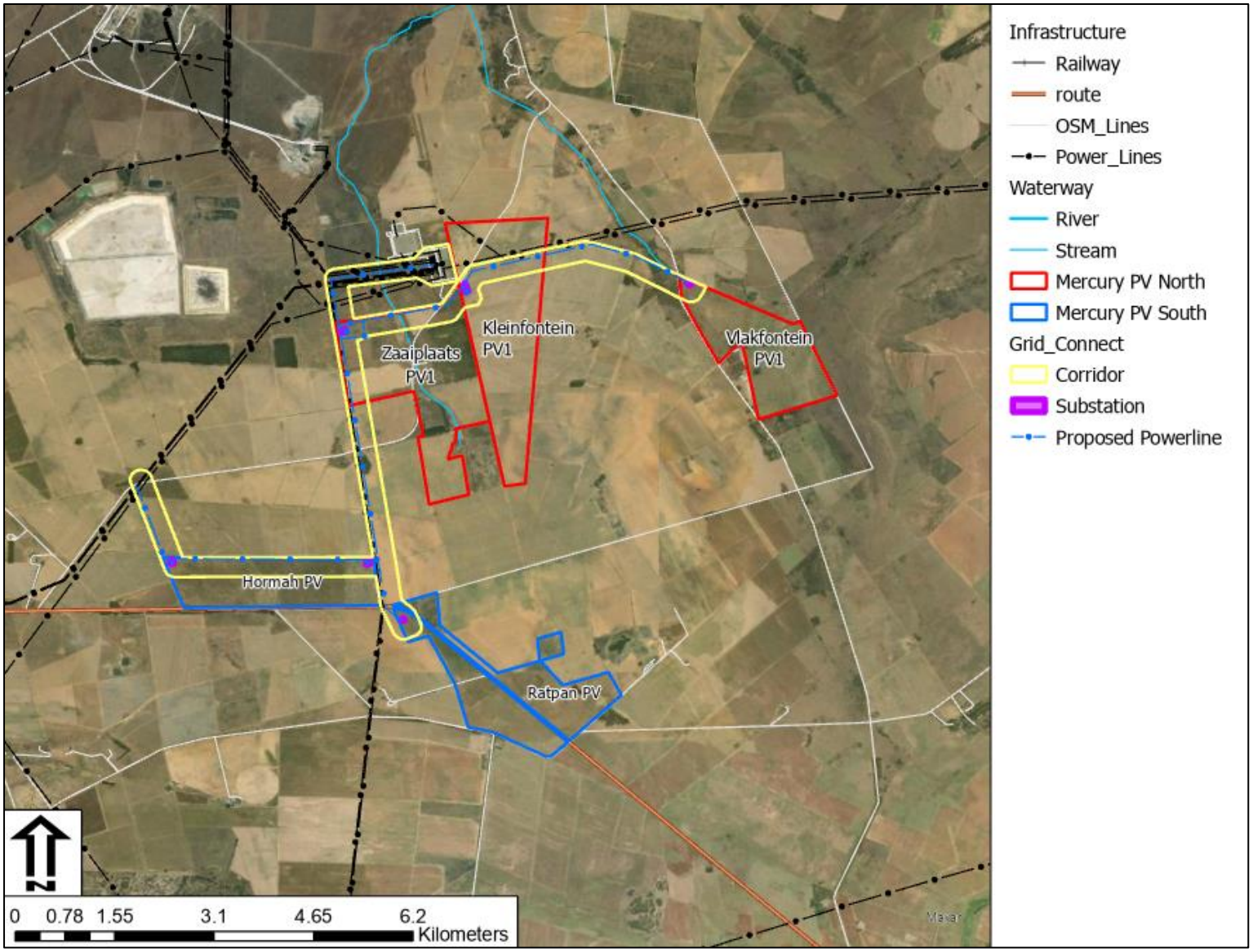


Figure 8: Combined layout map depicting the Northern and Southern PV Clusters and the Grid connection.

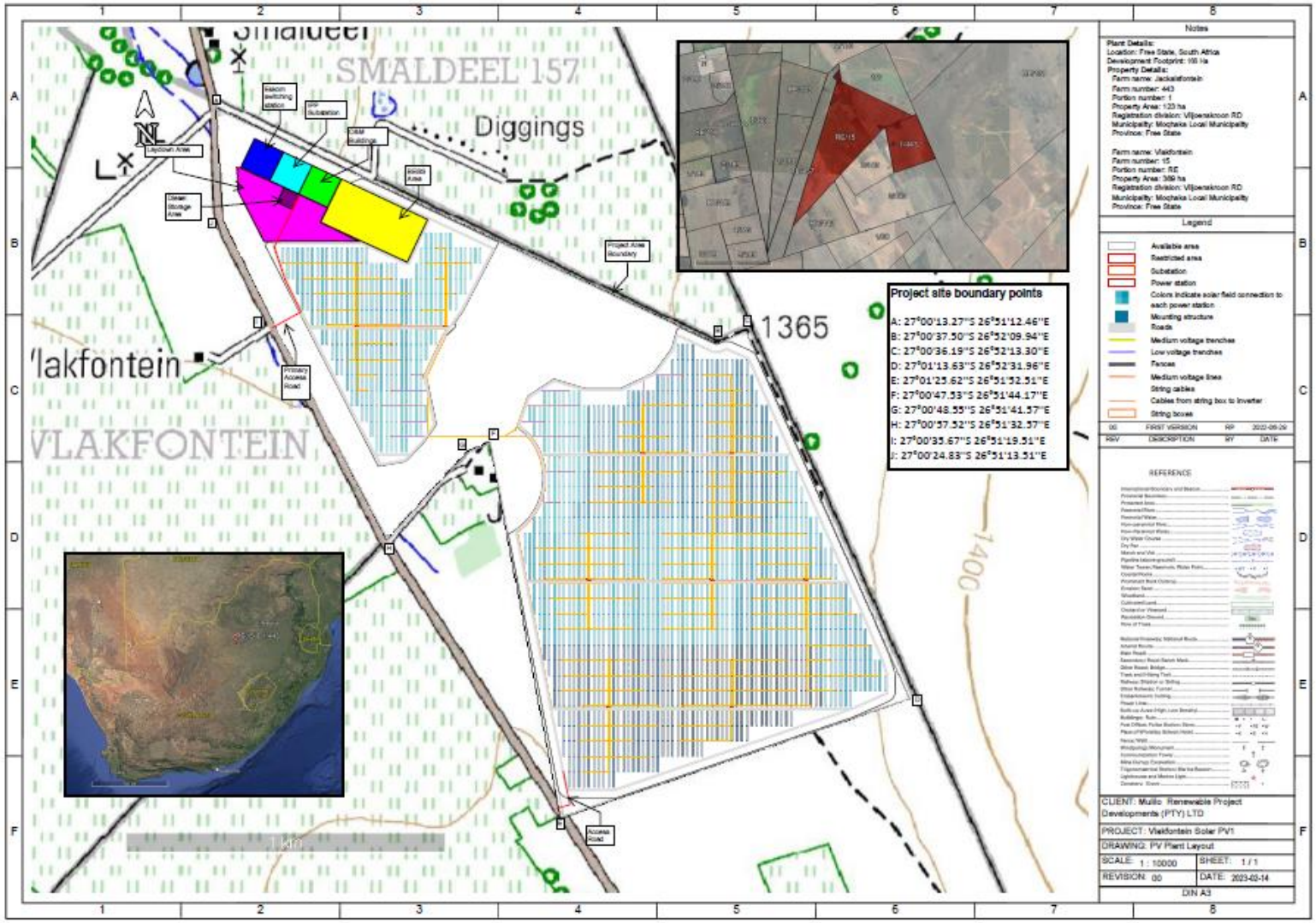


Figure 9: Detailed layout plan for Vlakfontein.

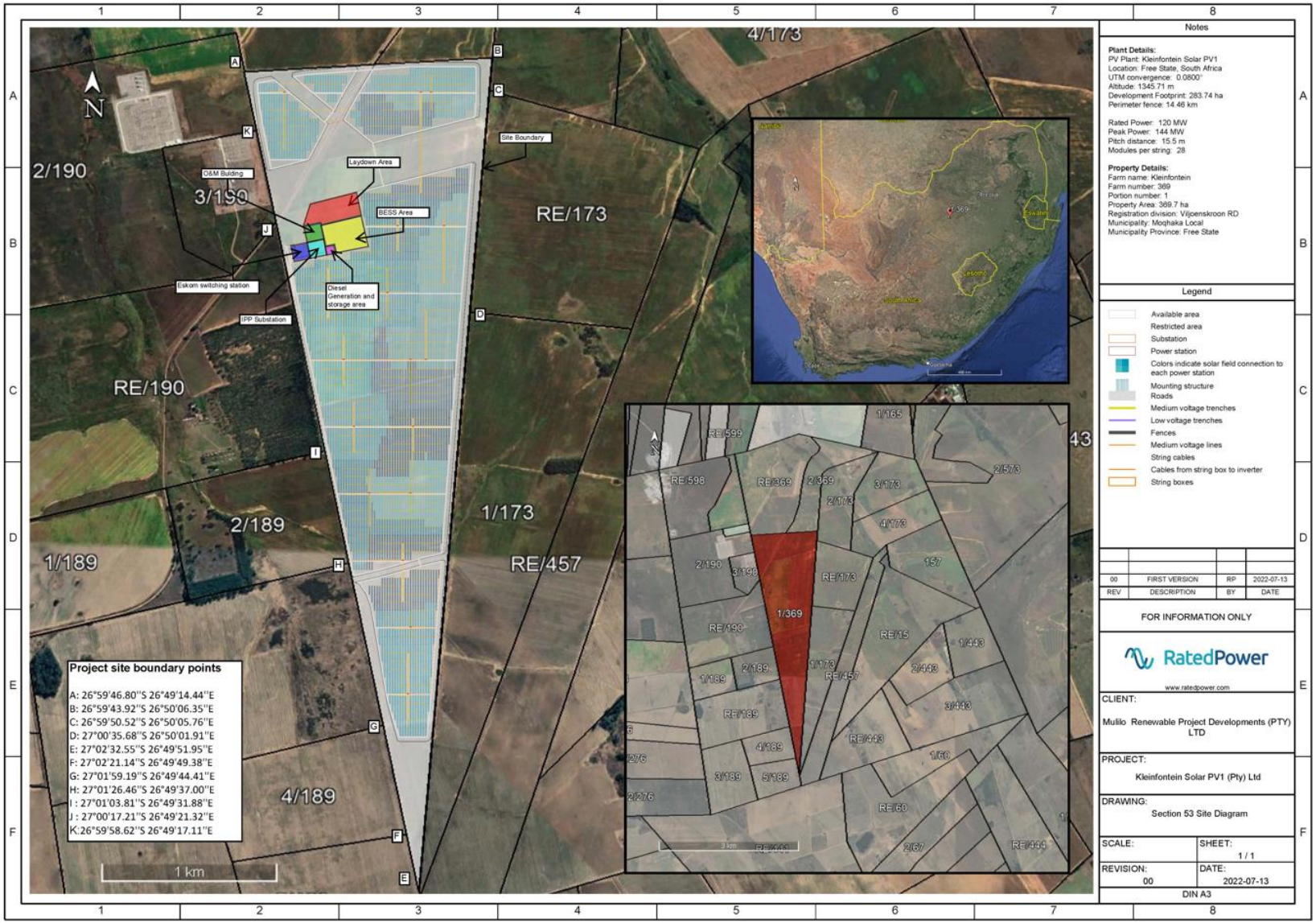


Figure 10: Detailed layout plan for Kleinfontein.

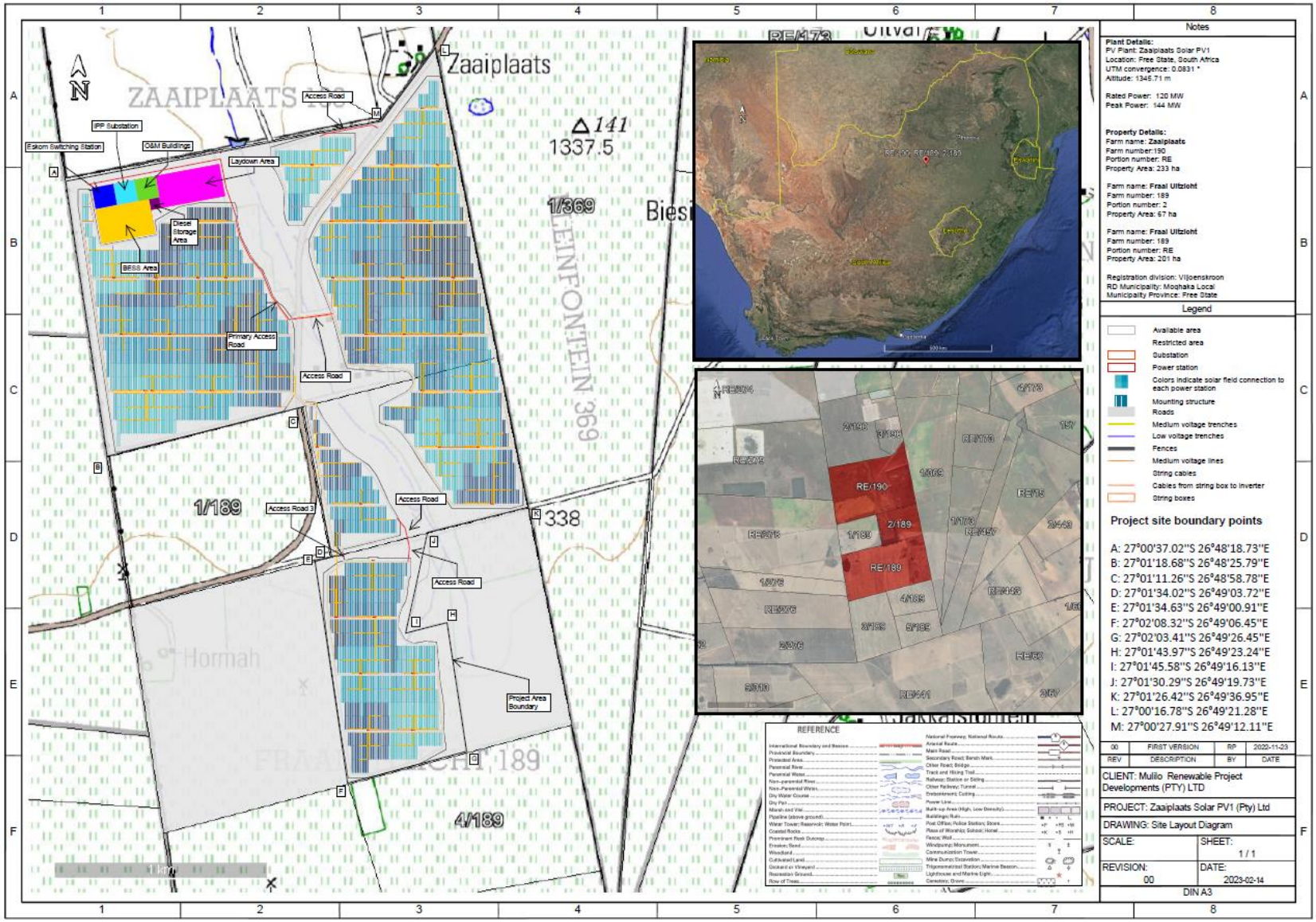


Figure 11: Detailed layout plan for Zaaiplaats.

5 LEGAL FRAMEWORK

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

5.1 International Good Practice

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

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

5.1.1 Guidelines for Landscape and Visual Impact Assessment, Second Edition

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

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

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

5.1.2 International Finance Corporation (IFC)

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

are sacred sites and areas of importance for recreation and aesthetic enjoyment" (IFC, 2012).

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

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

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

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

5.1.3 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)

5.2 National and Regional Legislation and Policies

In order to comply with the Visual Resource Management requirements, it is necessary to clarify which National and Regional planning policies govern the proposed development area to ensure that the scale, density and nature of activities or developments are harmonious and in keeping with the sense of place and character of the area as mapped in Figure 12 below.

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

Table 8: List of key planning informants to the project.

Theme	Requirements
Province	Free State Province
District Municipality	Fezile Dabi District Municipality
Local Municipality	Moqhaka Municipality
REDZ	Klerksdorp REDZ

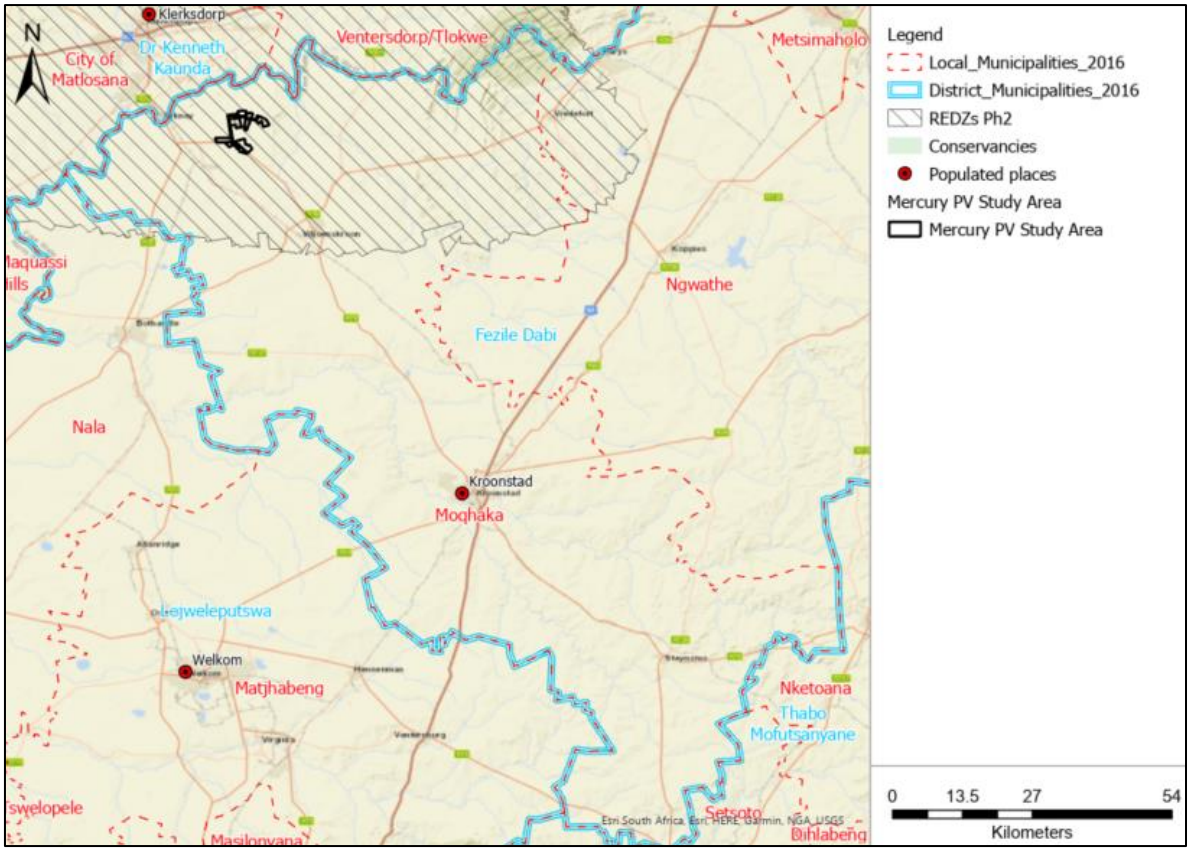


Figure 12: Planning locality map depicting the location of the project within the Klerksdorp REDZ.

5.2.1 DEA&DP Visual and Aesthetic Guidelines

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

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

5.2.2 REDZ Planning

A Strategic Environmental Assessment commissioned by the Department of Environmental Affairs, undertaken by the CSIR, identified Renewable Energy Development Zones (REDZs). These are gazetted geographical areas in which several wind and solar PV development projects will have the lowest negative impact on the environment while yielding the highest possible social and economic benefit to the country. (Department of Environment Affairs). **The proposed project is located within the Klerksdorp REDZ**.

5.2.3 Local and Regional Planning

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

Table 9: Fezile Dabi District Municipality (Fezile Dabi District Municipality, 2020)

Theme	Requirements	Page
Renewable Energy	Ensure access to affordable, reliable, sustainable & modern energy for all	39
	Supporting sustainable green energy initiatives on a national scale through a diverse range of clean energy options as envisaged in the Integrated Resource Plan (IRP 2010); and Support biofuel production facilities.	204
Tourism	To promote & develop the tourism sector in the District.	79

Table 10: Moqhaka Local Municipality Integrated Development Plan (Moqhaka Municipality, 2016)

Theme	Requirements	Page
Renewable Energy	Simplifying the regulatory regime to encourage renewable energy, regional hydroelectric initiatives, and independent power producers.	72
Economy	• Future growth is attributed to the strong commercial and industrial component of the region. • Future urbanisation will principally be attributed to farm workers that settle in the urban areas.	112
	• All the proposed future developments that have a potential to contribute to robust local economies require further investigation on impact and viability, to also be included in the LED sector plan	115
Tourism	Growth is envisaged due to the weekend related tourism potential of the area.	112
	The vision for Local Economic Development within Moqhaka Local Municipality is as follows: To build Moqhaka into one of the ultimate holiday getaway for domestic tourism within the Free State Province and Fezile Dabi District as well as the vibrant destination of choice to live and work.	115

5.3 Landscape Policy Fit

Policy fit refers to the degree to which the proposed landscape modifications align with International, National, Provincial and Local planning and policy. In terms of international best practice, the proposed landscape modification would not trigger any best practice guidelines as there are no significant cultural/ landscape resources on the site or immediate surrounds.

In terms of the local planning, there is a clear emphasis in support of renewable energy that aligns with the project planning that is further supported at a National level with the location of the project site within the Klerksdorp REDZ. There is also a focus on tourism and growth of tourist related resources. However, ~~A~~as there are no significant landscape

resources being utilised for tourism within the project zone of visual influence, the ***expected visual/ landscape policy fit of the landscape change is rated Medium to High.***

6 BASELINE VISUAL INVENTORY ASSESSMENT

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

6.1 Landscape Context

6.1.1 Regional Locality

According to the Moqhaka Local Municipality (LM) website, the LM is a Category B municipality situated within the southern part of the Fezile Dabi District in the Free State Province. It is the largest of four municipalities in the district, making up over a third of its geographical area. The former Kroonstad, Steynsrus and Viljoenskroon Transitional Local Councils and sections of the Riemland, Kroonkop and Koepel Transitional Rural Councils are included in the municipality. The seat of local government is Kroonstad. The website indicates that Moqhaka is significantly less urbanised in comparison to the other municipalities within the Fezile Dabi District. The Greater Kroonstad area is the centre of a large agricultural community that plays an important role in the economy of the district. Subsequently, industrial activities contribute significantly to the district's economy. Of possible relevance to the projects, the LM indicates that Kroonstad has recently become a distinguished holiday destination due to the ultra-modern and popular holiday resort of Kroonpark, adjacent to the Vals River (Moqhaka Municipality, n.d.).

In addition to the existing formal urban areas, several residential areas and proclaimed town areas are situated in Moqhaka with reference to Renovaal, Vierfontein and the Vaal Reefs hostel complex and settlement. Renovaal was established during 1974 adjacent the Vaal River with the intention to provide residence in the proximity of the gold mining activities in the North West Province. The town was also later marketed as a leisure residential area with recreation potential adjacent the Renoster and Vaal Rivers. Development of the town is, however, extremely latent, and only the proposed first phase of the town was established. According to Proclamation No. 167 of 1975, the concerned area represented by General Plan SG No. 459/1974, was proclaimed a township under the name Renovaal (Moqhaka Municipality, n.d.).

The following landscape themes were identified within the project vicinity as mapped in Figure 13 below.

- Eskom Mercury Substation and multiple power lines.
- A low hill to the east but essentially flat or moderately undulating terrain.

- Vaal River landscape resources.
- Mining landscapes to the northwest.
- Agrarian maize land uses with associated cultural landscape heritage.

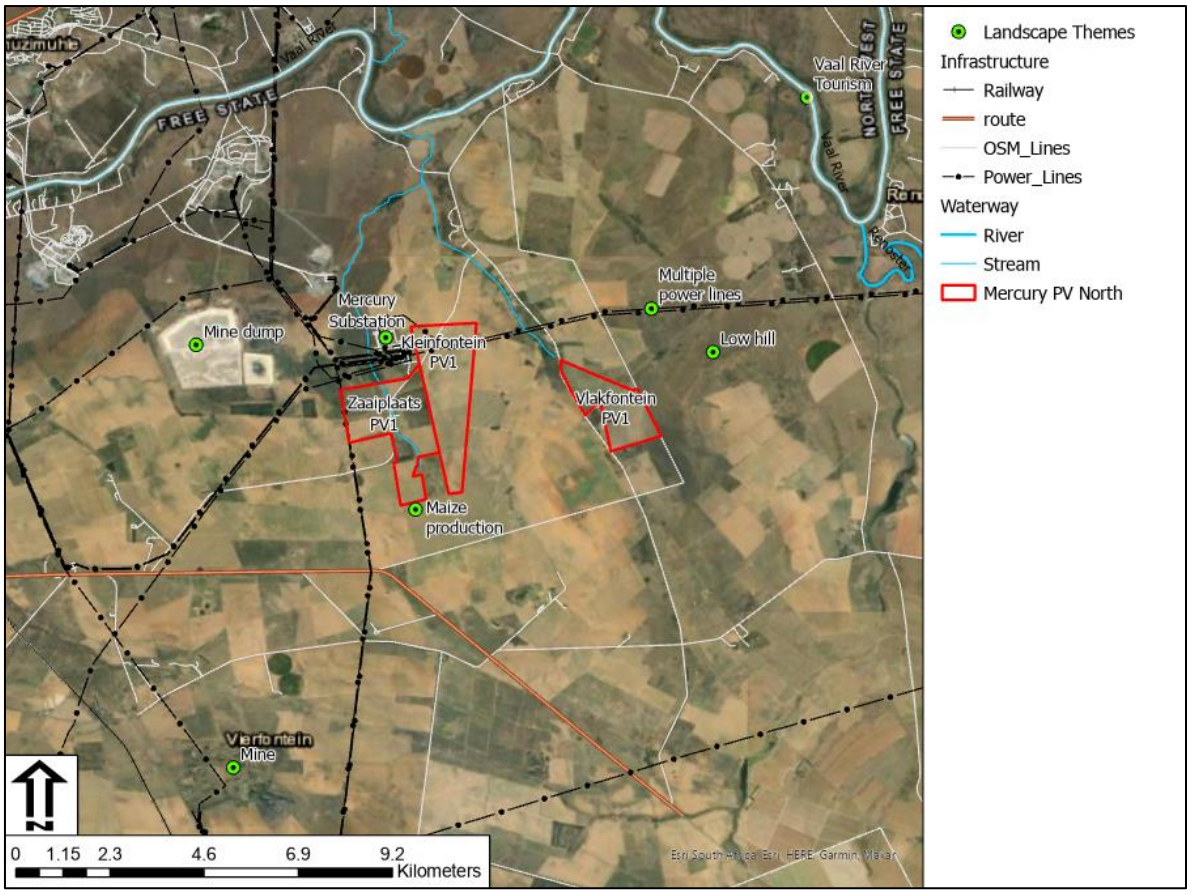


Figure 13. Local landscape themes map.

6.1.2 Infrastructure, Mining and Road Access

There are no significant roads within the project Zone of Visual Influence (ZVI) with R76 the main road between the small towns of Vijoenskraal and Orkney. The Eskom Mercury Substation is immediately adjacent to the project area and as a result, numerous power line corridors are routed through the landscape.

Visually, the regional landscape has a high absorption capacity: there are many visually intrusive artificial features present in the general locality which will serve to detract and diminish the visual impact presented by the new PV installations and supporting infrastructure. These include numerous powerlines, converging on a large regional Mercury Substation, mining features (mine dump) and agro-industrial features, such as centre pivot irrigation schemes. While the reflective nature of the PV panels may draw attention to the installations, visual intensity from receptors located over 6km from the site will further be diminished by hazy atmospheric conditions which tend to prevail during the highveld winters.

Figure 14: Photograph of the Eskom Mercury Substation.

Figure 15: Zoomed photograph of the mining landscapes.

6.1.3 Other Renewable Energy Projects

A better understanding of the location of other Renewable Energy projects is important as the intervisibility of multiple project is close proximity to each other has the potential to alter a rural landscape and possible degrade landscape and visual resources. In order to ascertain if this is a potential issue for the project, the DEFF Renewable Energy Areas spatial dataset is mapped within a 30km distance from the project area overlaid onto satellite imagery to better understand the regional land uses.

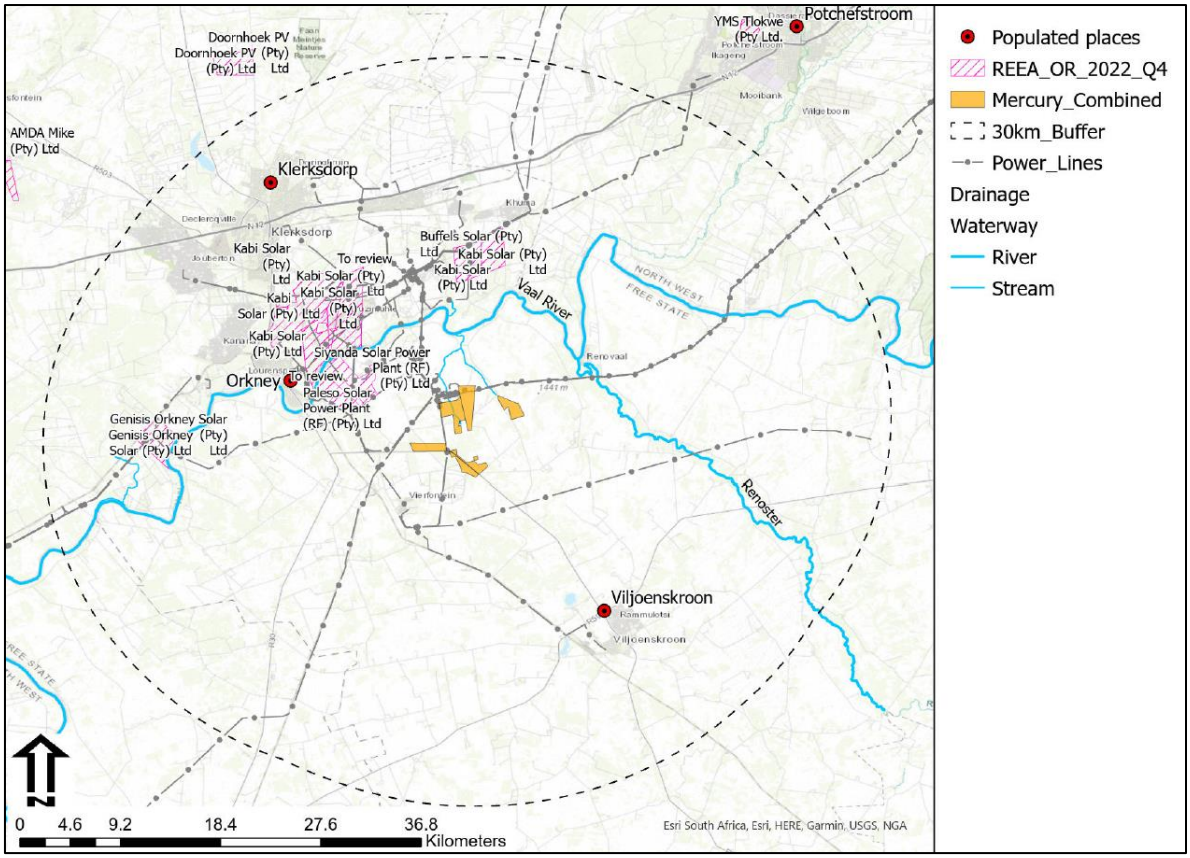


Figure 16: Map depicting DEA Renewable Energy project status.

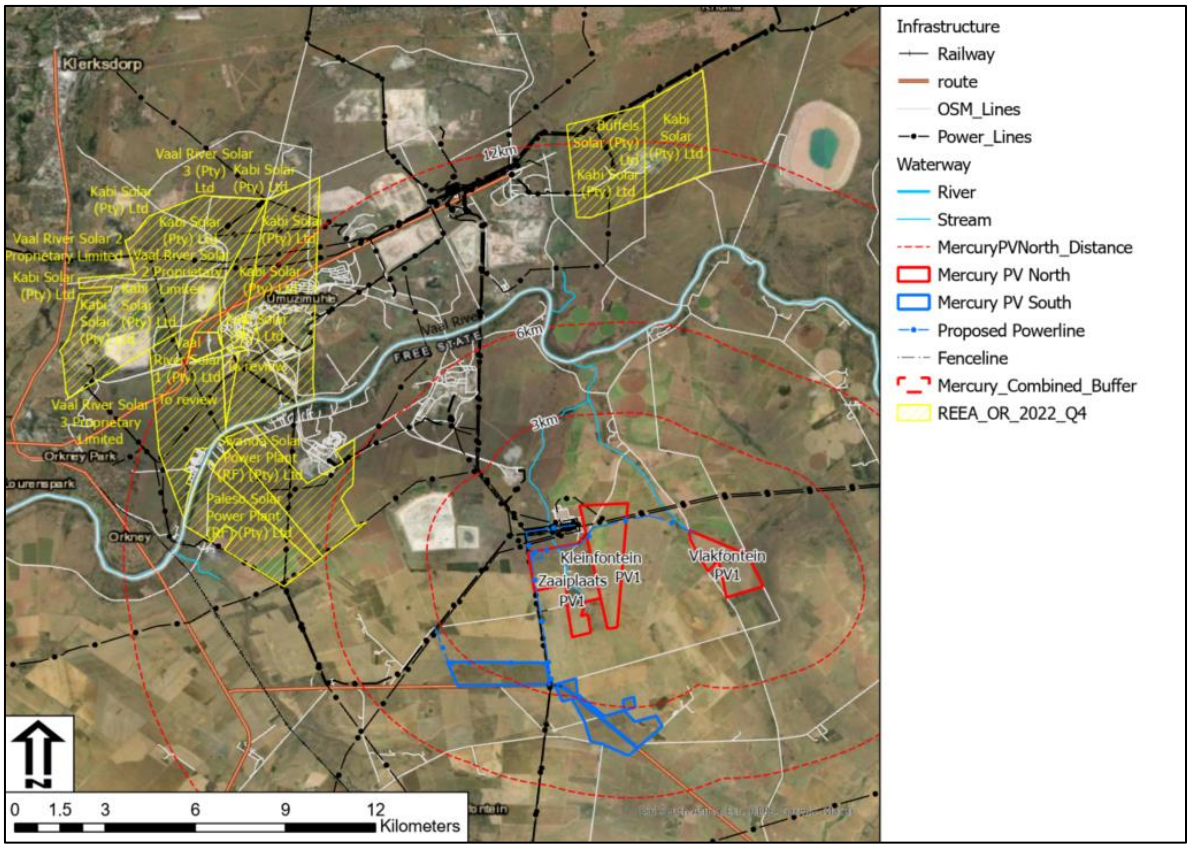


Figure 17: Map depicting DEA Renewable Energy project status.

The regional mapping depicts that numerous solar PV projects are proposed within the 30km buffer to the north and northwest of the projects. Proposed projects include the Vaal River Solar, Buffels Solar, numerous Kabi Solar, and closer to the proposed project in the northwest are Sivanda Solar and Paleso Solar.

While this intensity of development could influence the local landscape character, there area two factors that mitigate the negative intervisibility effects. The first factor pertains to distance where the nearest project is six kilometres distant. This places the other projects outside of the Foreground/ Mid Ground where landscape changes are most likely to influence the landscape character. The second factor pertains to the existing land use in the vicinity of the proposed Vaal River/ Kabi Solar cluster, where they are all in very close proximity to existing mine landscapes where the landscape character is already degraded. There are also sufficient spaces between the Mercury PV projects where local vegetation and topographic screening would also reduce intervisibility, and the local landscape is also degraded to some degree from the Mercury Substation and background views of the north-western mine dumps. In conclusion, the potential for negative cumulative effects to arise from intervisibility such that landscape resources around the Mercury solar projects would be degraded, is rated as Medium to Low.

6.1.4 Nature and Tourism Activities

Background research to recreation in the area identified the following:

The Vaal River is close to Viljoenskroon and is popular for the many water sports it offers. Viljoenskroon has history and character. It also has well-established stud farms, and those with a passion for horses come from afar to appreciate the world-class studs that live here. Viljoenskroon is also home to one of the largest grain silos in the country (https://www.sa-venues.com/attractionsfs/viljoenskroon.php, n.d.)*. Tourism activities include in the Viljoenskroon area include Agricultural Tourism including Agricultural Exhibitions, Stud Farming and the Evans Tractor Museum. Recreational tourism includes its proximity to water sports, hunting and nature reserves as well as golfing.* (Moqhaka Municipality, n.d.)

As depicted in Figure 18 below, the nearest significant nature conservation area is the Mispah Game Farm. This PNR is highly exposure to mining landscapes, and views towards the proposed PV site also include large mining landforms. The Bushybend Private Nature Reserve is in the viewshed, but situated will have partial, background views of the proposed landscape change, without significant change anticipated to the local PNR sense of place. The Mahemsvlei PNR is outside the project viewshed.

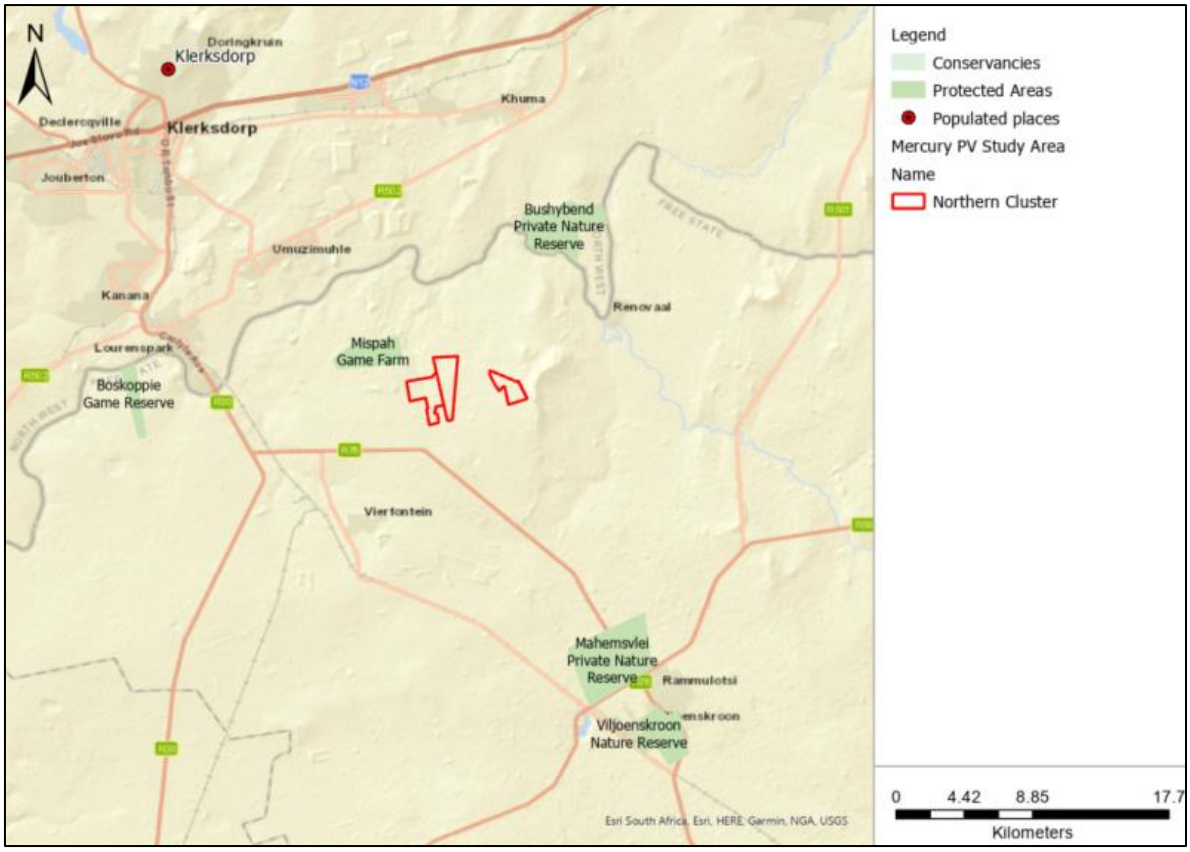


Figure 18: Map depicting the mapped tourism activities located within the project region.

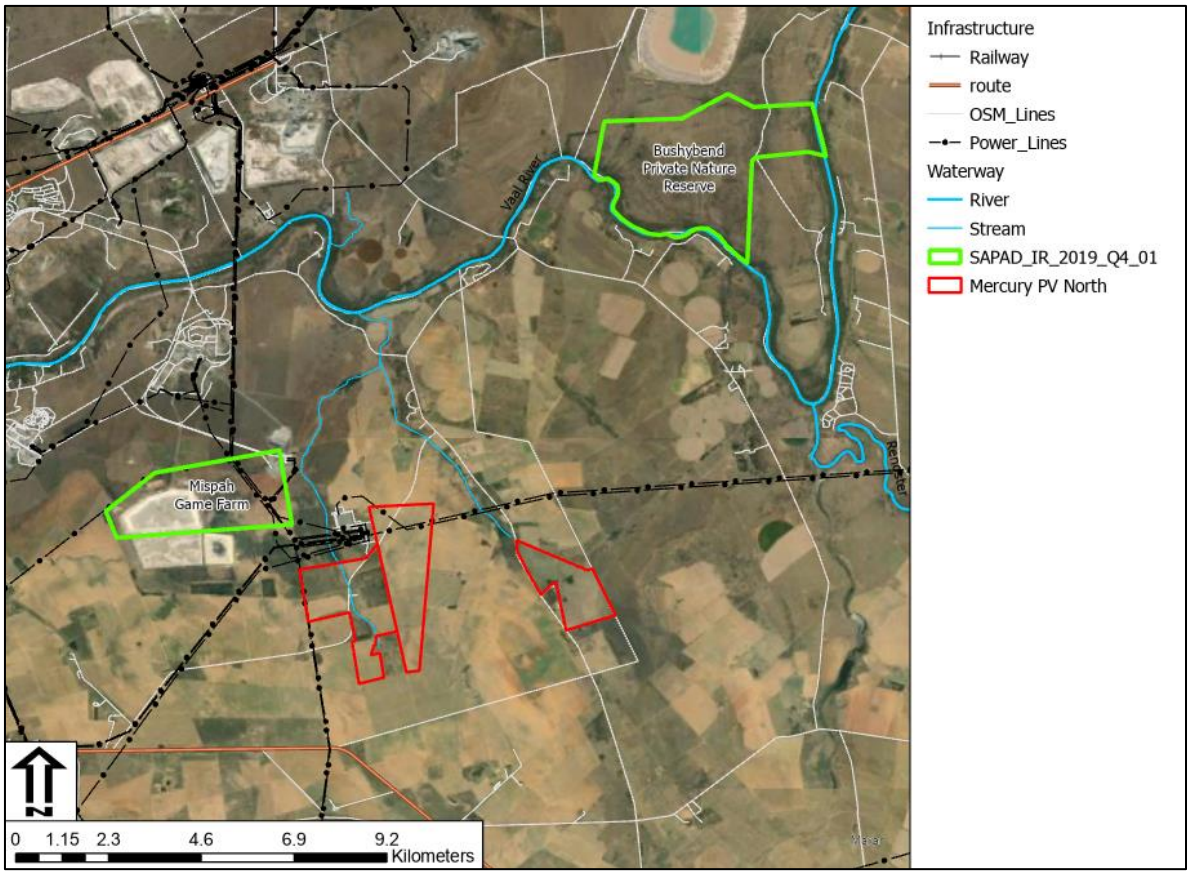


Figure 19: Tourism landscape significance map in relation to overall project areas.

The Vaal River is identified by the LM as a key tourist-related attraction in the region. Located 6km north from the northern PV cluster, views of the proposed PV landscape change as seen from the river locality are possible as the 6km distance is within the Foreground / Mid-ground where landscape change is likely to be noticed. However, as the Vaal River is in an incised valley, where views from the Vaal River towards the proposed development site are highly unlikely. The tourist attraction is also not accessed via any of the roads routed through the proposed development areas.

6.1.5 Vegetation

Vegetation type is a large factor in determining the scenic quality or the site in terms of colour and texture, as well as influencing the local ability of the landscape to absorb the landscape change. The following paragraph and mapping outline the broad vegetation biome and type.

According to the South African National Biodiversity Institute (SANBI) 2012 Vegetation Map of South Africa, Lesotho and Swaziland (South African National Biodiversity Institute, 2012) the project area is located in the Grassland Biome which covers large areas of the central part of southern Africa and includes a wide range of altitude from 300m-400m to over 3000m in the Lesotho highlands. The SANBI Plantzafrica website indicates that the extent of this biome can be defined on a basis of vegetation structure in combination with environmental factors, particularly the amount of summer rainfall and the minimum temperature in winter. The grasslands are strongly dominated by Poaceae (grasses) with woody species limited to specialised niches. Forbs, although not dominate, contribute significantly to the species richness.

The project area lies on the interface between the dry and the mesic grassland vegetation types: the Northern Cluster falls almost exclusively in the Vaal-Vet Sandy Grassland (dry) vegetation type, within the Grassland Biome; while the extreme eastern portion of the Vlakfontein PV1 site extends into the Rand Highveld Grassland (mesic). The Vaal-Vet Sandy Grassland is characterised by low-tussock grasslands with an abundant karroid element. *Themeda triandra* is an important feature of this vegetation type although it is vulnerable to overgrazing and is often lost to a dominance of *Aristida*, *Elionurus* and *Cymbopogan* species. The conservation status of this vegetation type is classified Endangered within only 0,3% statutorily conserved, while more than 63% is transformed for cultivation of commercial crops and the rest under heavy grazing pressure (SANBI Plantzafrica website). The Rand Highveld Grassland has similar grass species but tends to lack the karroid component as conditions tend to be more moist.

The Greater Kroonstad area is the centre of a large agricultural community that plays an important role in the economy of the district made up of primarily cattle and maize farms. (https://municipalities.co.za/overview/1041/moqhaka-local-municipality, n.d.). Much of the natural vegetation in the areas occupied by the northern cluster has been highly transformed through a combination of intensive crop production (maize) and commercial stock farming.

Although, visual screening from existing trees is likely to be limited as there are few trees in the landscape, the conditions are conductive to the establishment of trees as visual screens, should this be required under the mitigation measures.

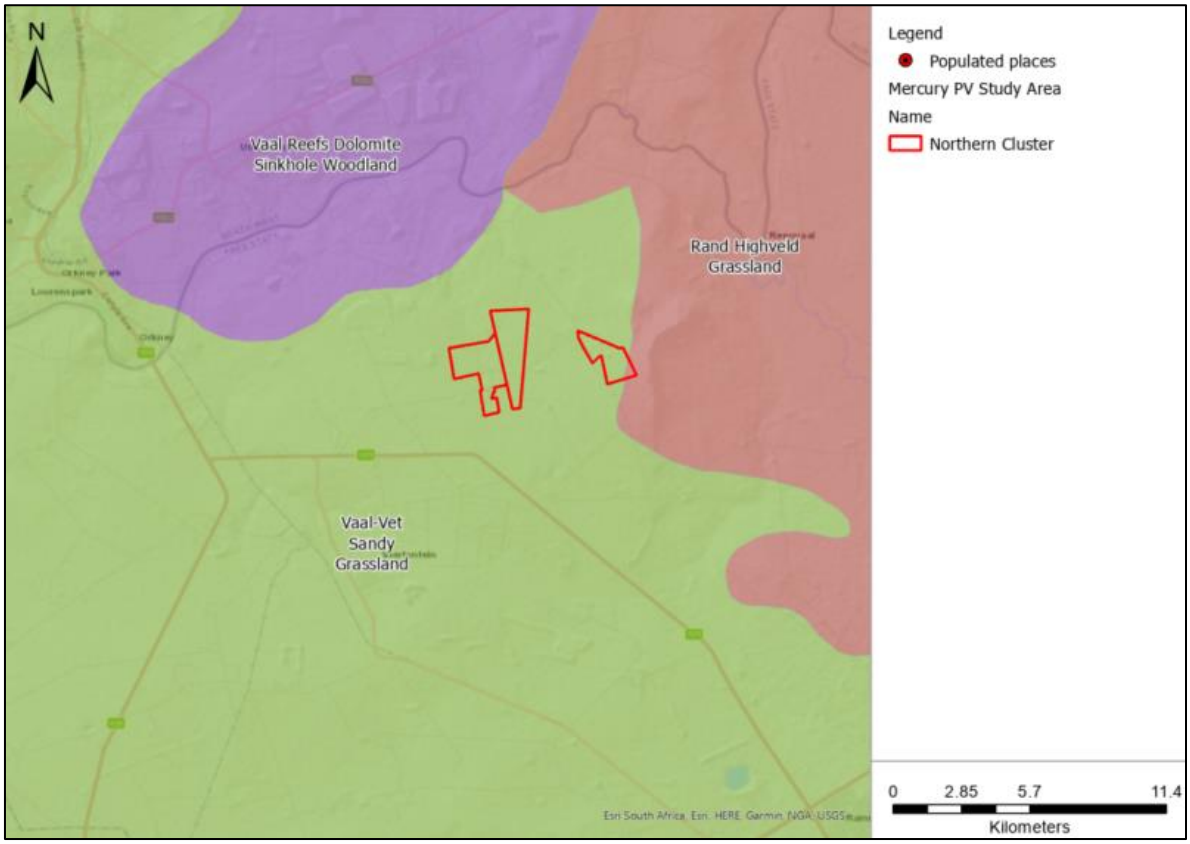


Figure 20. BGIS Vegetation Type Map (South African National Biodiversity Institute, 2018)

6.2 Project Zone of Visual Influence

The visible extent, or viewshed, is “the outer boundary defining a view catchment area, usually along crests and ridgelines” (Oberholzer, 2005). In order to define the extent of the possible influence of the proposed project, a viewshed analysis was undertaken from the proposed site at a specified height above ground level as indicated in the table below, which makes use of open-source NASA ASTER Digital Elevation Model data (NASA, 2009). The maps are informative only as visibility tends to diminish exponentially with distance, which is well recognised in visual analysis literature (Hull & Bishop, 1988). The viewshed is strongly associated with the regional topography and as such this topic is address before the viewshed analysis.

6.2.1 Regional Landscape Topography

Making use of the NASA STRM digital elevation model, profile lines were generated for the area within the regional locality of the project area. The map depicting the regional elevation profile lines can be view in Figure 21 below, with the regional terrain model and profile line located below the map. The regional topography is typical of the north-western Free State: i.e., flat to gently undulating with shallow, broad river valleys and drainage lines and low-lying ridges. Topographically, the region is dominated by the Vaal River, which

passes 5km to the north of the northern cluster. Within the regional topographic context, the minimum elevation is 1281mamsl along the Vaal River, with a maximum elevation of 1404mamsl - a north-south orientated ridge immediately to the east of the northern cluster. The Northern Cluster is on a gentle north-facing slope, with an average elevation of ~1335mamsl.

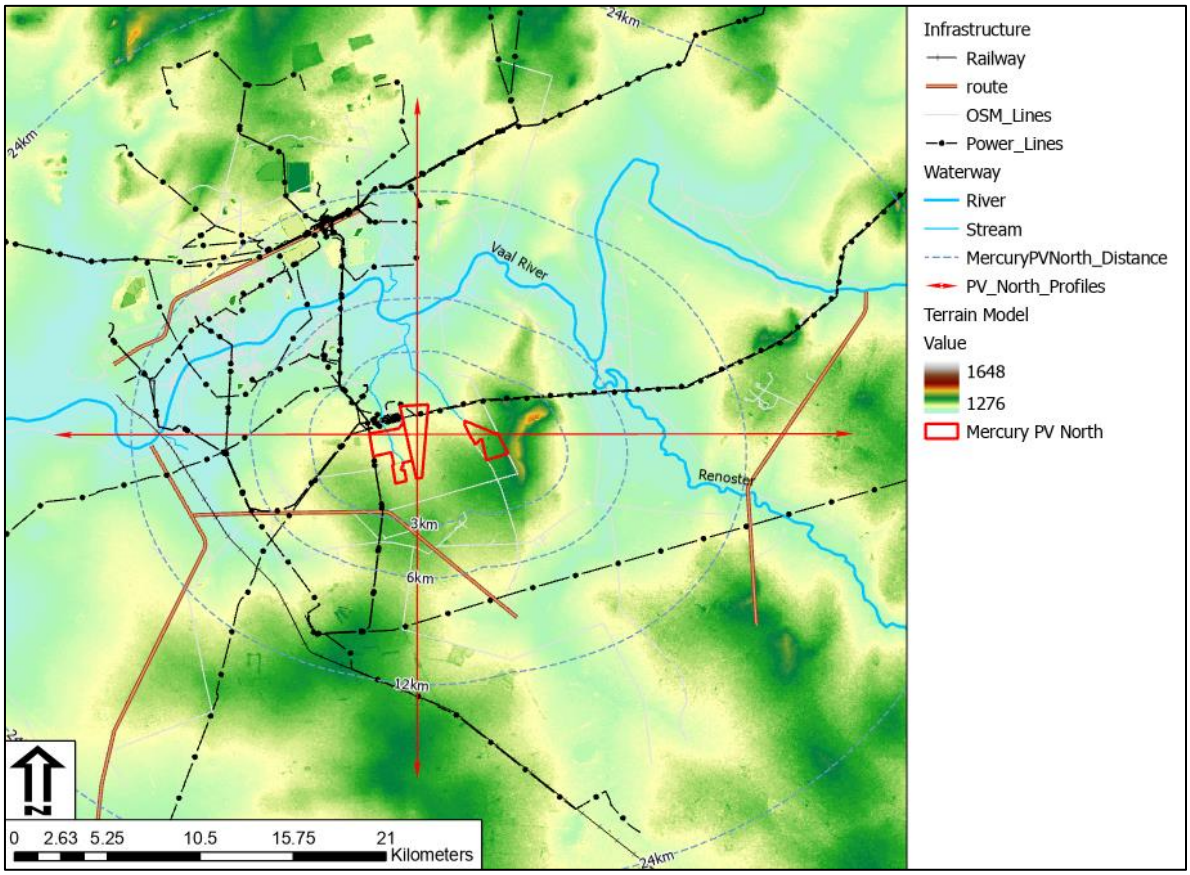


Figure 21: Regional Elevation Profiles East to West and North to South profiles (Google Earth Pro).

6.2.2 Site Slope and Landform

The following topographical landforms were identified within the locality of the project.

- Undulating terrain with no dominating landforms.
- Drainage lines with likely wetland areas.
- Possible low prominence, steep slope areas.

No significant landform features were identified on the sites. Zaaiplaats PV1 site does have a shallow drainage line where wetland features are likely. These areas are key features in the landscape and as such would need to be excluded as defined in the Surface Water Hydrologist specifications.

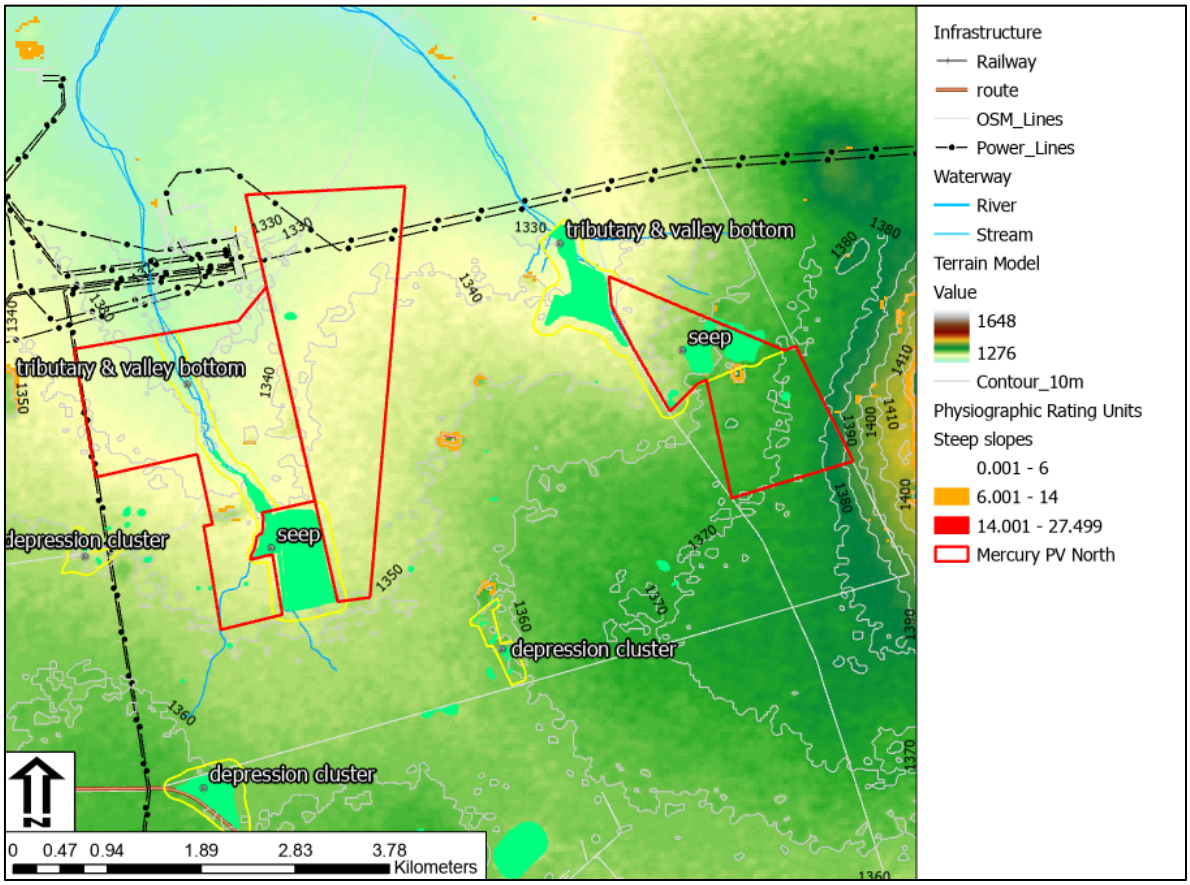


Figure 22: Study area topographic informed landforms map with overlay of Surface Water Hydrology constraints areas.

6.2.3 Viewshed Analysis

A viewshed analysis was undertaken for the site making use of NASA SRTM 30m Digital Elevation Model data. The Offset value for the PV Solar Facility was set above ground to represent the approximate height of the proposed development as reflected in the table below. 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.

Table 11: Proposed Project Heights Table

Proposed Activity	Approx. Height (m)	Terrain Model Extent
Mercury Cluster Project	5m	24km

As can be viewed in Figure 23 on the following page, the viewshed is mainly orientated in a northerly direction, i.e., towards and north of the Vaal River extending over 12km. In an easterly, southerly, and westerly direction, due to the local terrain, it is largely contained to within 3km. Several potentially sensitive receptors are located within the high frequency viewshed and within 6km of the site, notably: a short stretch of the R76 Highway; two gravel district roads and two farmsteads. The Wawielpark Holiday Resort on the Vaal River is in the viewshed, however, this is in a low view frequency zone and located within the Vaal River Valley with views focused towards the river landscape away from the proposed PV development.

The cumulative viewshed of the entire scheme is depicted in Figure 24. This is closely aligned to the Northern Cluster viewshed, which extends predominantly in a northerly direction, well over 12km. While the dark colour and semi-industrial nature of the PV panels may draw attention to the installations, visual intensity from receptors located over 6km from the site will further be diminished by hazy atmospheric conditions which tend to prevail during the highveld winters.

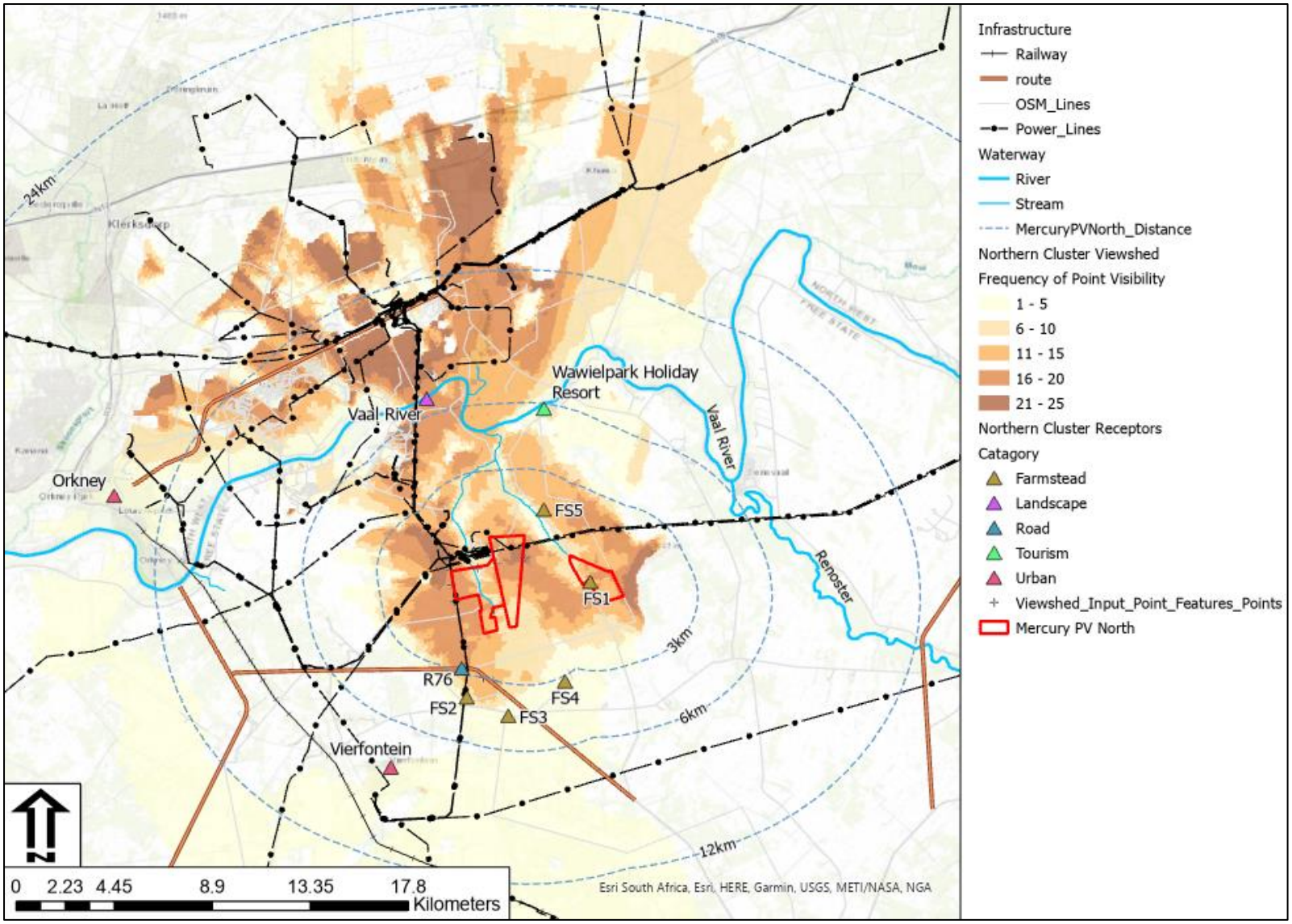


Figure 23: Northern Cluster viewshed frequency and receptors map.

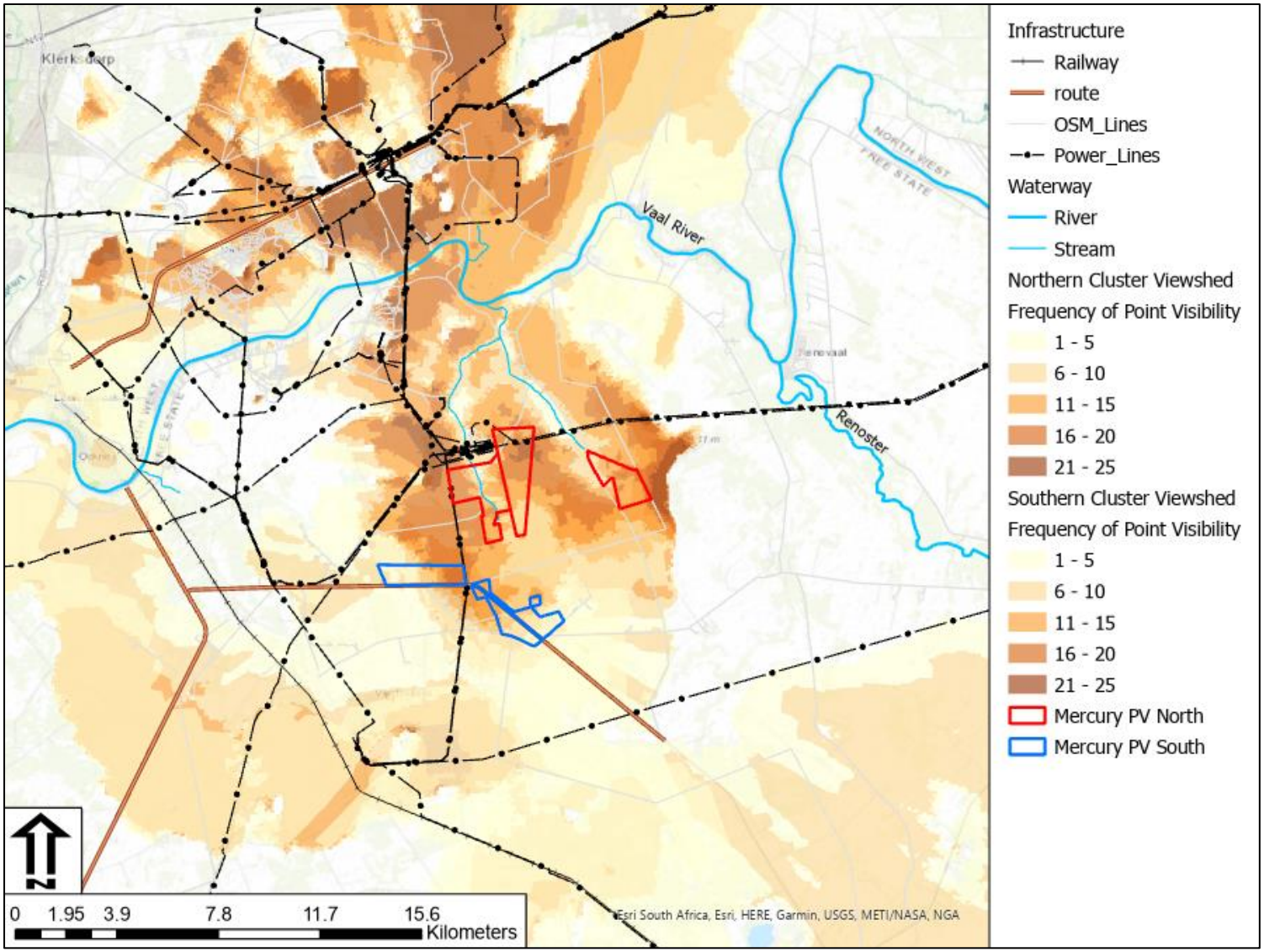


Figure 24: Combined viewshed map depicting the cumulative extent of the Mercury Cluster Project.

6.3 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 identifies the receptors identified within the ZVI, as well as 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 indicated the map on the following page. As motivated and mapped in Figure 25 below, the following receptors have been identified as Key Observation Points and should be used as locations to assess the suitability of the landscape change.

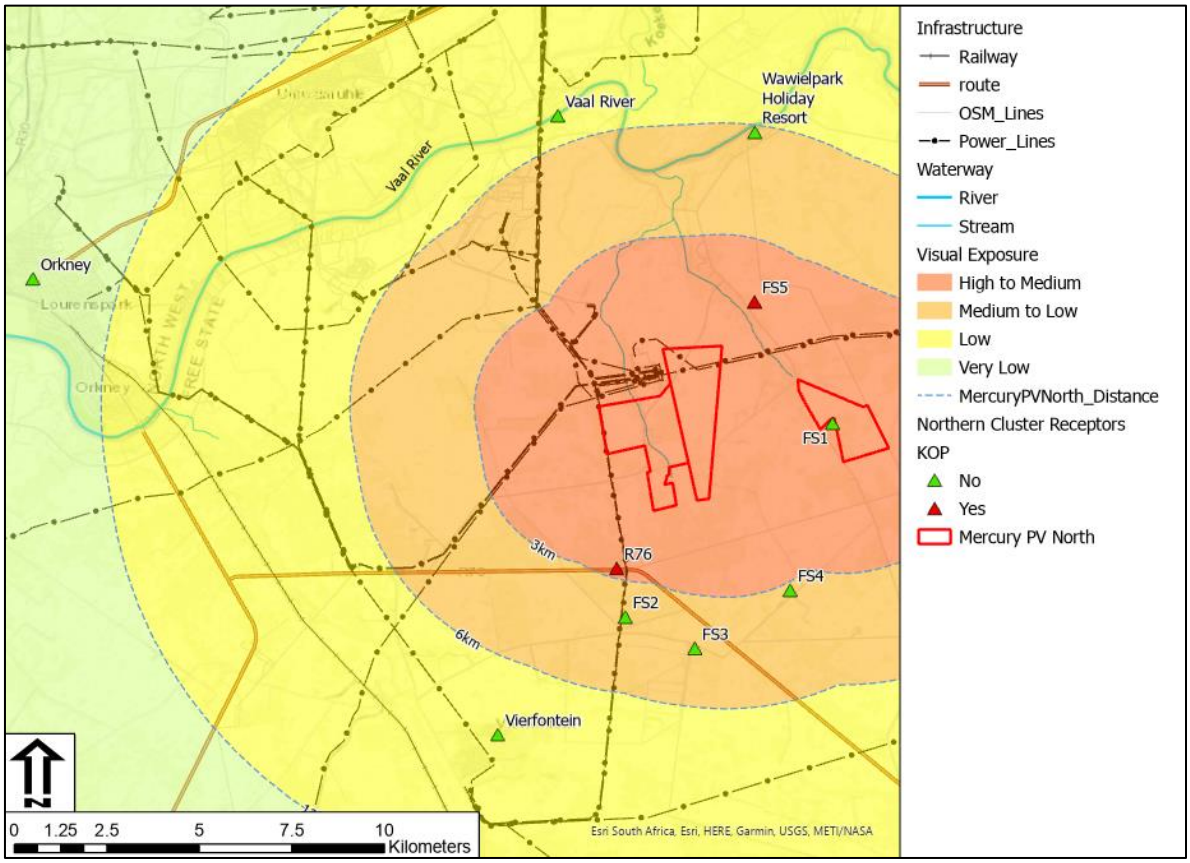


Figure 25: Receptor and Key Observation Point locality map.

Table 12: Receptor and KOP Motivation Table.

Name	Exposure	KOP	Category	Motivation
Vierfontein	Low	No	Urban	Low Exposure and higher VAC from built environment and local mining landscapes
FS1	Medium	No	Farmstead	Property owner proponent
Vaal River	Medium	No	Landscape	Medium Exposure and proximity to degraded mining landscapes degrading local landscape character.
FS2	Medium	No	Farmstead	Medium Exposure with local tree screening
FS3	Medium	No	Farmstead	Localised tree screening and dwelling appears un-

				used.
FS4	Medium	No	Farmstead	Medium Exposure with local tree screening towards site.
Orkney	Very Low	No	Urban	Very Low Exposure and built environment with Very High Visual Absorption Capacity
FS5	High	Yes	Farmstead	High Exposure with partial views towards site
Wawielpark Holiday Resort	Medium to Low	No	Tourism	Medium to Low Exposure with views north to the Vaal River away from site.
R76	Medium	Yes	Road	High Exposure to road receptors
Farm Road	Very High	Yes	Road	High Exposure to rural farm receptors

7 VISUAL RESOURCE MANAGEMENT

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

7.1 Physiographic Rating Units

The Physiographic Rating Units are the areas within the proposed Mercury Cluster Project development area that reflect specific physical and graphic elements that define a particular landscape character. These unique landscapes within the project development areas are rated to assess the scenic quality and receptor sensitivity to landscape change, which is then used to define a Visual Resource Management Class for each of the site's unique landscape/s. The exception is Class I, which is determined based on national and international policy / best practice and landscape significance and as such are not rated for scenic quality and receptor sensitivity to landscape change. Based on the SANBI mapping and the site visit to define key landscape features, the following broad-brush areas were tabled and mapped in Figure 26 below.

Table 13: Physiographic Landscape Rating Units.

Landscapes	Motivation
15m buffer on minor roads	Several minor farm roads are located within the project area. Routing between 5m high PV on either side of the road will result in Very High levels of visual intrusion. A 15m buffer needs to be retained to allow for some reduction in intensity of the landscape change, retaining existing vegetation within the buffer to assist in maintaining the local rural agricultural sense of place.
Wetland / Ecological sensitive areas	Wetlands and ecological sensitive areas are on the site, with the Surface Water Hydrological sensitive areas included in the landscape mapping as these features are a key component of the rural undulating landscape. These areas need to be excluded from development as per the relevant specialists' recommendations.
Undulating grasslands / cultivated lands	The remainder of the area is rural, agrarian landscapes with either high intensity maize cultivation or grasslands used for cattle farming.

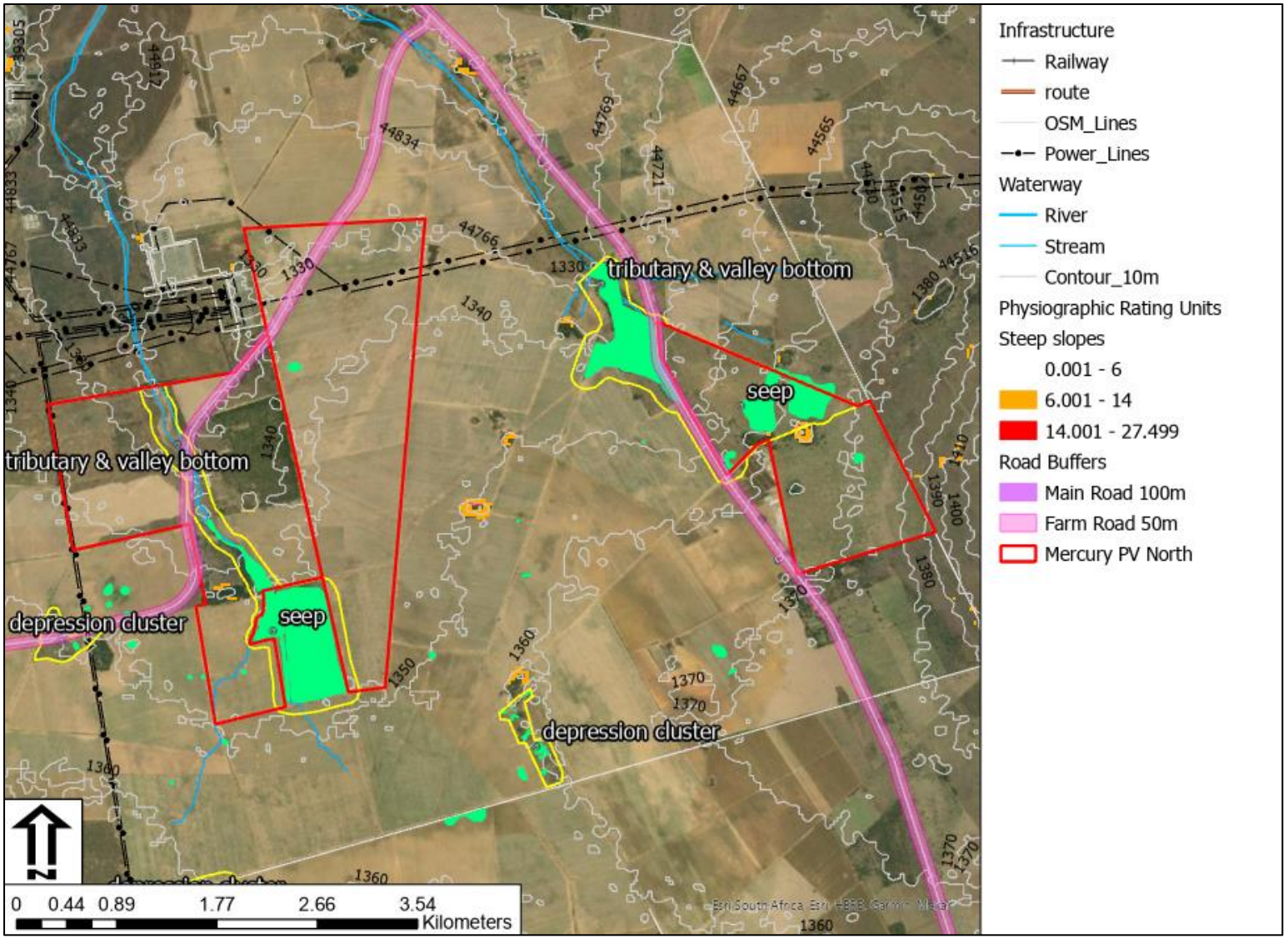


Figure 26: Physiographic Rating Units demarcated within the defined study area including sensitive wetland areas.

Table 14: 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**
Significant Heritage / Ecological / Hydrology	**(Class I is not rated)**																**I**
Sensitivity buffers (30m / 50m) and local topographic areas/ steep slopes	2	2	3	3	2	2	0	**14**	**B**	M	M	L	M	M	**M**	**III**	**II**
Undulating grasslands / cultivated lands	1	2	3	3	2	2	0	**13**	**B**	L	L	L	M	L	**L**	**IV**	**III**

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.

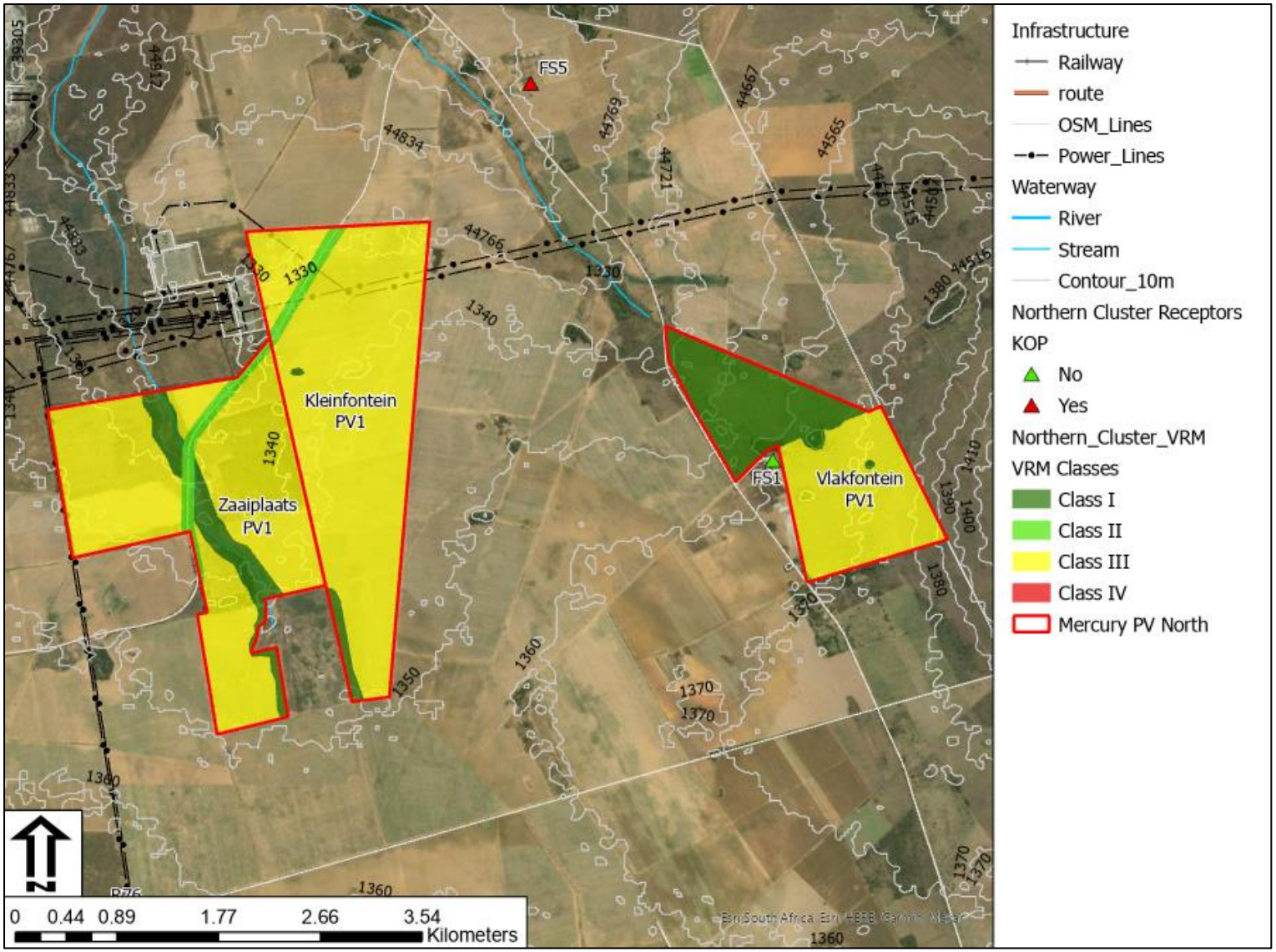


Figure 27: Visual Resource Management Classes and KOP map.

7.2 Scenic Quality Assessment

The scenic quality of the proposed development site is rated Medium. Landform is rated medium to low for the category that includes 'Sensitivity buffers and local topographic areas and steep slopes', and low for the undulating grasslands and cultivated lands which have few or no interesting features. Vegetation for the entire area is rated as low-medium as it occupies mainly highly transformed grasslands which are either under cultivation or heavily degraded by grazing. Scenic Quality for water is rated Medium across the entire area as there are a number of drainage lines and associated wetland features present in the area, although these do not dominate the landscape as there is no large open water features. Colour in the landscape is mainly provided by the patchwork of cultivated lands, natural vegetation, and is rated medium for the whole area - although there is some variety, colour is not a dominant scenic element. Landscape Scarcity is rated low for the entire area as, even though it is interesting within its setting, it is common within the region. Adjacent landscape is rated Medium to Low for the whole area as while the rural agrarian landscape does have value, the proximity to the substation and mining landscapes does degrade the overall scenic quality. Cultural modification is indicated as neutral as the existing manmade modifications in the landscape neither add nor detract from the visual harmony.

7.3 Receptor Sensitivity Assessment

Receptor sensitivity to landscape changes is rated Medium for the sensitivity buffers and local topographic areas, and Low for the undulating grasslands and cultivated lands. Initial assessment anticipates a moderate concern for the sensitive buffers and topographically prominent areas and a low level of concern for the undulating grasslands /cultivated lands. As the area is predominantly rural agricultural in nature, maintenance of the visual quality is rated medium for the sensitive buffers and low for the grasslands and cultivated lands. There is likely to be a low level of concern from most of the public users for maintaining the visual quality. The maintenance of visual quality to sustain adjacent land use objectives is moderate, as the area is located within an agricultural land use and also in close proximity to mining landscapes. The area also falls within a REDZ area, and there are no tourist related activities making use of the landscape resources. The Vaal River receptors are in background distance zones and valley located with no clear views to the proposed development site.

7.4 Visual Resource Management (VRM) Classes

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

7.4.1 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.**

7.4.2 VRM Class II

The Class II objective is to retain the existing character of the landscape and the level of change to the characteristic landscape should be low. The proposed development may be seen but should not attract the attention of the casual observer, and should repeat the basic elements of form, line, colour and texture found in the predominant natural features of the characteristic landscape.

- ***Farm road buffer (15m)***

The recommendation is that these areas are excluded from development to reduce visual intrusion and allow for partial retention of the rural agricultural sense of place of these rural agricultural routes. The PV panels would be buffered by the internal roads, creating a larger (approximately 30m) buffer.

7.4.3 VRM Class III

The Class III objective is to partially retain the existing character of the landscape, where the level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer, and changes should repeat the basic elements found in the predominant natural features of the characteristic landscape. The following landscape was defined as having Class III Visual Objectives where development would be most suitable:

- **Undulating grasslands / cultivated lands**

With Medium Scenic Quality ratings and Low Receptor Sensitivity likely, the resulting Visual Inventory rating is Class IV. However, as this is not an industrial type location, and where the surrounding rural agricultural landscape has landscape value, the Class IV was assigned as Visual Resource Management Class III. This change is also motivated based on the need to retain rural landscape integrity, but also recognising that these areas are within the Klerksdorp REDZ where renewable energy projects are promoted.

7.4.4 VRM Class IV

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**.

8 VISUAL IMPACT ASSESSMENT

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) was also assessed. To better understand the nature of the severity of the visual impacts, a Contrast Rating exercise was undertaken from the defined Key Observation Points.

8.1 Contrast Rating and Photomontages

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

The following criteria are utilised in defining the degree of contrast (DoC):

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

As this is a Basic Assessment, no photomontages were generated. The expected positioning of the PV area in the landscape was provisionally depicted on KOP photographs in the Annexure. The following table identified the KOP that would need to be used to assess the suitability of the landscape change.

Table 15: Contrast Rating Key Observation Points Table

Landscape Elements								
Key Observation Point	**Distance**	**Mitigation**	**Form**	**Line**	**Colour**	**Texture**	**Degree of Contrast**	**Visual Objectives Met?**
FS5	1.4km	W/Out	W	M	M	M	**M**	**Yes**
		With	*Not applicable*					
R76	2.8km	W/Out	W	W	W	W	**W**	**Yes**
		With	*Not applicable*					
Farm roads	30m	W/Out	M	S	S	S	**S**	**No**
		With	W	M	S	S	**M**	**Yes**

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

Farmstead 5

Located 1.4km to the north of the study area, the farm comprises a number of structures, with some on-site screening with garden trees planted in the direction of the project area. Kleinfontein PV1 will be visible, located on a moderately higher ground with no tree screening, but without a dominating prominence. The PV would appear as a line on the horizon but would appear relatively short in the greater landscape. Due to topographic undulation and existing trees in the landscape, Vlakfontein PV1 and Zaaiplaats PV1 would not be visible, and as such, a massing effect would be limited.

The resulting Medium DoC would meeting the Class III Visual Resource Management Objective without Mitigation. The landscape change would however be clearly noticeable but would not significantly detract from the working rural agricultural landscape of the receiving landscape.

R76 District Road

Located 2.7km to the south of the project, some atmospheric influence is likely to take place. With the PV projects located on lower terrain, and with existing trees in the landscape, visual contrast generated by the proposed PV panels is likely to be weak. The dispersed nature of the projects, with jagged boundary lines would assist in reducing clear intervisibility and as such, massing effects would be limited.

Farm Roads

Located in close proximity to the PV projects, the tall PV structures located adjacent to the road, would dominate the rural sense of place. The wall of PV would create a wide form, black in colour and with a glassy texture. Strong levels of visual contrast would result, and the Class III visual objective would not be met.

With mitigation and the retaining of a 15m buffer along the roads, retaining of existing trees, and the planting of medium height windbreak trees where necessary, the rural sense of place would be retained to some degree. The buffer areas should also be fenced off and retained for grazing of cattle to enhance the existing rural agrarian land uses of the area. This will also reduce fire risk.

8.2 Zaaiplaats PV1 & Kleinfontein PV1 Impact Ratings and Motivation

8.2.1 Design and Pre-Construction Phase

Not applicable

8.2.2 Construction Phase

Impact Description

- Due to the proximity to the Mercury Substation and multiple power line, the proposed development construction would result in a partial loss of rural sense of place from the removal of vegetation, the movement of large earth moving machinery and the construction vehicles.
- Windblown dust generated from vegetation removal, as well as dust from moving vehicles.
- Potential soil erosion from temporary access roads and laydown areas.
- Windblown litter from the laydown and construction sites.

- Lights at night for security detracting from the current, semi-dark rural sense of place.

Cumulative impact description

- Partial degradation of landscape resources that currently have some visual appeal where not exposed to the surrounding mining landscapes.
- Partial change in land use from rural agricultural to that of a semi-industrial landscape.

Mitigation

- Retaining of a 15m buffer on the rural roads as a No-go development area. The exception is the areas within 1.2km of the Mercury Substation where no setback buffer is required as the landscape character is already degraded.
- Retaining existing medium-sized trees within the setback buffer.
- The PV area fencing should be placed around the development area and not extend to the road. The buffer area should be retained for agricultural land uses to reduce grass growth that could become a dry season fire risk.
- Exclusion of wetland and drainage lines (and associated areas).
- Exclusion of development of steep slopes greater than 1:10m where applicable.
- The buildings should be painted a grey-brown colour.
- Fencing around the laydown and office complex areas should be simple, diamond shaped (to catch wind-blown litter) and appear transparent from a distance. The fences should be checked monthly for the collection of litter caught on the fence.
- Fencing should be located around the PV panels and appear transparent at a distance and not extended to the road areas.
- Lighting needs to be restrained and should be limited to strategic nodes/ office areas. Fencing should have not security lights at night.
- No overhead lighting should be utilised.
- Signage from the roads needs to be understated.

Impact Assessment

Name of Impact	Extent	Duration	Probability	Reversibility of impact	Significance without mitigation	Significance after mitigation
Loss of landscape character	Site	Short-term	Probable	High	High	Medium
Visual intrusion from Key Observation Points	Site	Short-term	Possible	High	High	Medium

- Short time period of the phase.
- Partial degradation of landscape resources due to the close proximity of the sites to the Mercury Substation as well as clear, Medium Exposure views of the northern mining landscapes.
- No tourist related activities in the ZVI making use of the landscape resources.

Impact on Irreplaceable Resources (*after* mitigation) If yes, please explain	~~YES~~	NO

Cumulative impact rating (*after* mitigation) If high, please explain	Low	~~Medium~~	~~High~~

8.2.3 Post- Construction and Operational Phase

Impact Description

- Long term operation of the PV project that will last for approximately 20 years. Given the long time periods, the PV panels will become a fixture in the landscape, changing the local sense of place to that of a semi-industrial landscape context, within a partially degraded rural landscape setting.

Cumulative impact description

- The establishment of the area as a renewable energy node, could attract other renewable energy developers to the region, resulting in a more established renewable energy landscape, creating larger massing effect from inter-visibility and essentially resulting in a loss of the existing rural agrarian sense of place.

Mitigation

- Continued establishment of windbreaks (10m spacing between trees) along the roads at strategic locations where existing tree vegetation along the farm roads is limited.
- Continuation of soil erosion and wind-blown dust management.

Impact Assessment

Name of Impact	Extent	Duration	Probability	Reversibility of impact	Significance without mitigation	Significance after mitigation
Loss of landscape character	Local	Long-term	Probable	High	Moderate	Low
Visual intrusion from Key Observation Points	Local	Long-term	Probable	High	Moderate	Low

- Partial degradation of landscape resources due to the close proximity of the sites to the Mercury Substation as well as clear, Medium Exposure views of the northern mining landscapes.
- No tourist related activities in the ZVI making use of the landscape resources.

Impact on Irreplaceable Resources (*after* mitigation) If yes, please explain	~~YES~~	NO

Cumulative impact rating (*after* mitigation) If high, please explain	Low	~~Medium~~	~~High~~

8.2.4 Decommissioning Phase

Impact Description

- Movement of large vehicles required for the removal of the PV panels and infrastructure.
- Wind-blown dust from movement of vehicles.
- Wind-blown litter from the laydown and construction sites.
-

Cumulative impact description

- Short-term change in land use from semi-industrial landscape to that of rural agricultural.

Mitigation

- All structures should be removed and where possible, recycled.
- Building structures should be broken down (including foundations).
- The rubble should be managed according to NEMWA and deposited at a registered landfill if it cannot be recycled or reused.
- All compacted areas should be rehabilitated according to a rehabilitation specialist.
- Monitoring for soil erosion should be undertaken on a routine biannual basis for at least one year following the completion of the Decommissioning Phase, or until such time as the surface is deemed to be sufficiently stabilised.

Impact Assessment

Name of Impact	Extent	Duration	Probability	Reversibility of impact	Significance without mitigation	Significance after mitigation
Loss of landscape character	Site	Short-term	Probable	High	Moderate	Low
Visual intrusion from Key Observation Points	Site	Short-term	Possible	High	Moderate	Low

- Short time period of the phase.
- Partial degradation of landscape resources due to the close proximity of the sites to the Mercury Substation as well as clear, Medium Exposure views of the northern mining landscapes.
- No tourist related activities in the ZVI making use of the landscape resources.

Impact on Irreplaceable Resources (*after* mitigation) If yes, please explain	~~YES~~	NO

Cumulative impact rating (*after* mitigation) If high, please explain	Low	~~Medium~~	~~High~~

8.3 Vlakfontein PV1 Impact Ratings and Motivation

8.3.1 Design and Pre-Construction Phase

Not applicable

8.3.2 Construction Phase

Impact Description

- The proposed development construction would result in a loss of rural sense of place from the removal of vegetation, the movement of large earth moving machinery and the construction vehicles.
- Wind blown dust generated from vegetation removal, as well as dust from moving vehicles.
- Potential soil erosion from temporary access roads and laydown areas.
- Lights at night for security detracting from the current, semi-dark rural sense of place.

Cumulative impact description

- Degradation of landscape resources that currently have some visual appeal where not exposed to the surrounding mining landscapes.
- Change in land use from rural agricultural to that of a semi-industrial landscape.

Mitigation

- Retaining of a 15m buffer on the rural roads as a No-go development area.
- Retaining existing medium sized trees within the setback buffer.
- The PV area fencing should be placed around the development area and not extend to the road. The buffer area should be retained for agricultural land uses to reduce grass growth that could become a dry season fire risk.
- Exclusion of wetland and drainage lines (and associated areas).
- Exclusion of development of steep slopes greater than 1:10m.
- Fencing should be located around the PV panels and not extended to the road areas.
- The buildings should be painted a grey-brown colour.
- Fencing should be simple, diamond shaped (to catch wind-blown litter) and appear transparent from a distance. The fences should be checked monthly for the collection of litter caught on the fence.
- Lighting needs to be restrained and should be limited to strategic nodes/ office areas. Fencing should have not security lights at night.
- No overhead lighting should be utilised.
- Signage from the roads needs to be understated.

Impact Assessment

Name of Impact	Extent	Duration	Probability	Reversibility of impact	Significance without mitigation	Significance after mitigation
Loss of landscape character	Site	Short-term	Probable	High	High	Medium
Visual intrusion from Key Observation Points	Site	Short-term	Possible	High	High	Medium

- Background views from the area include degraded mining landscapes.
- Short time period of the phase.

- Degradation of existing rural agrarian landscapes with Medium to High Scenic Quality.
- No tourist related activities in the ZVI making use of the landscape resources.

Impact on Irreplaceable Resources (*after* mitigation) If yes, please explain	~~YES~~	NO

Cumulative impact rating (*after* mitigation) If high, please explain	Low	~~Medium~~	~~High~~

8.3.3 Post- Construction and Operational Phase

Impact Description

- Long term operation of the PV project that will last for approximately 20 years. Given the long time periods, the PV panels will become a fixture in the landscape, changing the local sense of place to that of a semi-industrial landscape context, within a partially degraded rural landscape setting.

Cumulative impact description

- The establishment of the area as a renewable energy node, could attract other renewable energy developers to the region, resulting in a more established renewable energy landscape, creating larger massing effect from inter-visibility and essentially resulting in a loss of the existing rural agrarian sense of place.

Mitigation

- Continued establishment of windbreaks (10m spacing between trees) along the roads at strategic locations such that dominating views where existing tree vegetation along the farm roads is limited.
- Continuation of soil erosion and wind-blown dust management.

Impact Assessment

Name of Impact	Extent	Duration	Probability	Reversibility of impact	Significance without mitigation	Significance after mitigation
Loss of landscape character	Local	Long-term	Probable	High	Moderate	Low
Visual intrusion from Key Observation Points	Local	Long-term	Probable	High	Moderate	Low

- Background views from the area include degraded mining landscapes.
- Long time period of the phase.
- Degradation of existing rural agrarian landscapes with Medium to High Scenic Quality.
- No tourist related activities in the ZVI making use of the landscape resources.
- Limited High Exposure to the farm road receptors.
- Mitigation will be effective in partially containing the landscape change once the screening trees are established.

Impact on Irreplaceable Resources (*after* mitigation) If yes, please explain	~~YES~~	NO

Cumulative impact rating (*after* mitigation) If high, please explain	Low	~~Medium~~	~~High~~

8.3.4 Decommissioning Phase

Impact Description

- Movement of large vehicles required for the removal of the PV panels and infrastructure.
- Wind-blown dust from movement of vehicles.
- Wind-blown litter from the laydown and construction sites.

Cumulative impact description

- Short-term change in land use from semi-industrial landscape to that of a rural agricultural.

Mitigation

- All structures should be removed and where possible, recycled.
- Building structures should be broken down (including foundations).
- The rubble should be managed according to NEMWA and deposited at a registered landfill if it cannot be recycled or reused.
- All compacted areas should be rehabilitated according to a rehabilitation specialist.
- Monitoring for soil erosion should be undertaken on a routine biannual basis for at least one year following the completion of the Decommissioning Phase, or until such time as the surface is deemed to be sufficiently stabilised.

Impact Assessment

Name of Impact	Extent	Duration	Probability	Reversibility of impact	Significance without mitigation	Significance after mitigation
Loss of landscape character	Site	Short-term	Probable	High	Moderate	Low
Visual intrusion from Key Observation Points	Site	Short-term	Possible	High	Moderate	Low

- Background views from the area include degraded mining landscapes.
- Short time period of the phase.
- No tourist related activities in the ZVI making use of the landscape resources.

Impact on Irreplaceable Resources (*after* mitigation) If yes, please explain	~~YES~~	NO

Cumulative impact rating (*after* mitigation) If high, please explain	Low	~~Medium~~	~~High~~

9 PRELIMINARY ENVIRONMENTAL MANAGEMENT PLAN

9.1 PV Project

9.1.1 Design Phase

- Design the PV project such that there is a 15m development exclusion buffer from all farm roads and that the wetland and steep slopes areas are excluded from development.
- Placement of construction camps and laydowns away from receptors and in closer proximity to the substation where the existing landscape character is already degraded.

9.1.2 Construction Phase

- Indigenous trees within the 15m farm road buffer should be retained for visual screening along roads outside of the 1.2km distance from the Mercury Substation.
- The PV area fencing should be placed around the development area and not extend to the road. The buffer area should be retained for agricultural land uses to reduce grass growth that could become a dry season fire risk, and cut by tractor-mower in winter to reduce fire risk if necessary (subject to fire management plan).
- Following the removal of the vegetation, windblown dust during construction should be monitored by the ECO to ensure that it does not become a nuisance factor to the local receptors. 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 direction from the ECO.
- Topsoil from the footprints of the road and structures should be dealt with in accordance with EMP.
- The buildings should be painted a grey-brown colour.
- Fencing around the laydowns and camps should be simple, diamond shaped (to catch wind-blown litter) and appear transparent from a distance. The fences should be checked on a monthly basis for the collection of litter caught on the fence. The fencing around the PV area should per electrified and located around the PV panel areas, and not extent to the road verge.
- Signage on the main access routes should be moderated.
- Lights at night have the potential to significantly increase the visual exposure of the proposed project. It is recommended that mitigations be implemented to reduce light spillage (refer to appendix for general guidelines).
- No overhead lighting can be used.
- Camps, Battery Energy Storage Systems, and generator units need to be screened by the planting of medium sized indigenous trees to allow for visual screening.

9.1.3 Operation Phase

- Lights at night have the potential to significantly increase the visual exposure of the proposed project. It is recommended that mitigations be implemented to reduce light spillage (refer to appendix for general guidelines).
- The security fencing around the PV panels should not have security lighting.
- No overhead lighting can be used.
- Continued erosion control and management of dust.

9.1.4 Decommissioning Phase

- All structures should be removed and where possible, recycled.
- Building structures should be broken down (including foundations).
- The rubble should be managed according to NEMWA and deposited at a registered landfill if it cannot be recycled or reused.
- All compacted areas should be rehabilitated according to a rehabilitation specialist.
- Monitoring for soil erosion should be undertaken on a routine basis biannually for a year following the completion of the Decommissioning Phase.

10 PRELIMINARY OPPORTUNITIES AND CONSTRAINTS

10.1 Zaaiplaats PV1 & Kleinfontein PV1

10.1.1 Opportunities

- Located in very close proximity to the Mercury Substation and mining related landforms where the landscape is partially degraded from the infrastructure and power lines.
- Partially undulating terrain reduces intervisibility.
- No receptors of tourist-related nature within the project ZVI.
- Potential for reduction in higher levels of visual intrusion with mitigation.

10.1.2 Constraints

- Existing rural sense of place has Medium to High levels of Scenic Quality in areas not visually exposed to the Mercury Substation.
- Proximity to drainage lines and wetlands that add to the local sense of place.
- High Visual Exposure to the farm road receptors.

10.2 Vlakfontein PV1

10.2.1 Opportunities

- Background view of the mining related landforms where the landscape is partially degraded from the infrastructure and power lines.
- Partially undulating terrain reduces intervisibility.
- No receptors of tourist-related nature within the project ZVI.
- A single farm-related receptor with some buffering from the PV landscape change.
- Potential for reduction in higher levels of visual intrusion with mitigation.

10.2.2 Constraints

- Existing rural sense of place has Medium to High levels of Scenic Quality in areas not visually exposed to the Mercury Substation.
- Proximity to drainage lines and wetlands that add to the local sense of place.
- High Visual Exposure to the farm road receptors.

11 CONCLUSION

It is the recommendation that the proposed development should commence WITH MITIGATION for the following key reasons:

- The proposed development areas have background views of degraded mining landscapes or are within proximity of the Mercury Substation where the rural agricultural landscape is partially degraded.
- Receptors are few and have partial visual screening of the proposed landscape change.
- No tourist related activities are making use of the rural agricultural landscapes.

Mitigation required to ensure that the landscape change remains congruent with the rural agricultural landscape character:

- 15m development exclusion buffer of the farm roads as a non-development buffer outside of the 1.2km distance from the Mercury Substation where the landscape character is already degraded.
- Retaining existing medium sized trees within the buffer as much as possible.

12 BIBLIOGRAPHY

Department of Environment Affairs. (2013). *DEA National Wind and Solar PV Strategic Environmenal Assessment.*

Fezile Dabi District Municipality. (2020). *Fezile Dabi District Municipality IDP 2020.*

https://municipalities.co.za/overview/1041/moqhaka-local-municipality. (n.d.).

https://www.sa-venues.com/attractionsfs/viljoenskroon.php. (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. (2012). *International Finance Corporation (IFC) prescribes eight performance standards (PS) on environmental and social sustainability. Millennium Ecosystem Assessment. 2005.*

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

Moqhaka Municipality. (2016). *Moqhaka Municipality Final IDP 2016/2017.*

Moqhaka Municipality. (n.d.). *http://www.moqhaka.fs.gov.za/*.

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.*

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.*

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. (2018). *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.*

www.hawaiirenewableenergy.org/Villamesias2. (n.d.).

13 ANNEXURE A: SITE VISIT PHOTOGRAPHS AND COMMENTS

The following photographs were taken during the field survey as mapped below. The text below the photograph describes the landscape and visual issues of the locality, if applicable.

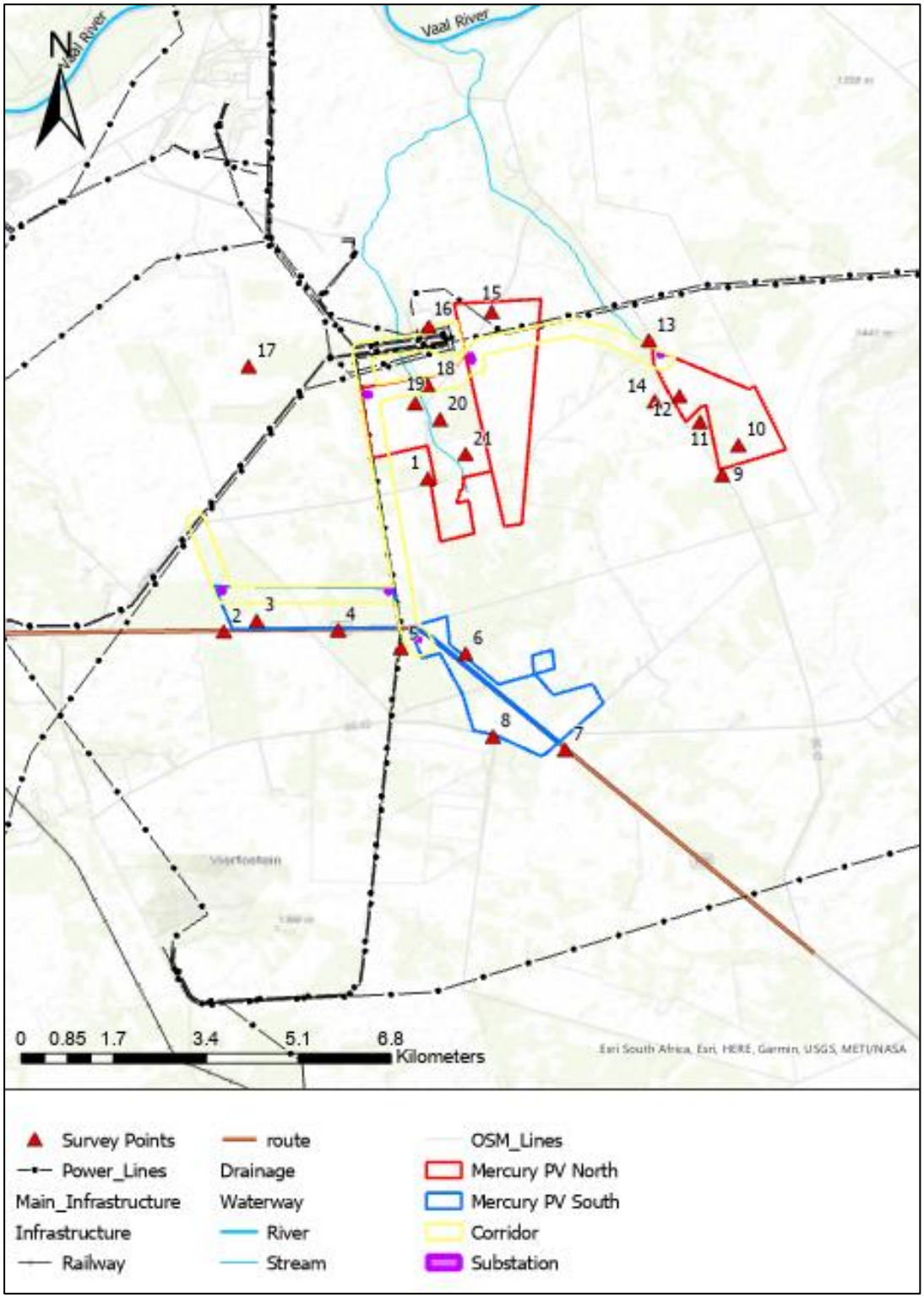


Figure 28. Site survey point map.

ID	2
PHOTO	Road Receptor
DIRECTION	East
COMMENT	The proposed Hormah PV development would be front, and centre left for the road receptors. Land uses are currently agricultural. A grouping of gum trees is in close proximity to the road, restricting reviews for majority of the site. Mitigation requirements is that some of the gum trees along the road are retained to reduce visual intrusion and to maintain the existing rural agricultural sense of place.

ID	3
PHOTO	Road Receptor
DIRECTION	North
COMMENT	Open fields of previously cultivated lands as seen due north from the R70 road. Located near the road receptors, the proposed Hormah PV panels would result in clear views with High visual exposure. The landscape is flat with limited features. A power line routing is in the background that does reduce the scenic quality to some degree.

ID	4
PHOTO	Hormah PV Site
DIRECTION	East
COMMENT	Photograph depicting the proposed PV site. The landform is flat and is currently grass-covered and has previously been cultivated. The area is not regionally prominent and as such the Zone of Visual Influence is likely to be contained by the slightly undulating terrain as well as the trees and vegetation existing in the landscape. Visual intrusion is likely to be minimal. Tailings facility is also visible in the background reducing the scenic quality of the original landscape.

ID	5
PHOTO	Road Receptor
DIRECTION	South
COMMENT	Photograph depicting the view along the road towards the North with the proposed Ratpan PV landscape change taking place on either side of the road. Tailings facilities from the mining areas are visible in the background degrading the sense of place to some degree. The existing agricultural land uses add to the Rural Agricultural sense of place. Recommendation that some buffering along the road is provided to reduce visual intrusion due to very high levels of Visual exposure.

ID	6
PHOTO	Ratpan PV site
DIRECTION	Northeast
COMMENT	The photographs depict the location where the photovoltaic panels would be proposed as well as the associated substation. Land use is currently intensive agriculture with maize planted as a crop. Landform is slightly raised which is likely to expand the visual extent of the proposed Project. Trees used as windbreaks in the facility would effectively reduce the visual expansion of the project.

ID	7
PHOTO	Road Receptor
DIRECTION	Northwest
COMMENT	The photograph depicts the flat rural agricultural landscape where the proposed landscape change would take place. Proposed Ratpan PV panels would be located on either side of the road with visual intrusion strongly experienced due to the proximity of the panels. The rural agricultural sense of place is intact due to the existing agrarian land uses.

ID	8
PHOTO	Farmstead Gossayn
DIRECTION	South
COMMENT	Farmstead is located directly adjacent to the proposed Ratpan PV site. There appears to be no permanent residence at the locality. Windbreaks around the existing dwellings would reduce the visibility towards the proposed landscape change reducing the extent of the visual contrast as seen from the dwelling. Mitigations could include planting more trees around the house or creating a buffer along the road reducing the visual exposure.

ID	9
PHOTO	Road and Farmstead Receptor
DIRECTION	North
COMMENT	Photograph depicting the view from the road towards the proposed Vlakfontein PV site. Existing trees in the vista would help break up the clarity of view reducing the visual contrast and massing effects.

ID	10
PHOTO	Vlakfontein PV Site
DIRECTION	East
COMMENT	Flat terrain with low hills in background with trees in landscape providing some scenic quality. Low hills on the right hand side visible in the photo would also reduce the extent of the landscape change.

ID	11
PHOTO	Vlakfontein landscape sense of place
DIRECTION	East
COMMENT	Photo of intensive feed lot located adjacent to the proposed PV area. Property owners are part of the project and as such are not registered as receptors.

ID	12
PHOTO	Vlakfontein PV site
DIRECTION	East
COMMENT	Flat terrain with some trees in landscape but with background views of mine tailing's facilities.

ID	13
PHOTO	Vlakfontein PV Receptor vacant
DIRECTION	East
COMMENT	Tree screening and no receptor locality.

ID	14
PHOTO	Vlakfontein surrounds sense of place
DIRECTION	West
COMMENT	Flat terrain and trees

ID	15
PHOTO	Kleinfontein PV Farm Road Receptor
DIRECTION	Southwest
COMMENT	Flat terrain and substation landscape context. Suitable for PV development as landscape resources are compromised by the adjacent substation.

ID	16
PHOTO	Mercury substation
DIRECTION	West
COMMENT	Large landscape modification with landscape degradation from development and transmission lines.

ID	17
PHOTO	Mining landscape context
DIRECTION	Northwest
COMMENT	Multiple power lines with mining tailings dumps in the background significantly impact the landscape character of this region.

ID	18
PHOTO	Zaaiplaats PV Site
DIRECTION	Northwest
COMMENT	Agricultural and transmission line landscape context. Suitable for substation development.

ID	19
PHOTO	Site wetlands and drainage lines Zaaiplaats PV
DIRECTION	Northwest
COMMENT	Possible wetland on site that not suitable for PV development.

ID	20
PHOTO	Site old farm and gum trees Zaaiplaats PV
DIRECTION	East
COMMENT	Vacant farm dwelling with gum tree patches. Drainage line setbacks required.

ID	21
PHOTO	Site croplands Zaaiplaats PV
DIRECTION	East
COMMENT	Site croplands well setback from the road with slight undulation of the terrain allowing some reduction in zone of visual influence.

14 ANNEXURE B: METHODOLOGY DETAIL

14.1 Baseline Analysis Stage

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

14.1.1 Scenic Quality

The scenic quality is determined making use of the VRM Scenic Quality Checklist (refer to Table 17. **Error! Reference source not found.**) 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:

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

14.1.2 Receptor Sensitivity

Receptor Sensitivity levels are a measure of public concern for scenic quality and assessed making use of the Sensitivity Checklist in Table 18. . 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.

14.1.3 Exposure

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

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

Distance from a landscape modification influences the size and clarity of the landscape modification viewing. The Bureau of Land Management defines three distance categories:

i. ***Foreground / Middle ground***, up to approximately 6km, which is where there is potential for the sense of place to change;
ii. ***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
iii. ***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.

14.1.4 Key Observation Points

During the Baseline Inventory Stage, Key Observation Points (KOPs) are identified. KOPs are defined by the Bureau of Land Management as the people (receptors) located in strategic locations surrounding the property that make consistent use of the views associated with the site where the landscape modifications are proposed. These locations are important in terms of the VRM methodology, which requires that the Degree of Contrast (DoC) that the

proposed landscape modifications will make to the existing landscape be measured from these most critical locations, or receptors, surrounding the property. To define the KOPs, potential receptor locations were identified in the viewshed analysis, and screened, based on the following criteria:

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

14.2 Assessment and Impact Stage

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

14.2.1 Contrast Rating

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

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

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

Based on the findings of the contrast rating, the Magnitude of the Landscape and Visual Impact Assessment is determined.

14.2.2 Photomontages

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

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

The Code of Ethical Conduct states that the presenter should:

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

15 ANNEXURE C: SPECIALIST INFORMATION

15.1 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

15.2 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 eighteen years and has successfully established and retained a large client base throughout southern Africa which include amongst other, Rio Tinto (Pty) Ltd, Bannerman (Pty) Ltd, Anglo Coal (Pty) Ltd, Eskom (Pty) Ltd, NamSolar and Vale (Pty) Ltd, Ariva (Pty) Ltd, Harmony Gold (Pty) Ltd, Millennium Challenge Account (USA), Pretoria Portland Cement (Pty) Ltd

14. Languages:

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

15. Projects:

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 16: VRM Africa Projects Assessments Table

YEAR	NAME	DESCRIPTION	LOCATION
2022	Sea Vista St Francis Bay	Resort	Eastern 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	Avondale Gordonia 132kV Power Line	Infrastructure	Northern Cape (SA)
2021	Maitland Mines Wedding Venue	Resort	Eastern 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	Wolvedans Megadump Facility	Mining	Mpumalanga (SA)
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	Nothern Cape (SA)
2015	Dyasonsklip and Sirius Grid TX	Solar Energy	Nothern Cape (SA)
2015	Dyasonsklip PV	Solar Energy	Nothern Cape (SA)
2015	Zeerust PV and transmission line	Solar Energy	North West (SA)
2015	Bloemsmond SEF	Solar Energy	Nothern Cape (SA)
2015	Juwi Copperton PV	Solar Energy	Nothern Cape (SA)
2015	Humansrus Capital 14 PV	Solar Energy	Nothern Cape (SA)
2015	Humansrus Capital 13 PV	Solar Energy	Nothern 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	Nothern Cape (SA)
2014	AEP Mogobe SEF	Solar Energy	Nothern 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 Wind Farm 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 (Koeberg)	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	Mapumalanga (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	Stonehouse Development	Residential	Western Cape (SA)

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)

16 ANNEXURE D: VRM CHECKLISTS AND TERMINOLOGY

Table 17: Scenic Quality Checklist

KEY FACTORS	**RATING CRITERIA AND SCORE**		
SCORE	**5**	**3**	**1**
Land Form	High vertical relief as expressed in pro##nt 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 18: 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 19: VRM Terminology Table

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

Simple	Basic, composed of few elements	**Organic**	Derived from nature; occurring or developing gradually and naturally
Complex	Complicated; made up of many interrelated parts	**Structure**	Organised; planned and controlled; with definite shape, form, or pattern
Weak	Lacking strength of character	**Regular**	Repeatedly occurring in an ordered fashion
Strong	Bold, definite, having prominence	**Horizontal**	Parallel to the horizon
Dominant	Controlling, influencing the surrounding environment	**Vertical**	Perpendicular to the horizon; upright
Flat	Level and horizontal without any slope; even and smooth without any bumps or hollows	**Geometric**	Consisting of straight lines and simple shapes
Rolling	Progressive and consistent in form, usually rounded	**Angular**	Sharply defined; used to describe an object identified by angles

Undulating	Moving sinuously like waves; wavy in appearance	**Acute**	Less than 90°; used to describe a sharp angle
Plateau	Uniformly elevated flat to gently undulating land bounded on one or more sides by steep slopes	**Parallel**	Relating to or being lines, planes, or curved surfaces that are always the same distance apart and therefore never meet
Ridge	A narrow landform typical of a highpoint or apex; a long narrow hilltop or range of hills	**Curved**	Rounded or bending in shape
Valley	Low-lying area; a long low area of land, often with a river or stream running through it, that is surrounded by higher ground	**Wavy**	Repeatedly curving forming a series of smooth curves that go in one direction and then another
Plain	A flat expanse of land; fairly flat dry land, usually with few trees	**Feathered**	Layered; consisting of many fine parallel strands
Steep	Sloping sharply often to the extent of being almost vertical	**Indistinct**	Vague; lacking clarity or form
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

17 ANNEXURE E: GENERAL LIGHTS AT NIGHT MITIGATIONS

Mitigation:

- Effective light management needs to be incorporated into the design of the lighting to ensure that the visual influence is limited to the mine, without jeopardising 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.

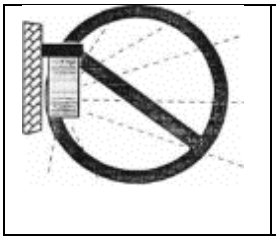
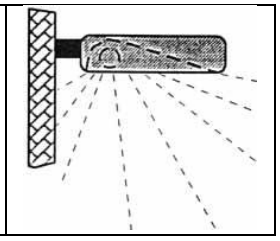
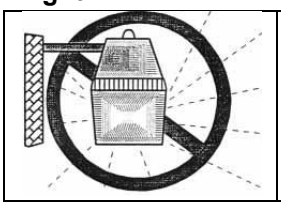
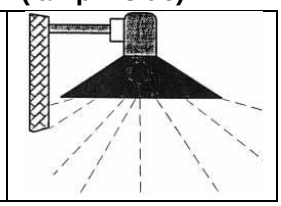
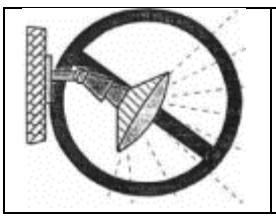
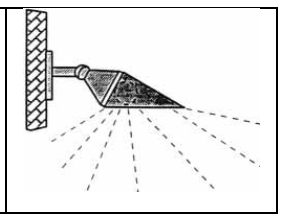
Glare Here's the basic rule of thumb: If you can see the bright bulb from a distance, it's a bad light. With a good light, you see lit ground instead of the dazzling bulb. "Glare" is light that beams directly from a bulb into your eye. It hampers the vision of pedestrians, cyclists, and drivers.

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?

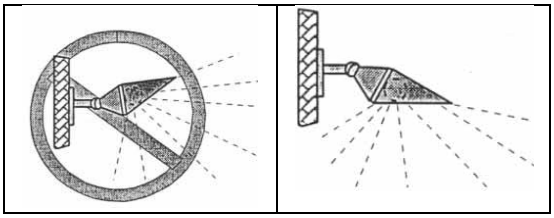
Provide only enough light for the task at hand; don't over-light, and don't spill light off your

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.
- 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!

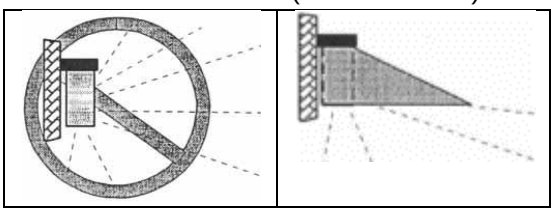
What You Can Do To Modify Existing Fixtures

Change this . . . to this (aim downward)



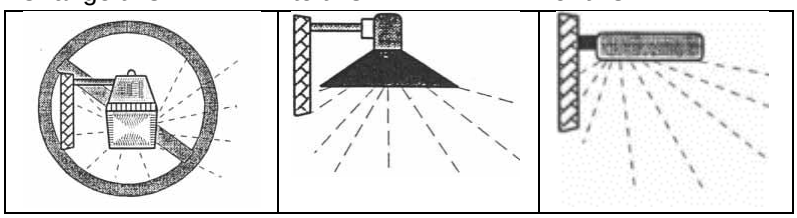
Floodlight:

Change this . . . to this (aim downward)



Wall Pack

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.