CRESCO ENERGY (PTY) LTD.

PROPOSED CONSTRUCTION OF THE 150MW NOUPOORT CONCENTRATED SOLAR POWER PROJECT, NORTHERN CAPE PROVINCE

VISUAL IMPACT SCOPING REPORT

APRIL 2016

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ACRONYMS

CSP Concentrating Solar Power

DENC Northern Cape Department of Environment and Nature Conservation

DoE Department of Energy

EIA Environmental Impact Assessment

DSG Direct Steam Generation

GIS Geographical Information System

HTF Heat Transfer Fluid

LCAs Landscape Character Areas

NEMA National Environmental Management Act, Act No. 107 of 1998

PTT Parabolic Trough Technology

REIPPP Renewable Energy Independent Power Producer Procurement Programme

VAC Visual Absorption Capacity

VISR Visual Impact Scoping Report

ZTV Zones of Theoretical Visibility

1 INTRODUCTION

1.1 GENERAL

CRESCO Energy (Pty) Ltd. (Cresco) proposes the construction of a Concentrated Solar Power (CSP) Project and associated infrastructure (known as the Noupoort CSP Project) on the Remaining Extent of the Farm 207, Portion 1 and Portion 4 of the Farm Carolus Poort 167, which is situated approximately 4 km north-west of Noupoort. The proposed site falls within the jurisdiction of the Umsobomvu Local Municipality and within the greater Pixley ka Seme District Municipality in the Northern Cape Province **(Map 1)**.

The contracted capacity of the Noupoort CSP Project will be up to 150MW with a development footprint of 900 ha in extent within the broader properties of 3460 ha. The purpose of the proposed Noupoort CSP Project will be to evacuate the generated power into the Eskom electricity grid. The project is proposed to be bid in the Department of Energy's (DoE) Renewable Energy Independent Power Producer Procurement Programme (REIPPPP).

In terms of the EIA Regulations published in terms of Section 24(5) of the National Environmental Management Act (NEMA), Act No. 107 of 1998, the proposed project requires environmental authorisation from the National Department of Environmental Affairs (DEA) in consultation with the Northern Cape Department of Environment and Nature Conservation (DENC) for the construction and operation of the proposed CSP Project. A key specialist impact to be assessed comprises the visual impact that the facility will have on surrounding areas.

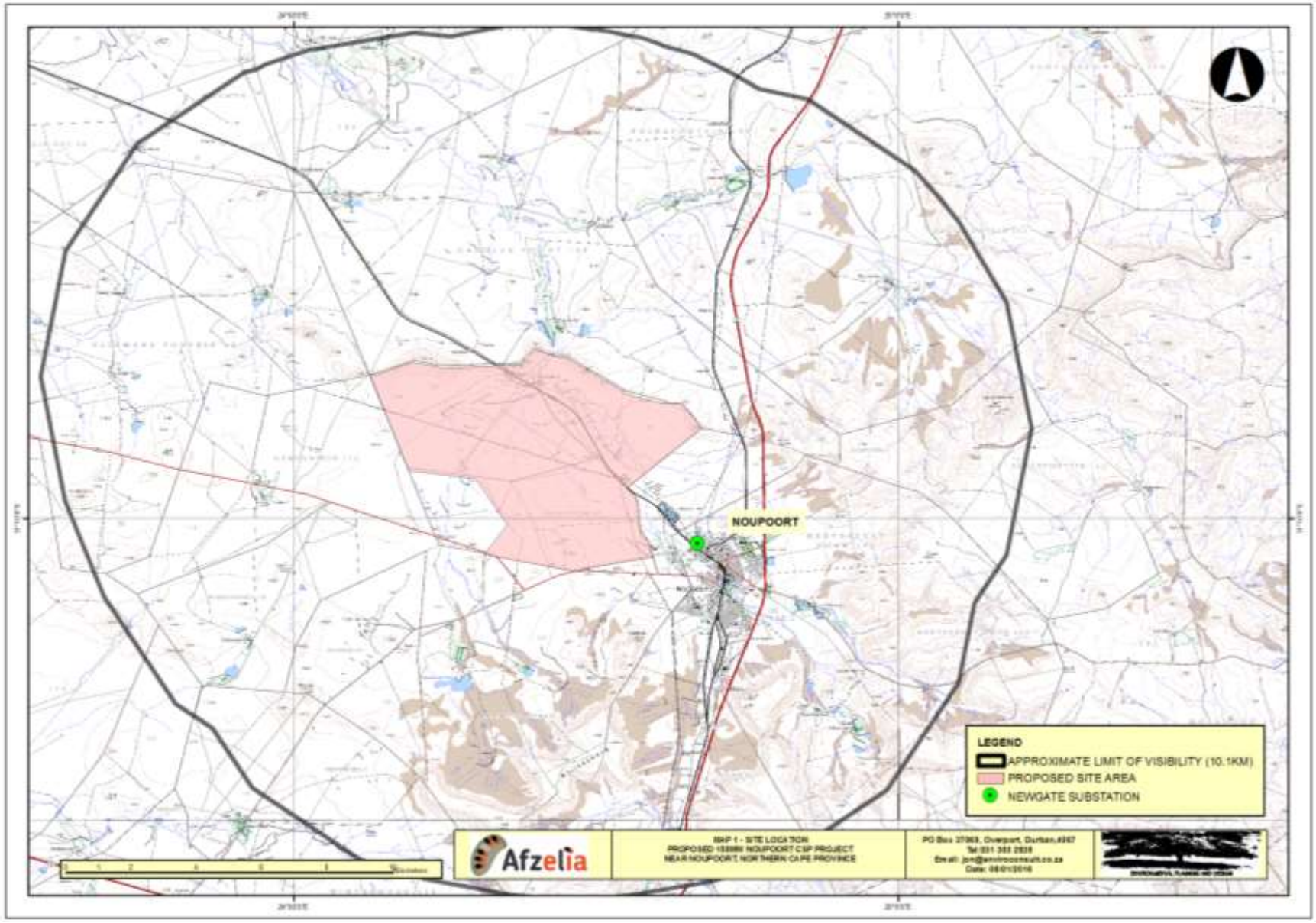
This desk-top Visual Impact Scoping Report (VISR) study thus forms part of the Scoping Phase Study (A desk-top study wherein potential issues associated with the proposed project are initially identified and those issues requiring further investigation through the Environmental Impact Assessment (EIA) Phase are highlighted). Thereafter the VISR will be developed in greater detail to form part of the EIA Phase Assessment (A detailed study of the potentially significant impacts identified in the Scoping Phase, including specialist investigation). The Scoping and EIA Process is being undertaken for the proposed Noupoort CSP Project, by Savannah Environmental (Pty) Ltd., on behalf of CRESCO Energy (Pty) Ltd.

1.2 PROJECT LOCATION

The proposed Noupoort CSP Project is to be located on Portions 1 and 4 of the Farm Carolus Poort 167 as well as the Remaining Extent of Farm 207. Geographic coordinates of the approximate centre point of the site are;

	DEGREES	MINUTES	SECONDS
LATITUDE (S)	31°	09'	11.34"
LONGITUDE (E)	24°	54'	00.89"

Several site alternatives were considered by CRESCO Energy (Pty) Ltd and the Remaining Extent of Farm 207, Portion 1 and Portion 4 of Farm Carolus Poort 167 were considered to be highly favourable and the most suitable location for the development of the Noupoort CSP Facility and all associated infrastructure. It is understood that the entire site area is approximately 3460 ha of which approximately 900 ha will be required for the CSP facility and associated infrastructure. Therefore, approximately 26% of the site is required for the development. This mean that there are onsite location alternatives.


NOUPOORT
LEGEND
APPROXIMATE LIMIT OF VISIBILITY (10.1KM)
PROPOSED SITE AREA
NEWGATE SUBSTATION
Afzelia

1.3 BACKGROUND OF SPECIALIST

Jon Marshall qualified as a Landscape Architect in 1978. He is also a certified Environmental Impact Assessment Practitioner of South Africa. He has been involved in Visual Impact Assessment over a period of approximately 30 years. He has developed the necessary computer skills to prepare viewshed analysis and three dimensional modelling to illustrate impact assessments. He has undertaken visual impact assessments for major buildings, industrial development and mining, as well as infrastructure projects (including renewable energy developments) and has been involved in the preparation of visual guidelines for large-scale developments.

A brief Curriculum Vitae outlining relevant projects is included as **Appendix I.**

1.4 THE NATURE OF VISUAL IMPACT

Visual impacts may relate to a general change in the character of an area or in the change in a specific view for a person or group of people.

Visual impacts can be positive or negative and a degree of subjectivity is required in deciding this point. The approach of any visual assessment should, as objectively as possible, describe a landscape and as far as is possible reflect the likely majority view regarding positive / negative aspect of an impact. This can be difficult particularly in South Africa due to different values and cultures associated with various sectors of the population. For example, poorer and particularly rural based sectors of the population are possibly more concerned with the productive nature of a landscape than its appearance, whereas the wealthier sectors might be more concerned with scenic value particularly as it is associated with property values. If possible the values and opinions of all impacted sectors of the community should be considered.

General change to a landscape might have greater or lesser significance subject to;

a) Numbers of people that might use the landscape,
b) The use of the landscape,
c) The level of protection afforded the landscape,
d) The rarity of the landscape.

In terms of change to a specific view this might be defined as either visual intrusion or visual obstruction.

a) Visual intrusion is a change in a view of a landscape that reduces the quality of the view. This can be a highly subjective judgement, subjectivity has been removed as far as is possible in this assessment by classifying the landscape character of each area and providing a description of the change in the landscape that will occur due to the proposed development.
b) Visual obstruction is the blocking of views or foreshortening of views. This can generally be measured in terms of extent.

More often than not such an impact will be a combination of intrusion and obstruction. Obstruction can be measured in terms of the extent of an existing view that is screened by a development. However, judging intrusion requires a degree of subjectivity. It is however possible to relate this judgement to the manner in which proposed change would impact on the use or enjoyment of an area which again requires an understanding or local values.

1.5 RELEVANT GUIDELINES

Work is to be undertaken in accordance with the following guideline documents;

a. The Government of the Western Cape Guideline for Involving Visual and Aesthetic Specialists in EIA Processes (Western Cape Guideline) (Oberholzer, 2005). This is the only local relevant guideline available in South Africa, setting various levels of assessment subject to the nature of the proposed development and surrounding landscape, and

b. The Landscape Institute and Institute of Environmental Management and Assessment (UK) Guidelines for Landscape and Visual Impact Assessment which provides detail of international best practice (UK Guidelines) (Landscape Institute and Institute of Environmental Assessment and Management, 2013).

Together these documents provide a basis for the level and approach of a VIA as well as the necessary tools for assessment and making an assessment legible to stakeholders.

1.6 SCOPING OBJECTIVES

This Environmental Scoping Study identifies and evaluates potential environmental impacts associated with all aspects of the proposed Project. In terms of the EIA Regulations, feasible and reasonable alternatives should be assessed within the Scoping Study. The scope of an environmental assessment is defined by the range of issues and feasible alternatives to be considered, and the approach towards the assessment that will follow.

The characteristics of a scoping exercise are as follows:

a) Feasible and reasonable alternatives are identified and a preferred selected for further assessment;
b) Important characteristics of the affected environment are identified;
c) Significant issues that are to be examined in the assessment procedure are identified; and
d) It provides the basis for determining terms of reference for the assessment procedure.

Based on a brief assessment of the landscape and likely receptors and in accordance with the Western Cape Guidelines, this scoping study will identify key concerns or issues relating to potential visual impacts arising from the project, and to determine boundaries and parameters for visual input.

2. PROJECT DESCRIPTION

2.1 PROJECT MOTIVATION

The purpose of the proposed Noupoort CSP Project will be to evacuate the generated power into the Eskom electricity grid. The project is proposed to be bid into the DoE's REIPPPP. Ultimately, the project will be a part of the renewable energy projects portfolio in South Africa.

2.2 PROJECT DESCRIPTION

The proposed Noupoort CSP project will comprise parabolic trough technology (PTT) utilising water as a heat transfer fluid (HTF), and a generation capacity of up to 150MW. An area of 900 ha is required for the facility. Energy may be stored up to an average of 6 hours. Associated infrastructure will include:

- Solar collector field comprising of all systems and infrastructure related to the control and operation of the parabolic troughs;
- Energy Centre;
- Power Block;
- On-site project substation;
- A new 132kV power line to connect the on-site substation to the Eskom's electricity grid;
- Access roads and fencing around the development area;
- Lined evaporation ponds;
- Gas boiler for the start-up process of the facility;
- Water supply pipeline;
- On-site water storage tanks/reservoirs;
- Water treatment facility;
- Plant assembly facility;
- Offices and workshop areas for maintenance and storage; and
- Temporary laydown areas.

Parabolic troughs are curved, mirrored troughs which reflect direct solar radiation onto a glass tube (also called a receiver, absorber, or collector), which contains HTF (water), running the length of the trough, and positioned at the focal point of the reflectors **(Plate 1 and 2)**.

The collector continuously tracks the sun to ensure the reflection of the sun rays onto the receiver.

Parabolic trough power plants utilise the solar field to heat the HTF, in this case water, to create steam, which is realised into a steam turbine that is housed in a turbine house, to generate electricity. The applicant has confirmed that dry cooling technology will be used for this project, therefore cooling towers will not be required, which will not result in the ever present water vapour clouds, commonly associated with PTT.

Refer to **Figure 1** below for a generic layout.

The main visible components of the parabolic trough facility will therefore include the following features:

- A solar field;
- A power plant/ power island/ Energy Centre;
- A cooling system using dry technology;
- An electrical switchyard and substation facility;
- Support buildings (control building and maintenance facilities).

Plate 1. Example of existing Parabolic Trough Solar Field. (photograph extracted from solarhomes web site, http://www.jc-solarhomes.com)

Plate 2. Example of existing 50MW Parabolic Trough CSP Plant in Torre de Miguel Sesmero, Badjoz, Spain. (photograph extracted from PennEnergy Web Site, http://www.pennenergy.com). It should be noted that dry cooling technology is proposed for the project under consideration in this report so there will be no steam visible from the cooling plant.

The applicant has confirmed that the maximum height of the trough in its noon position will be 5005 mm, whilst in the morning or afternoon position it will be 7908 mm. This maximum height has been used for the calculation of the Zones of Theoretical Visibility (ZTV) as described in Section 4.

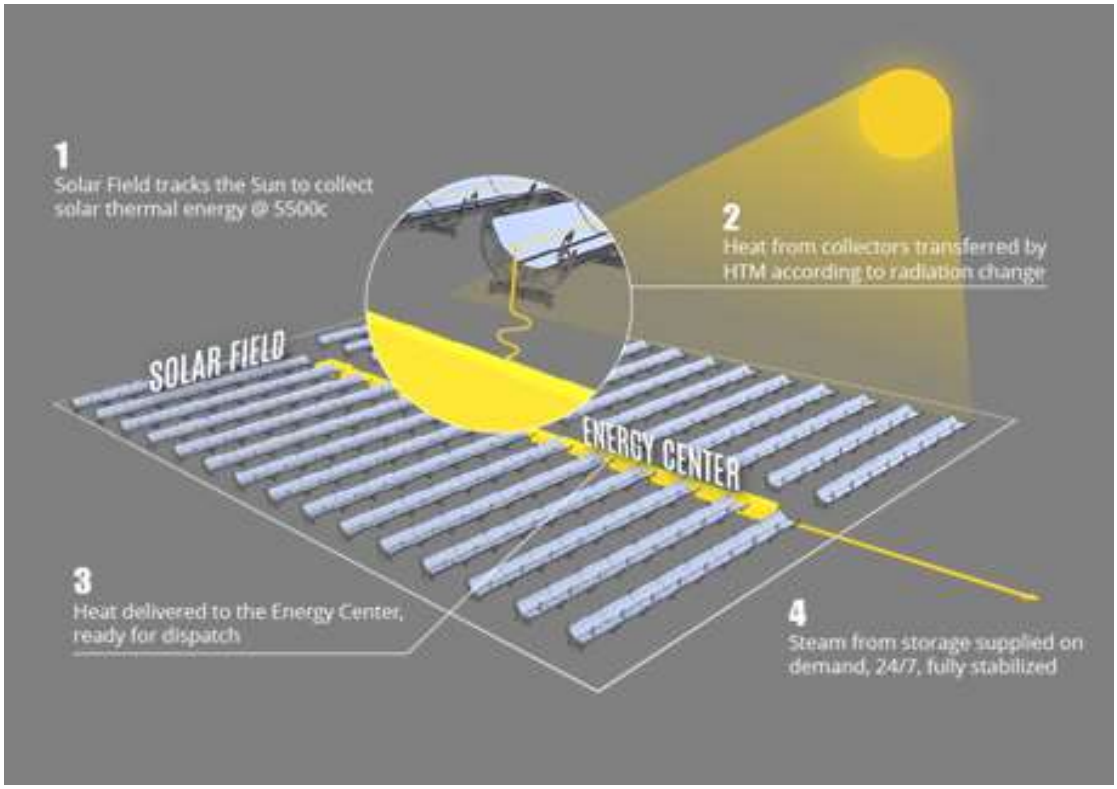


Figure 1. Generic Layout of Parabolic Trough CSP Project (courtesy of Brenmiller Energy).

3. DESCRIPTION OF RECEIVING ENVIRONMENT AND POSSIBLE SENSITIVE RECEPTORS

It is possible that landscape change due to the proposed development could impact the character of an important landscape. Landscape character can be derived from specific features relating to the urban or rural setting and may include key natural, historic or culturally significant elements. Importance might also relate to landscapes that are uncommon or under threat from development.

This section will:

- describe the types of landscape that may be impacted;
- indicate likely degree of sensitivity; and
- describe how the landscape areas are likely to be impacted.

3.1 LANDSCAPE CHARACTER

Landscape character is defined as, "a distinct, recognisable and consistent pattern of elements in the landscape that makes one landscape different from another".

Landscape Character is a composite of a number of influencing factors including:

- Landform and drainage;
- Nature and density of development; and
- Vegetation patterns.

Landscape character was defined from available Geographical Information System (GIS) datasets, online mapping and aerial photography. This will be ground-truthed during the EIA assessment stage.

The town of Noupoort, and the proposed CSP site to the west of Noupoort are situated on the gentle slopes of a valley, which is bounded to the south and south-east by high terrain and ridge lines. The terrain slopes downward in a north-westerly direction. Drainage lines, which run from south-east to north-west dissect the terrain.

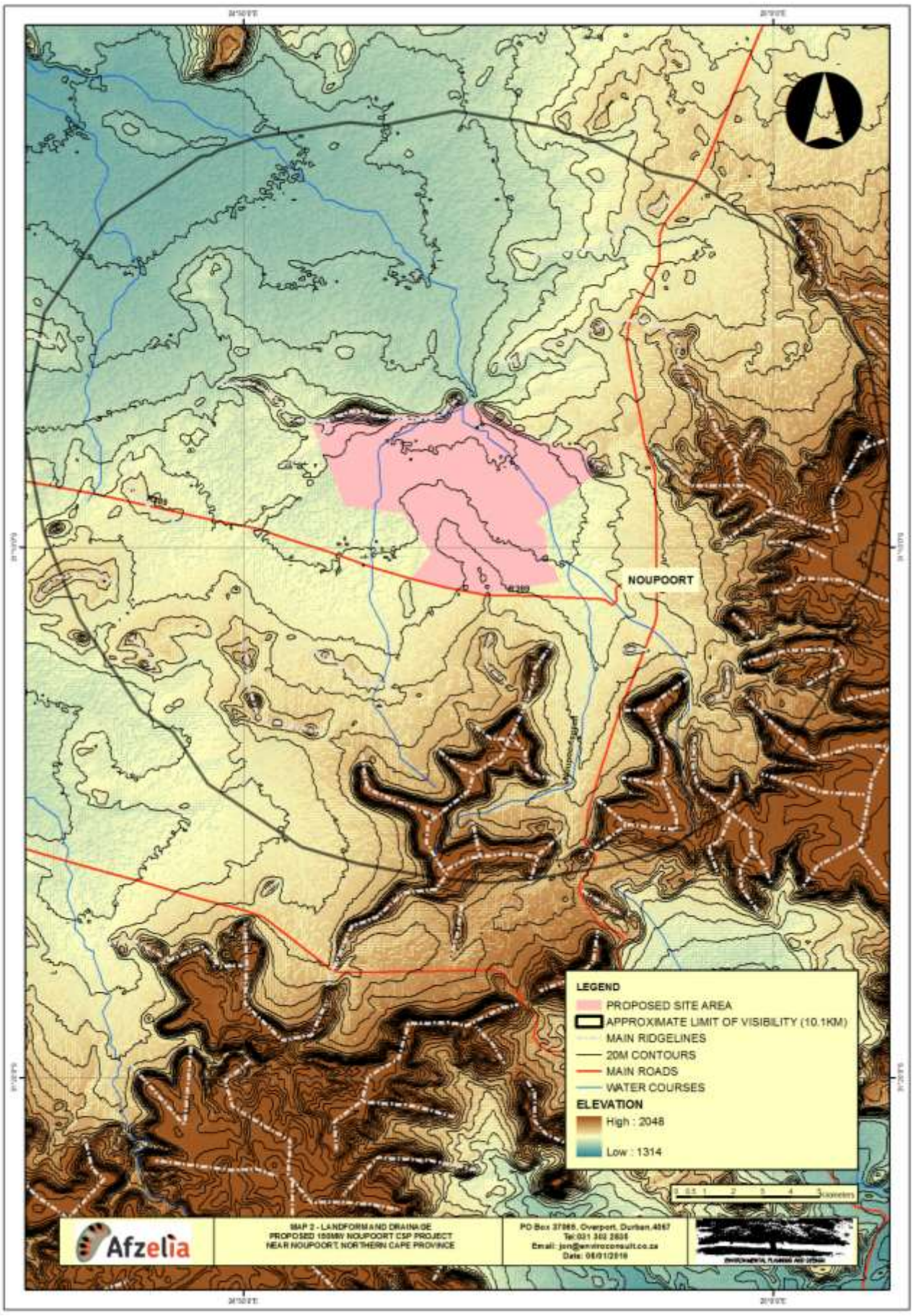
The region is predominantly rural in character, with isolated pockets of agricultural cropping, which are located in close proximity to drainage lines/ farm dams. The urban town of Noupoort is located in close proximity to the south-east of the site.

Detail of the main influencing factors are indicated below:

3.1.1 Landform and Drainage

The study area occurs on land that ranges in elevation from approximately 1700 m a.s.l. (at the lowest points on the north east and north west boundaries) to 1800 m a.s.l. (at the top of the nearby ridgeline on the southern boundary). The terrain therefore slopes downward from the south-east to the north-west. The terrain is dissected by drainage lines, which also run from the south-east to the north-west.

Key topographic features of the surrounding landform include a series of ridgelines close to the northern site boundary that rise approximately 50m above adjacent site levels. These ridgelines are likely to provide a large degree of visual screening for areas to the north. **(Map 2)**.


NOUPOORT
LEGEND
PROPOSED SITE AREA
APPROXIMATE LIMIT OF VISIBILITY (10.1KM)
MAIN RIDGELINES
20M CONTOURS
MAIN ROADS
WATER COURSES
ELEVATION
High : 2048
Low : 1314
Afzelia
MAP 2 - LANDFORM AND DRAINAGE
PROPOSED 150MW NOUPOORT CSP PROJECT
NEAR NOUPOORT, NORTHERN CAPE PROVINCE

There are two dominant topographical units/ terrain types of the region, which may be described as: *gently sloping hillslopes (within which the site and the town of Noupoort fall; and ridgelines (to the south-east)*. These ridgelines are likely to limit visibility from the south and south-east. Outliers may also be present extending into the flatter areas to the north. These will have an influence on local visibility.

3.1.2 Existing Development

The drainage lines and their provision of water have to a large extent, dictated settlement pattern and landuse in this arid region, as has the railway line, which was built in 1883. The present day railway line, which runs parallel to the N9 (north-south), forms part of the main artery for iron ore and manganese exports from the Northern Cape to Port Elizabeth. Commercial activity in Noupoort is heavily dependent on railway activity.

Apart from the densely populated urban settlement of Noupoort, the majority of the study area is sparsely populated (less than 10 people/ km^2) and consists of a landscape of wide-open spaces with very little development.

Tourism is not well-developed within the area, however there is potential for its development. The town has a rich Anglo-Boer history.

Farming homesteads dot the countryside at irregular intervals.

The study area has a predominant rural natural character (grassland, cattle and sheep farming) with limited development outside the urban area of Noupoort **(Map 3).**

3.1.3 Planned Development

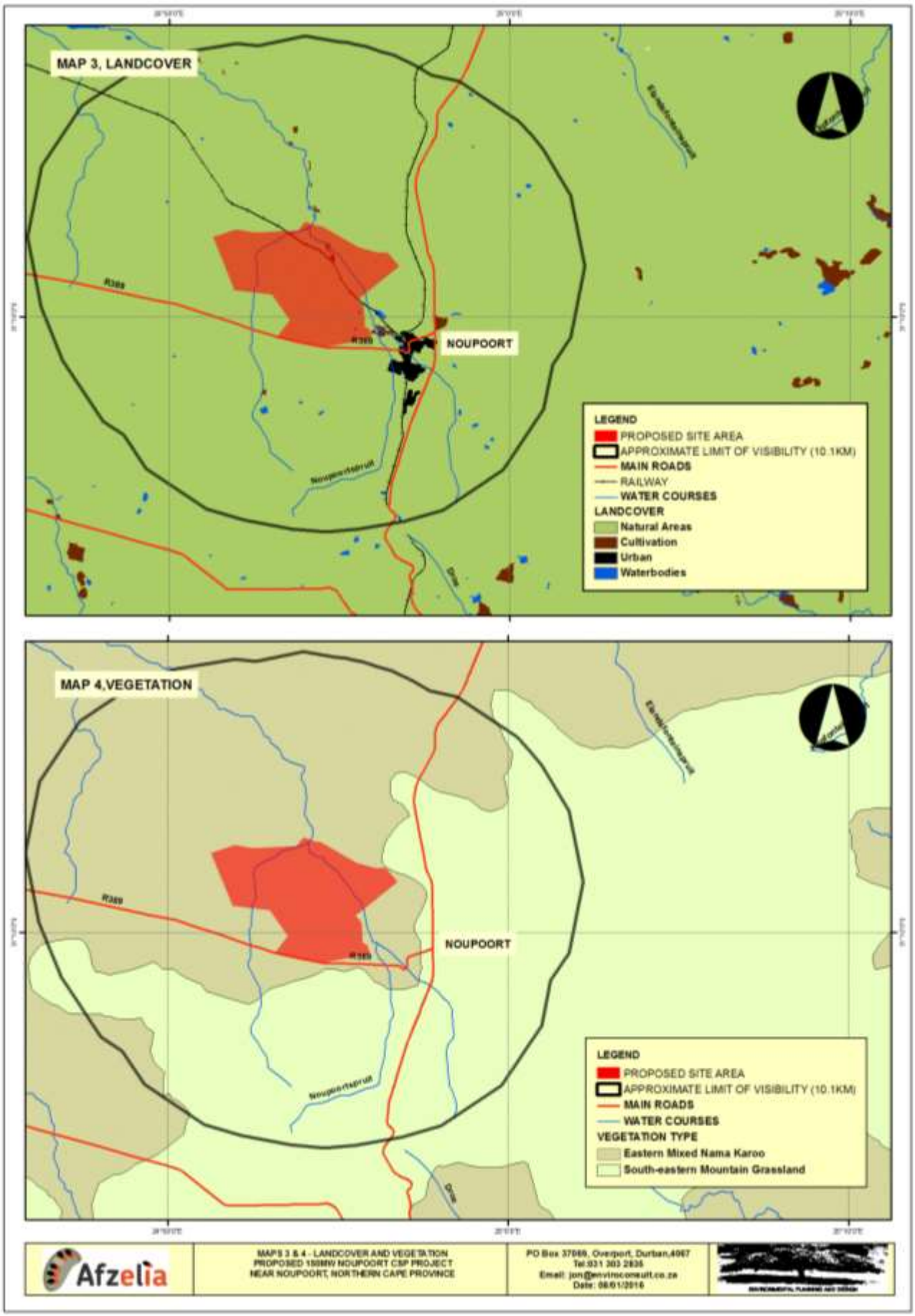
An 80MW windfarm has been approved and is under construction approximately 10km to the east of Noupoort. This facility is due to commence operation in mid-2016.

3.1.4 Vegetation Patterns

The vegetation map **(Map 4)** as produced for this VIA study has used the vegetation classification system by Low & Rebelo (1996). Two vegetation types are noted, Eastern Mixed Nama Karoo (on the valley slopes to the north-west) and South-eastern Mountain Grassland (on the ridgelines to the north-east). Both vegetation types are low and therefore unlikely to be significant in either defining character or providing any form of Visual Absorption Capacity (VAC).

Low & Rebelo (1996), although an older vegetation classification system, has been used for mapping purposes, as it correlates with topographic features (which also helps to determine landscape character). In addition, it's the height, density and broad vegetation type rather than detailed vegetation analysis that is generally critical to VIA.

Immediately surrounding homesteads and the urban fringe taller alien introduced vegetation may be found. This vegetation would provide greater screening abilities and VAC.


MAP 3, LANDCOVER
NOUPOORT
R389
LEGEND
PROPOSED SITE AREA
APPROXIMATE LIMIT OF VISIBILITY (10.1KM)
MAIN ROADS
RAILWAY
WATER COURSES
LANDCOVER
Natural Areas
Cultivation
Urban
Waterbodies
MAP 4,VEGETATION
NOUPOORT
R389
LEGEND
PROPOSED SITE AREA
APPROXIMATE LIMIT OF VISIBILITY (10.1KM)
MAIN ROADS
WATER COURSES
VEGETATION TYPE
Eastern Mixed Nama Karoo
South-eastern Mountain Grassland
Afzelia
MAPS 3 & 4 - LANDCOVER AND VEGETATION
PROPOSED 150MW NOUPOORT CSP PROJECT
NEAR NOUPOORT, NORTHERN CAPE PROVINCE
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Date: 08/01/2016

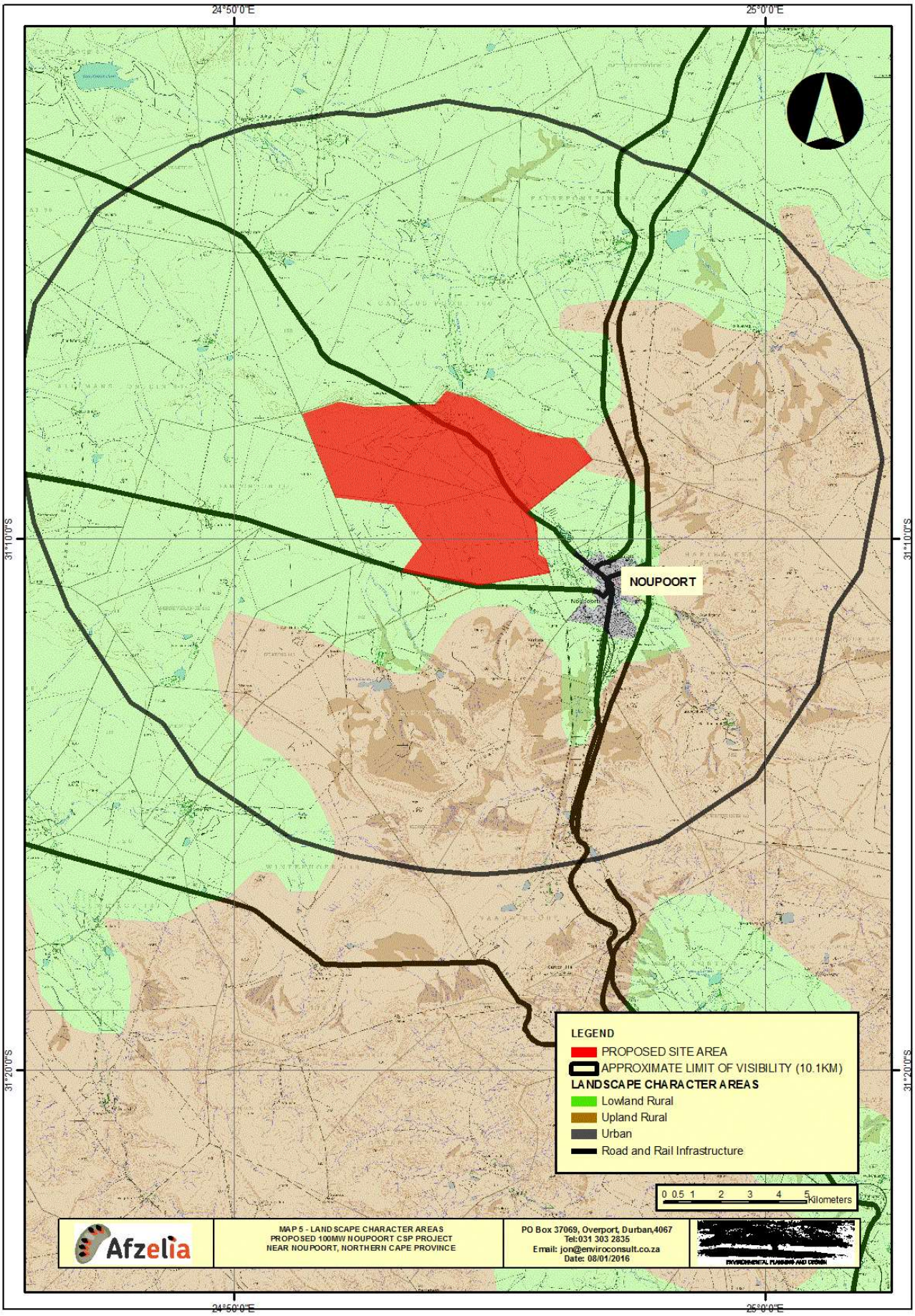
3.2 LANDSCAPE CHARACTER AREAS & VISUAL ABSORPTION CAPACITY

Landscape Character Areas (LCAs) are defined as, "single unique areas which are the discrete geographical areas of a particular landscape type".

Visual Absorption Capacity (VAC) is defined as the landscape's ability to absorb physical changes without transformation in its visual character and quality. Where elements that contrast with existing landscape character are proposed, VAC is dependent on elements such as landform, vegetation and other development to provide screening of a new element. The scale and texture of a landscape is also critical in providing VAC, for example; a new large scale industrial development located within a rural small scale field pattern is likely to be all the more obvious due to its scale.

The following broad character areas, as depicted on **Map 5**, are recognised in the region;

- **Lowland Rural.** Gently undulating topography with low intensity grazing (cattle and sheep), low level grassland/ shrubland, occasional agricultural cropping/ pastures, occasional non-perennial streams, and occasional farmsteads. Limited VAC is provided by gentle undulations and dark patches of woody vegetation which means that low/ dark structures are likely to be assimilated into the landscape. The VAC for this LCA is however largely dependent on the level of the viewer above the surrounding plain. From low levels the surrounding vegetation is likely to combine to provide screening, however as the viewpoint is elevated above the plain on ridgelines and undulations, the screening effect of existing vegetation over short distances is likely to reduce drastically as the viewer sees over and between individual woody plants.
- **Upland Rural**. This area consists of higher valley slopes and the meandering ridgelines to the south-east. It is generally dryer than the lower slopes. Vegetation is therefore more stunted. Land uses include low intensity grazing on grassland/ small shrublands (cattle and sheep). There are five isolated farmsteads within the landscape. Ridgeline provides the possibility of elevating the viewer and increasing visibility over the site area which reduces VAC. The low vegetation that generally covers the area is unlikely to contribute significantly to the VAC of the landscape. It should however be noted that due to the meandering nature of the ridgelines, the topography in many instances will obscure views.
- **Noupoort Urban area**. This area includes the town of Noupoort. Buildings, infrastructure and ornamental street and garden vegetation within the town have the potential to provide a high degree of VAC from within the urban area.


24°50'0"E
25°0'0"E
31°10'0"S
31°20'0"S
NOUPOORT
LEGEND
PROPOSED SITE AREA
APPROXIMATE LIMIT OF VISIBILITY (10.1KM)
LANDSCAPE CHARACTER AREAS
Lowland Rural
Upland Rural
Urban
Road and Rail Infrastructure
0 0.5 1 2 3 4 5 Kilometers
Afzelia
MAP 5 - LANDSCAPE CHARACTER AREAS
PROPOSED 100MW NOUPOORT CSP PROJECT
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Date: 08/01/2016

3.3 LANDSCAPE QUALITY AND IMPORTANCE

3.3.1 General

The importance of the study area, excluding Noupoort, lies in its rural character and natural features and their ability to provide a backdrop for potential tourism activities in the area, or to tourists passing through the area.

Importance can also be attributed to the need to ensure a reasonable quality of life for local people who reside, work and use the area for recreation.

This character is however changing with the construction of the Noupoort wind farm to the east of the town, with the area taking on more of an industrialised character with renewable technology likely to be more prominent.

No protected landscapes have been identified within the area that is likely to be affected.

3.3.2 Lowland Rural

This landscape is of functional importance for grazing and limited agricultural cropping. The main concern for the majority of users is therefore likely to be related to the productivity of the area rather than its aesthetic concerns. The area is also a potential backdrop for tourism uses, particularly for tourists passing through the area and with potential development in historical tourism. Homesteads/ farmsteads are also of importance as people live and work in these areas.

There may be concern related to maintaining the quality of views from the corridor for tourism traffic.

3.3.3 Upland Rural

This LCA is important for upland agricultural (grazing) character and the natural features provide a backdrop for tourism and local recreation related activities. Views are important from main roads (N9 and R389), which carry a degree of tourism / recreation related traffic to and through the area. The N9 is of importance as it is a major carrier road, more so than the R389.

3.3.4 Noupoort Urban area

This LCA is important for its urban context and as people live and work in this area. Relatively large houses are evident on the town's western edge, which could have implications for property values as a result of view changes.

3.4 VISUAL RECEPTORS

3.4.1 Possible visual receptors.

This section is intended to highlight possible Receptors within the landscape which due to use could be sensitive to landscape change. They include;

- **Area Receptors and areas critical to quality of life** These include activity areas that could be sensitive to their outlook such as protected areas or areas that are important for tourism potential and their cohesive rural agricultural character. Further investigation is required to determine the presence of protected areas or areas important for tourism. The area has a rich Anglo Boer history. The town of Noupoort may also be classed as an area receptor.

- **Linear Receptors** which include routes through the area which are comprised of two main routes; the **N9**, which links Colesberg (at the National N1), and Middleburg, bypassing Noupoort leading towards George; and the **R389**, which links Noupoort to Hanover (at the National N1), and bypasses the proposed site to the south. **Two minor roads** lead off the R389, one leads in a northerly direction immediately east of the site, whilst the other leads in southerly direction, some distance west of the site. A **third minor road** leads away from Noupoort in an easterly direction. All routes are likely to carry a proportion of tourism and local related traffic. The main routes carry the majority of visitors between the towns as well as tourists on route from Bloemfontein to the Garden Route of Knysna and its surrounds and to Cape Town. The minor routes would likely carry local traffic. In addition, **a railway line runs** from the south through Noupoort and splits into two lines on the northern outskirts of the town. One line continues north whilst the other line leads towards the north-west and bypasses the proposed site at its northern boundary.
- **Point Receptors** include isolated and small groups of homesteads that are generally associated with the drainage lines/ water availability areas. In total there are approximately 20 homesteads within the approximate limit of visibility.

Possible visual receptors or areas, places and routes that may be sensitive to landscape change are indicated on **Maps 6, 7 and 8** (included under **Section 4** of this report) indicating the Zones of Theoretical Visibility (ZTV) of the proposed project.

LANDSCAPE CHARACTER AREAS

LOWLAND RURAL

UPLAND RURAL

NOUPOORT URBAN AREA

4 THE NATURE OF POTENTIAL VISUAL IMPACTS

4.1 GENERAL

Impacts could include general landscape change or change due to the proposed development that could detract from the existing character as well as change of view for affected people and/ or activities;

a. **General landscape change or degradation**. This is particularly important for protected areas where the landscape character might be deemed to be exceptional or rare. However, it can also be important in non-protected areas particularly where landscape character is critical to a specific broad-scale use such as tourism, or simply for the general enjoyment of an area. This is generally assessed by the breaking down of a landscape into components that make up the overall character and understanding how proposed elements may change the balance of the various elements. The height, mass, form and colour of new elements all help to make new elements more or less obvious as does the structure of an existing landscape which can provide screening ability or texture that helps to assimilate new elements. This effect is known as Visual Absorption Capacity (VAC).

b. **Change in specific views** within the affected area from which the character of a view may be important for a specific use or enjoyment of the area.
    - **Visual intrusion** is a change in a view of a landscape that reduces the quality of the view. This can be a highly subjective judgement. Subjectivity has however been removed as far as is possible by classifying the landscape character of each area and providing a description of the change in the landscape that will occur due to the proposed development. The subjective part of the assessment is to define whether the impact is negative or positive. Again to make the assessment as objective as possible, the judgement is based on the level of dependency of the use in question on existing landscape characteristics.
    - **Visual obstruction** is the blocking of views or foreshortening of views. This can generally be measured in terms of extent.

    Due to the nature of the proposed development and the character of the area, visual impacts are expected to relate largely to intrusion.

4.2 ZONES OF THEORETICAL VISIBILITY

4.2.1 Definitions and Assumptions

Zones of Theoretical Visibility (ZTV) are defined by the UK Guidelines as, "a map usually digitally produced showing areas of land within which a development is theoretically visible".

As site layouts have not been provided at the time of reporting, ZTV analysis have been undertaken in order to indicate;

- All areas that could be affected (Map 6);
- The likely areas that would be affected by developing the area that could minimise visual impacts by associating the development closely with existing development areas and locating it in the relatively low eastern section of the site (Map 7); and
- The areas that could be affected by developing the section of the site that is likely to be most visible. This includes the highest central ridgeline (Map 8).

The ZTV analysis has been undertaken using Arc Spatial Analyst GIS. The assessment is based on terrain data that has been derived from satellite imagery. This data was originally prepared by NASA and is freely available on the CIAT-CCAFS website (http://www.cgiar-csi.org).

4.2.2 Limit of Visibility

The GIS Assessment does not take the curvature of the earth into account. In order to provide an indication of the likely limit of visibility due to this effect a universally accepted navigational formula (**Appendix II**) has been used to calculate the likely distance that the proposed structures might be visible over. This indicates that in a flat landscape the proposed structures may be visible for the following distance;

ELEMENT	APPROXIMATE LIMIT OF VISIBILITY
Parabolic trough at vertical position, maximum 7.9 m high.	10.1 km

It is noted that the landscape to the north and west within this distance from the proposed site is relatively flat/ gently sloping and so this approximate limit of visibility is considered appropriate. However, to the south and east, the terrain is more rugged and rises to form ridgelines. It is possible that from higher viewpoints the limit of visibility will extend by 2 – 3 km.

In reality visibility could be reduced by:

- Weather conditions that limit visibility. This would include hazy conditions during fine weather as well as mist and rain; and
- Scale and colour of individual elements making it difficult to differentiate structures from background.

4.2.3 Likely Visibility of the proposed development

Maps 6 indicates the ZTV of the proposed development (including development across the full extent of the site).

Views to the north and west past the site boundary are largely screened by topography. To the south 33% to 66% of the proposed site could be visible to approximately 7km from the site boundary. To the east 33% to 66% of the site is indicated as being visible to the urban area and beyond to approximately 8km from the site. In reality however, the site is likely to be visible to the western edge of the town and from there, the urban area will screen the majority of views.

In terms of visibility to roads, the assessment indicates that 33% to 66% of the site could be visible to approximately 20km of the R389 and up to 11km of the N9. Small sections of the site (less than 33%) are indicated as being visible to the N10 but outside the approximate limit of visibility.

It should be noted that views over the majority of the site area are likely to be limited. This is due to the topography of the site which has a ridgeline running through it from the north to the south.

Map 7 indicates the likely ZTV associated with development of the eastern section of the site. This indicates that development of this sector is likely to be visible to the east of the site only. The impact area includes the urban area.

Map 8 indicates the likely ZTV associated with development of the higher central areas of the site on and around the ridgeline that bisects the area. This indicates that development of this sector is likely to have a similar impact area as development extending over the entire site area.

4.3. POSSIBLE IMPLICATIONS FOR LANDSCAPE CHARACTER

4.3.1 General

It is anticipated that the parabolic troughs will be aligned in rows on a north to south access with only sufficient space between the rows to allow access for operation and maintenance. This means that when a facility is viewed from ground level, it will appear as a single row of units. However, when viewed from a slightly elevated position, the individual rows combine to increase the visual mass.

The height of the parabolic troughs will vary through the day as it tracks the sun, meaning that during the early morning and late afternoon when the sun is low, it will reach its full height and at around mid-day when the sun is highest, the structures will be relatively low (maximum 7.9m).

From close viewpoints the solid hard-line is likely to contrast with the natural terrain and vegetation. As the viewer moves away from the development however, this contrast is likely to be less obvious. With distance it is also likely that the cumulative effect of screening provided by relatively thin taller vegetation will increase also softening the hard engineered outline.

When the parabolic trough is aligned facing a viewpoint, light reflecting off the mirrored surfaces is likely to make the structures more obvious. In general, therefore it is likely to be most obvious to the east in the morning and to the west in the afternoon.

The parabolic troughs can also reflect the colour of the sky or the surrounding landscape subject to their inclination. The colour of the facility is therefore likely to change as the angle of the sun changes until the viewer sees the back face of the structure when the colour of the finish on the reverse side of the mirror is seen. This side is also likely to be viewed in at least partial shadow.

Where the development is seen from an elevated viewpoint, it is likely that the structures will visually combine providing an impression of an extensive industrial development **(Plate 3)**. Views from upland areas to the south and south-east could provide this impression **(Plate 4, 5 and 6)**.

4.3.1 Area of impact

The ZTV analysis has indicated that;

- Development of the central ridgeline is likely to affect the largest area of the landscape.
- Development of western sections of the site is likely to affect relatively natural landscape areas to the west, and
- Development of the eastern section of the site is likely to affect areas that are largely already affected by urban development and associated infrastructure.

Plate 3. Example view of a parabolic trough CSP project from an elevated, close viewpoint (Renewable Energy Focus.com, http://www.renewableenergyfocus.com).

The structures visually combine to give the impression of an extensive industrial development.

Plate 4. Example view of a parabolic trough CSP project from an elevated position and at a distance (Miracle or mirage web site, http://coyot.es/miracleormirage). The reflection makes the development obvious. This may be similar to the view from higher land to the south and south-east of the project.

Plate 5. Example view of a parabolic trough CSP project from a distance and at a low level (basin and range watch web site http://www.basinandrangewatch.org/Ivanpah-Updates-3). The CSP projects appear as a narrow line in the landscape. They are made obvious by the light reflecting from the mirrored surfaces.

Plate 6. Example view of a parabolic trough CSP project from a close range and at a low level (United States Department of Interior, 2013). The CSP projects appear as an engineered solid line that contrasts with the surrounding natural landscape. With distance and softening with intervening vegetation the contrast is likely to become less obvious. Note, the section indicated with the arrow has had the back of mirrors coloured.

4.4. POSSIBLE IMPLICATIONS FOR VISUAL RECEPTORS

Implications for visual receptors can be divided into:

1) Possible **changes in views** over the landscape that could affect sensitive users or general enjoyment of views; and
2) **Glint and / or glare** that could cause eye damage or nuisance to receivers. Linear collectors such as parabolic troughs are known to have the following effects (Clifford, 2011):
   - **Specular reflections**[1] from the mirrors when they are moving to or from stowed position and from specular reflections off the ends of the trough or mirrors when the sun is low and aligned with the mirrors (e.g. reflections from the south end of a north–south field when the sun is low in the northern horizon); and
   - **Diffuse**[2] and specular reflections from receiver tubes and bellows shields.

4.4.1 Possible changes in views over the landscape that could affect sensitive users or general enjoyment of views

The review of possible sensitive receptors in the region is highlighted as follows:

The N9 and R389 main roads. The N9 is located approximately 3 km to the east of the proposed site within the approximate limit of visibility. The R389 is located to the immediate south of the proposed site, also within the approximate limit of visibility. The ZTV analysis indicates that both of these roads could be impacted over some distances (approximately 11 km for the N9 and 20 km for the R389 within all visibility zones). They are located to the south and east of the facility which means that they could be impacted by glint and / or glare from the proposed development.

It is thus likely that the proposed development of the parabolic trough CSP project on the subject site could have a significant impact on views from these roads,

[1] Specular reflection is the mirror-like reflection of light (or of other kinds of wave) from a surface, in which light from a single incoming direction (a ray) is reflected into a single outgoing direction

[2] Diffuse reflection is the reflection of light from a surface such that an incident ray is reflected at many angles.

particularly the R389, which is closer and runs immediately south of the proposed development site.

Two minor roads off the R389 and third minor road from Noupoort to east. One minor road off the R389 leads in a northerly direction immediately east of the site, whilst the other leads in southerly direction, some distance west of the site. The third minor road leads from Noupoort in an easterly direction. These roads are likely to be used by farmers/ local people accessing the rural areas to the north, south-west and east of the site. The interest of this group is likely to be focused on the productivity of the land rather than aesthetics. The ZTV indicates that views will be possible over approximately 8 km (northerly road), 8 km (southerly road) and 4 km (easterly road) within the approximate limit of visibility (10.1 km). It is also likely that intervening vegetation and minor landform changes will have a modifying effect on views although views over the development are likely from sections of the road.

Railway line. A railway line runs from the south through Noupoort and splits into two lines on the northern outskirts of the town. One line continues north whilst the other line leads towards the north-west and bypasses the proposed site at its northern boundary. The railway line is used for commercial purposes therefore uses will likely be focused on the transport activity. The ZTV indicates that views will be possible over approximately 7 km (northerly rail road) and 3 km (north-westerly rail road) within the approximate limit of visibility (10.1 km). It is also likely that intervening vegetation and minor landform changes will have a modifying effect on views although views over the development are likely from sections of the railway.

Homesteads located in the landscape surrounding the proposed project. The scoping assessment has identified 20 possible receptors within the approximate limit of visibility (10.1 km), in all directions of the site. Eleven of these fall within the likely area of visibility, with three in close proximity to the site (approximately 1 km), to the site's south-east corner boundary.

Rural homesteads are generally located at relatively low points in the landscape in areas where water may be more available and where shelter might be provided by both taller vegetation and topography. This is likely to have implications for visibility of the proposed development.

Noupoort town The proposed development site will be visible from Noupoort. Some substantial houses are located on the western edge of the town which could be significantly affected. Buildings and infrastructure may have a modifying effect on views and in many instances may provide screening.

4.4.2 Possible Glint and/ or Glare

Glint is defined as a momentary flash of light, while glare is defined as a more continuous source of excessive brightness relative to the ambient lighting. Hazards from glint and glare from concentrating solar power plants include the potential for permanent eye injury (e.g., retinal burn) and temporary disability or distractions (e.g., flash blindness), which may impact people working nearby, pilots flying overhead, or motorists driving alongside the site (Clifford *et al*., 2009).

Research indicates that glint and glare problems are most likely to occur to the east and south-east of a facility in the morning, to the west and south-west in the

afternoon and evening. Glint and glare that is likely to be most problematic is likely to occur in the early morning and late afternoon/ evening as the sun is lowest in the north and light is reflected at a low level along the collector further south.

From review of the locations of possible sensitive receivers, it seems likely that a small number of homesteads could be affected. Motorists on the N9 and R389 could also be affected.

The angle of incidence of light on the mirrors during the periods of greatest risk (early morning and late afternoon) will be acute. This means that the angle of reflection will also be acute but will rise gradually away from the site. In a flat landscape therefore, the effects of glare should quickly rise over the viewer's head. It is only where the topography rises at a similar rate as the angle of reflection that extensive areas are likely to be affected by glare.

4.4.3 Possible Mitigation Measures

The US Bureau of Land Management highlights the following mitigation measures in their Best Practices Manual for Reducing Visual Impacts of Renewable Energy Facilities (United States Department of Interior, 2013);

a) Vegetation Clearance

Often, vegetation beneath a solar field is completely stripped and the area may be levelled prior to construction; however, depending on the solar technology employed, these procedures may not be necessary. In some cases, grasses and some low shrubs can be left under the parabolic trough field, or shrubs can be trimmed to shorten them to an acceptable height. If vegetation can safely be left beneath the structures and does not interfere with facility construction, operation, or maintenance, strong colour contrasts associated with exposed or eroded soils can be reduced, as can texture contrasts caused by vegetation removal. The visual benefits of leaving vegetation underneath structures varies depending on the height and spacing between solar collectors; it is most effective at reducing visual impacts for more widely spaced and taller collector arrays because there is more space visible underneath and between the collectors. Leaving or replacing vegetation underneath the structures has non-visual benefits as well, such as reduced runoff and erosion, and reduced cost for revegetation at the time of decommissioning.

The applicant has confirmed that existing vegetation will be left beneath the solar collectors.

b) Colour

Colour-treat trough mirror backs at parabolic trough facility. Colour-treated mirror backs appear as a dark band visible at the front left of the trough field. Untreated mirror backs appear blue. In this case, the colour treatment used has the added benefit of strengthening the mirrors, and it improves energy production efficiency during low-energy production conditions.

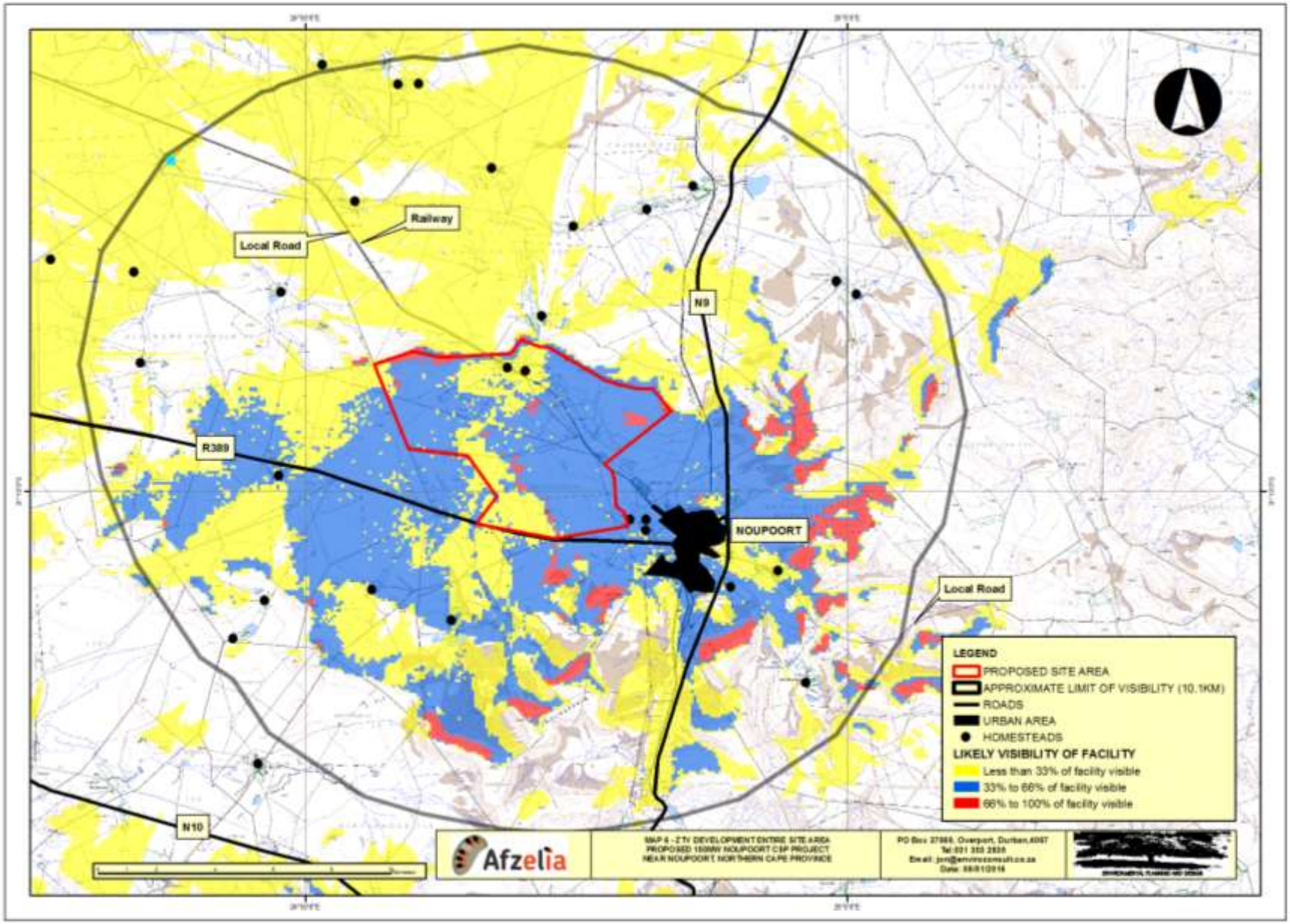
Depending on the component and treatment method, treatments could be subject to fading or flaking, and may require re-treatment to maintain proper coloration.

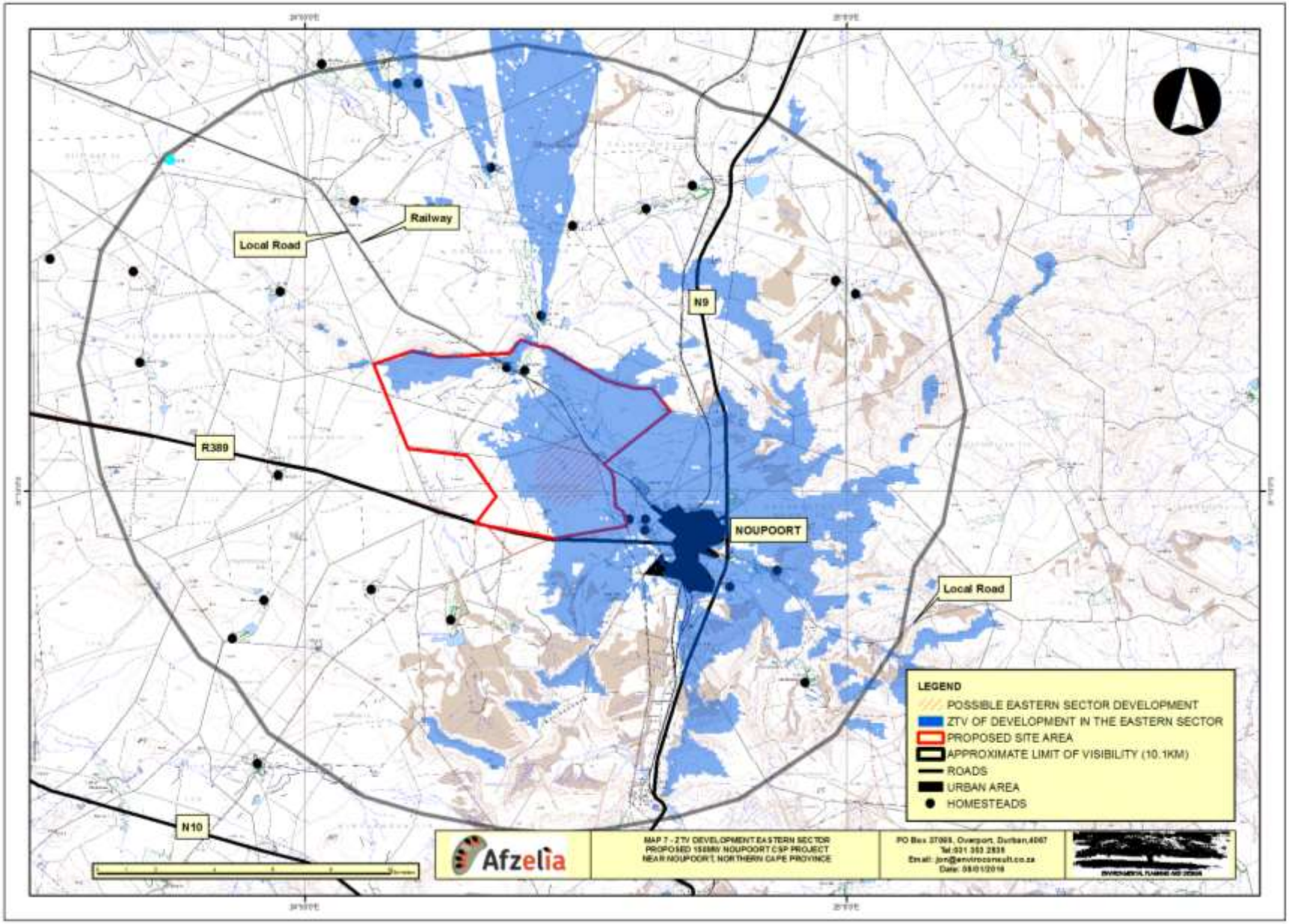
c) Fencing / Screening

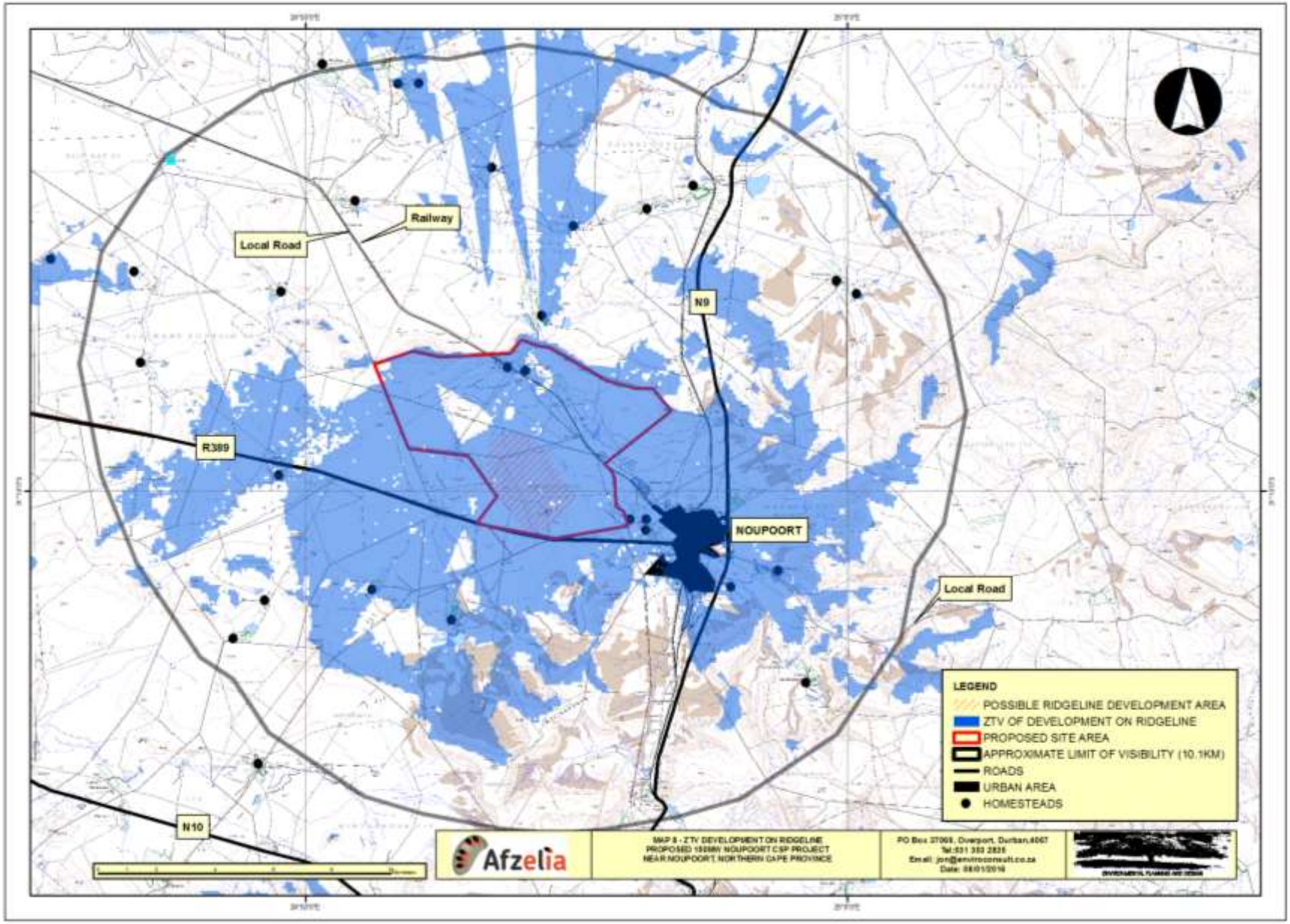
Where significant offsite glare is unavoidable, fencing with privacy slats, earthen berms, or vegetative screening materials may be employed.

d) Resting position of troughs

It is often during the early morning and late evening moving of troughs to and from the over night resting position that glare becomes problematic. It would be simple to time this movement during hours of darkness to avoid this risk.


Railway
Local Road
N9
R389
NOUPOORT
Local Road
N10
LEGEND
PROPOSED SITE AREA
APPROXIMATE LIMIT OF VISIBILITY (10.1KM)
ROADS
URBAN AREA
HOMESTEADS
LIKELY VISIBILITY OF FACILITY
Less than 33% of facility visible
33% to 66% of facility visible
66% to 100% of facility visible
Afzelia


Railway
Local Road
N9
R389
NOUPOORT
Local Road
N10
LEGEND
POSSIBLE EASTERN SECTOR DEVELOPMENT
ZTV OF DEVELOPMENT IN THE EASTERN SECTOR
PROPOSED SITE AREA
APPROXIMATE LIMIT OF VISIBILITY (10.1KM)
ROADS
URBAN AREA
HOMESTEADS
Afzelia
MAP 7 - ZTV DEVELOPMENT EASTERN SECTOR
PROPOSED 150MW NOUPOORT CSP PROJECT
NEAR NOUPOORT, NORTHERN CAPE PROVINCE


Railway
Local Road
N9
R389
NOUPOORT
Local Road
N10
LEGEND
POSSIBLE RIDGELINE DEVELOPMENT AREA
ZTV OF DEVELOPMENT ON RIDGELINE
PROPOSED SITE AREA
APPROXIMATE LIMIT OF VISIBILITY (10.1KM)
ROADS
URBAN AREA
HOMESTEADS
Afzelia
MAP 8 - ZTV DEVELOPMENT ON RIDGELINE
PROPOSED 150MW NOUPOORT CSP PROJECT
NEAR NOUPOORT, NORTHERN CAPE PROVINCE

5 IDENTIFIED AREAS OF IMPACT

5.1 IMPACTS TO BE CONSIDERED

Possible impacts identified include:

a) Potential impacts on general landscape character of the area;
b) Potential visual impact on users of the N9;
c) Potential visual impact on users of the R389;
d) Potential visual impact on users of three minor roads;
e) Potential visual impact on users of the railway line/s;
f) Potential visual impact on residents of homesteads in close proximity (3);
g) Potential visual impact on residents of Noupoort particularly on the western edge of the town;
h) Potential lighting impacts; and
i) Ocular impacts associated with glint and glare.

These issues will be considered in the context of possible degradation of Landscape Character Areas, visual effects identified and possible cumulative influence of other possible projects that exist or are planned in the vicinity.

Possible mitigation measures also need to be identified.

5.1.1 Initial Assessment of Likely Impacts

Impact

a) Potential impacts on general **landscape character** of the area.

Desktop Sensitivity Analysis of the Site:

Issue	Nature of Impact	Extent of Impact	No-Go Areas
Industrialisation of general landscape character.	The assessment indicates that the proposed development could be visible from and therefore affect the character of the rural landscape surrounding the site over an area of approximately 20 km measured east to west and 12 km measured north to south. Given that the rural landscape character is likely to be changed to a similar extent by existing (town centre) and currently authorised development (wind farm to the east) and given that there do not appear to be any affected protected areas or sensitive uses, this character change is unlikely to be significant and is assessed as l**ow to medium**. The ZTV assessment also indicates that development of the eastern section of the site is only likely to impact the landscape that is already	This is likely to be a local impact.	From the desk top scoping assessment, it does not appear that there are no-go areas. However, in order to protect the more natural landscape areas outside the influence of the urban area, it appears that the ridgeline and areas of the site to the west of the site should be avoided. A site visit is required to confirm this.

	affected by urban development and infrastructure. Development of other sections of the site are also likely to impact on areas of more natural landscape to the west of the proposed site.		

Landscape degradation
Landscape degradation is expected to be **low to medium**.

Discussion of expected significance:
Given this project will be seen in the context of the wider urban town area and wind farm project, the significance of this impact is likely to be **low**.
Mitigation might include;

- Minimizing clearance
- Maintaining natural vegetation within and below troughs
- Protection of boundary vegetation.
- Arranging development on the lower, north easterly quadrant of the site which will reduce visibility. **Refer to Map 7**.

There is unlikely to be an irreplaceable loss.
The impact will reverse on decommissioning of the facility.

Cumulative Impacts.
The development of the eastern section of the proposed site will not significantly alter the character of the area, particularly as it is located close to an already urban centre and as a wind farm is also under construction to the east of Noupoort.
The development will also be seen in the context of an existing railway line that is likely to have an existing industrialization effect on surrounding areas.
Development of the central and western sections of the site are likely to extend the cumulative impact of development on the more natural rural landscape.

Gaps in knowledge & recommendations for further study
Confirmation of the nature of the surrounding landscape, possible sensitive uses.
From review of existing GIS data sets there are no protected areas of national importance that are likely to be impacted. It is possible however that there could be sensitive and local conservation / recreational uses.
The likely sensitivity of the western section of the urban area to views of the proposed development needs to be assessed on site.
These issues need to be confirmed through a site visit.

Impact

b) Potential visual impact on **users of the N9**

Desktop Sensitivity Analysis of the Site:

Issue	Nature of Impact	Extent of Impact	No-Go Areas
Industrialisation of a natural landscape as seen from the N9	The assessment indicates that the development could be visible for approximately 11 km within the approximate limit of visibility for all visibility zones. The section of the N9 south of Noupoort would be the most affected (some 4 km), due to the higher elevation and also due to potential glint and glare in the mornings and late afternoons that will likely be experienced. The local elevation of the road relative to the site and the nature of vegetation is likely to be critical in either hiding	Likely local impact	From the desk top scoping assessment, it does not appear that there are no-go areas. However, a site visit is required to confirm this.

	the development area or opening up views over it.		

Landscape degradation
Landscape degradation is expected to be **low**.

Discussion of expected significance:
The N9 is a well-used tourist and connector route, the significance of the possible impact is anticipated to be **low** along the northern section and **medium** along the southern section, due to potential glint and glare and the road's elevation. VAC and distance may significantly reduce visibility, glint and glare, however this will require confirmation via ground-truthing. Mitigation may be required along sections of the road in the form of appropriate screen fencing/ planting to minimize glint/ glare for road users. There will be no irreplaceable loss.
The impact will reverse on decommissioning of the facility.

Cumulative Impacts.
The development of the proposed site within the Noupoort area will not significantly alter the character of the area, particularly as it is located close to an already urban centre and as a wind farm is also under construction to the east of Noupoort.

Gaps in knowledge & recommendations for further study
Minor undulations in landform and density of vegetation could have significant influence on the visibility and nature of views of the development. A site visit is required to assess this in detail.

Impact

c) Potential visual impact on **users of the R389**

Desktop Sensitivity Analysis of the Site:

Issue	Nature of Impact	Extent of Impact	No-Go Areas
Industrialisation of a natural landscape as seen from the R389	The assessment indicates that the development could be visible for approximately 20 km within the approximate limit of visibility, within all zones of visibility. The section of the R389 in close proximity to the site and close to Noupoort would likely be the most affected. The local elevation of the road relative to the site and the nature of vegetation is likely to be critical in either hiding the development area or opening up views over it.	Likely local impact	From the desk top scoping assessment it does not appear that there are no-go areas. However, an undeveloped buffer area may be advisable between the proposed development and the R389. A site visit is required to confirm this.

Landscape degradation
Landscape degradation is expected to be **low to medium**.

Discussion of expected significance:
Given that the R389 is a well-used tourist and connector route, the significance of the possible impact is anticipated to be **medium** along the majority of the R389 and **medium to high** along the section of road in close proximity to the proposed site (some 4.5 km) and in sections nearer to town. VAC and distance may reduce these respectively to **low** and to **medium**. The site is also large, being 3430 ha in extent, with a proposed development footprint of 900 ha, i.e. only 26% of the site will be developed. This will provide opportunity to construct the visible structures away from sensitive receptors (toward the north-east quadrant of the site). **Map 7** indicates that developing the lower easterly quadrant of the site could reduce impacts on the R389.
The section of the road closest to the site could also be affected by glint and glare. Mitigation may be required in the form of appropriate screen fencing/ planting, particularly

in areas that may experience glint/ glare.
There will be no irreplaceable loss. The impact will reverse on decommissioning of the facility.

Cumulative Impacts.
The development of the proposed site could extend the influence of development along the road.

Gaps in knowledge & recommendations for further study
Minor undulations in landform and density of vegetation could have significant influence on the visibility and nature of views of the development. A site visit is required to assess this in detail. A more detailed assessment of glint and glare particularly for the R389 in close proximity to the site.

Impact

d) Potential visual impact on **users of the three minor roads**

Desktop Sensitivity Analysis of the Site:

Issue	Nature of Impact	Extent of Impact	No-Go Areas
Industrialisation of a natural landscape as seen from three minor roads	The ZTV indicates that views will be possible over approximately 8 km (northerly road), 8 km (southerly road) and 4 km (easterly road) within the approximate limit of visibility (10.1 km). The northerly road would be the most affected as it borders onto the site's northern border and from this road 33-66% of the site would be visible. The local elevation of the road relative to the site and the nature of vegetation is likely to be critical in either hiding the development area or opening up views over it.	Likely local impact	From the desk top scoping assessment it does not appear that there are no-go areas. However, a site visit is required to confirm this.

Landscape degradation
Landscape degradation is expected to be **very low**.

Discussion of expected significance:
Given however that these minor roads are used mostly by farmers/ local people and that the interest is focused on productivity and not aesthetics the significance of the possible impact is anticipated to be **low.** However, along the section of the northerly road, which borders the northern boundary of the proposed site, the impact is anticipated to be **medium to high.** It should be noted though that a railway line also borders this section of the site, hence landscape character has already been altered. In addition, as mentioned above, the site is also fairly large, being 3460ha in extent, with a proposed development footprint of 900ha, i.e. only 26% of the site will be developed. This will provide opportunity to construct the visible structures away from sensitive receptors (toward the north-east quadrant of the site). **Map 7** indicates that developing the lower easterly quadrant of the site could reduce impacts on the the surrounding landscape including local roads.

Mitigation may be required in the form of appropriate fencing/ planting.
There will be no irreplaceable loss. The impact will reverse on decommissioning of the facility.

Cumulative Impacts.
The development of the proposed site within the Noupoort area will not significantly alter the character of the area, particularly as it is located close to an already urban centre and

as a wind farm is also under construction to the east of Noupoort. In addition, the proposed development will not add significantly to the existing impact associated with the railway line's presence

Gaps in knowledge & recommendations for further study
Minor undulations in landform and density of vegetation could have significant influence on the visibility and nature of views of the development. A site visit is required to assess this in detail.

Impact

e) Potential visual impact on users of the **railway line/s.**

Desktop Sensitivity Analysis of the Site:

Issue	Nature of Impact	Extent of Impact	No-Go Areas
Industrialisation of a natural landscape as seen from the railway line	The ZTV indicates that views will be possible over approximately 3 km of the north-western branch of the railway line and 7 km over the northern branch of the line within the approximate limit of visibility (10.1 km). The north-western railway branch would be the most affected as it borders onto the site's northern border and from this line 33-66% of the site would be visible. No glint/ glare is expected to be visible from the railway lines. The local elevation of the line relative to the site and the nature of vegetation is likely to be critical in either hiding the development area or opening up views over it.	Likely local impact	From the desk top scoping assessment it does not appear that there are no-go areas. However, a site visit is required to confirm this.

Landscape degradation
Landscape degradation is expected to be **very low**.

Discussion of expected significance:
Given that these lines are used for commercial purposes and that the interest is focused on business/ industrial activities and not aesthetics the significance of the possible impact is anticipated to be **negligible.**
Mitigation will likely not be required. There will be no irreplaceable loss. The impact will reverse on decommissioning of the facility.

Cumulative Impacts.
The development of the proposed site within the Noupoort area will not significantly alter the character of the area, particularly as it is located close to an already urban centre and as a wind farm is also under construction to the east of Noupoort.

Gaps in knowledge & recommendations for further study
This issue appears to be largely irrelevant due to the nature of the line which is used for goods. It will be reviewed during the EIA stage and if found irrelevant will not be reported on further.

Impact

f) Potential visual impact on residents of **settlements and homesteads** in close

proximity (3 homesteads).

Desktop Sensitivity Analysis of the Site:

Issue	Nature of Impact	Extent of Impact	No-Go Areas
Industrialisation of a natural landscape as seen from local homesteads	The scoping assessment has identified approximately 20 possible receivers within the approximate limit of visibility (10.1 km), in all directions of the site. Eleven of these fall within the zone of visibility, with three within or in close proximity to the site (approximately 1 km). Homesteads are generally associated with agriculture and largely have ornamental and woody vegetation planted around and within them. This vegetation is likely to have some influence in screening or pat screening views of external areas.	This is likely to be a local impact.	From the desk-top scoping assessment it does not appear that there is any no-go area although a buffer area may be required around homesteads within and close to the site boundary. A site visit is however required to confirm this.

Landscape degradation
Landscape degradation is expected to be **low to medium**.

Discussion of expected significance:
Given the likely nature of the homesteads with a focus on agriculture and the distance between the homesteads and the development, the significance of the possible impact is anticipated to be generally **low**.

The three homestead within or in close proximity to the site may however experience a **high** impact.

Mitigation is unlikely to generally be necessary, apart from the homestead in close proximity, which may require a buffer area and / or screen planting/ fencing.

The site is also large, being 3460 ha in extent, with a proposed development footprint of 900 ha, i.e. only 26% of the site will be developed. This will provide opportunity to construct the visible structures away from sensitive receptors (toward the north-east quadrant of the site). **Map 7** indicates that developing the lower easterly quadrant of the site could reduce impacts on the surrounding landscape including local homesteads.

There is unlikely to be an irreplaceable loss.

The impact will reverse on decommissioning of the facility.

Cumulative Impacts.
The development of the proposed site within the Noupoort area will not significantly alter the character of the area, particularly as it is located close to an already urban centre and as a wind farm is also under construction to the east of Noupoort.

Gaps in knowledge & recommendations for further study
Minor undulations in landform and density of vegetation could have a significant influence on the visibility and nature of views of the development. A site visit is required to assess

this in detail.

Impact

g) Potential visual impact on **residents of Noupoort**.

Desktop Sensitivity Analysis of the Site:

Issue	Nature of Impact	Extent of Impact	No-Go Areas
Industrialisation of a townscape	The assessment indicates that the small town of Noupoort could change in character to an industrialised town.	This is likely to be a local impact.	From the desk top scoping assessment it does not appear that there is any no-go area. A site visit is however required to confirm this.

Landscape degradation

Landscape degradation is expected to be **negligible to medium**. This is subject to the relative location of the proposed development as well as the sensitivity of the western section of the urban area.

Discussion of expected significance:

The change in character is generally expected to be minimal, given that the area is already urbanised and that a wind farm is to be constructed to the east of the town.

Houses on the north-western edge of the urban area generally overlook a rural landscape, though with a railway line running close by. It is possible that the development may industrialise this view. This could be significant as this area appears to be comprised of relatively large properties that may be dependent on outlook for maintenance of property value.

The significance could be **negligible to high** subject to the location of the proposed development within the site, the nature of the affected area and the degree of VAC provided by the existing landscape including existing railway infrastructure.

Cumulative Impacts.

The development of the proposed site within the Noupoort area will not significantly alter the character of the area, particularly as it is located close to an already urban centre and as a wind farm is also under construction to the east of Noupoort.

The proposed development will be viewed in the context of an existing railway line which is already likely to impose a degree of industrialization on the landscape character.

Gaps in knowledge & recommendations for further study

Buildings and infrastructure within the town could have significant influence on the visibility and nature of views of the development.

Confirmation of the nature of affected properties particularly on the western edge of the urban area.

A site visit is required to assess this in detail.

Impact

h) Potential visual impact of **night lighting.**

Desktop Sensitivity Analysis of the Site:

Issue	Nature of Impact	Extent of	No-Go Areas

		Impact	
Industrialisation of a natural landscape as seen at night	It is likely that operational lighting will be required at buildings and security lighting may be required within and around the facility.	This is likely to be a local impact.	From the desk top scoping assessment it does not appear that there are any no-go areas. A site visit is however required to confirm this.

Landscape degradation
Landscape degradation is expected to be **low**.

Discussion of expected significance:
Subject to the location of the proposed development the significance of this impact could be medium to low. If seen in the context of existing lighting of the urban area then the impact is likely to be low.
Mitigation might include;

- Use of infra-red systems;
- Control of lighting so that it is split into sectors and only activated during inspections/ alarm activations;
- Setting back the visible components of the facility away from sensitive receptors towards the north-east quadrant of the site.
- Choice of light fittings to minimize spread of light outside the facility.

There will be no irreplaceable loss.
The impact will reverse on decommissioning of the facility.

Cumulative Impacts.
The development of the proposed site could extend the influence of lighting within the landscape.

Gaps in knowledge & recommendations for further study
Minor undulations in landform and density of vegetation could have significant influence on the visibility and nature of views of the development. A site visit is required to assess this in detail.

Impact

i) Ocular impacts associated with **glint and glare**.

Desktop Sensitivity Analysis of the Site:

Issue	**Nature of Impact**	**Extent of Impact**	**No-Go Areas**
Impacts can vary from permanent eye injury, persistence of vision that could make driving on local roads dangerous to low level nuisance.	All large scale solar facilities are capable of causing offsite glint and glare that may cause annoyance and visual discomfort. Typically, the main risk of glint and glare associated with linear collectors such as parabolic troughs occur from; • Specular reflections from the mirrors when they are moving from stowed to tracking. • Specular reflections off the ends of the trough or mirrors when the sun has a low elevation angle (e.g., reflections from the north end of a north-south field when the sun is low in the southern horizon). • Diffuse and specular reflections from receiver	This is likely to be a local impact.	From the assessment it appears that the development could create a glint and glare problem. It seems likely however that this might be mitigated through screening. This impact is therefore unlikely to requirea no-go area.

	tubes The main mitigation measures include: • Screening with opaque fencing / earth berms • Careful siting and operation of solar collectors (e.g., siting the facility away from roads and trails where possible) or turning mirrors away from the sun during time periods when glare impacts are significantly adverse may substantially reduce or avoid visual impacts from offsite glare. In the southern hemisphere typically these impacts are most likely to occur to the east, west and south of a facility. In order for there to be an issue it is necessary for the facility to be visible to receivers.		

Landscape degradation
Landscape degradation is expected to be **low**.

Discussion of expected significance:
Possible glint and glare issues have been highlighted throughout the assessment.
From the review of visibility undertaken in assessment of other impacts, it is obvious that the identified receivers that have the potential to be impacted are:

- Users of the R389, particularly immediately south of the proposed site;
- Three homesteads to the east of the site, one being in close proximity to the south eastern boundary of the proposed site.
- The north-western edge of the urban area.

Given the possible screening effect of vegetation and minor land form and the potential to set back visible components of the facility towards the north-eastern sectors of the site, it is possible that glint and glare **will not** be a major concern. Preliminary information indicates that the site slopes away from possible affected parties which if this is the case will help to minimise risk. Screening will also help to reduce any potential impact, particularly during early morning and late afternoon. The impact could therefore be **negligible to high,** should screening not be possible.

The site is also large, being 3460 ha in extent, with a proposed development footprint of 900 ha, i.e. only 35% of the site will be developed. This will provide opportunity to construct the visible structures away from sensitive receptors (toward the north-east quadrant of the site). Map 7 indicates that developing the lower north easterly quadrant of the site could reduce impacts on the surrounding receptors and will take the problem further from sensitive areas such as residents and roads.

Distance is likely to help mitigate impacts. It is unlikely that there will be an irreplaceable loss. The impact will reverse on decommissioning of the facility.

Cumulative Impacts.
It is unlikely that there will be other developments with significant risk of glint and glare

either proposed or existing in the area.

Gaps in knowledge & recommendations for further study

A brief assessment may be undertaken using the analytical glare estimation tool on the Sandia Laboratories web site (https://share.sandia.gov/phlux). The use of this site is now a US Civil Aviation Authority requirement for assessments in close proximity to US airports. The following is required to be confirmed in order to assess the impact of the site:

- The proposed layout of site in relation to authorised projects.
- Mirror reflectivity.
- Root Mean Square (RMS) error.
- Mirror focal length.
- Reflective area.
- Direct Normal Irradiance levels (DNI)
- A site visit is required to check the screening ability of vegetation and minor landform changes.

The Sandia Laboratories web site has been unavailable recently so it may not be possible to utilize this facility. In which case, the assessment will provide comment based on the likely direction and angle of reflections during early morning and late afternoon will be prepared.

6 RECOMMENDED ASSESSMENT METHODOLOGY

6.1 REQUIREMENTS IN ACCORDANCE WITH THE WESTERN CAPE GUIDELINES

The criterion recommended by the Western Cape Guidelines for justification of level of input for a VIA is the expected level of visual impact. This categorisation is derived from the following matrix;

Type of environment	Type of development (see Box 3) Low to high intensity				
	Category 1 development	Category 2 development	Category 3 development	Category 4 development	Category 5 development
Protected/wild areas of international, national, or regional significance	Moderate visual impact expected	High visual impact expected	High visual impact expected	Very high visual impact expected	Very high visual impact expected
Areas or routes of high scenic, cultural, historical significance	Minimal visual impact expected	Moderate visual impact expected	High visual impact expected	High visual impact expected	Very high visual impact expected
Areas or routes of medium scenic, cultural or historical significance	Little or no visual impact expected	Minimal visual impact expected	Moderate visual impact expected	High visual impact expected	High visual impact expected
Areas or routes of low scenic, cultural, historical significance / disturbed	Little or no visual impact expected. Possible benefits	Little or no visual impact expected	Minimal visual impact expected	Moderate visual impact expected	High visual impact expected
Disturbed or degraded sites / run-down urban areas / wasteland	Little or no visual impact expected. Possible benefits	Little or no visual impact expected. Possible benefits	Little or no visual impact expected	Minimal visual impact expected	Moderate visual impact expected

The proposed development involves the construction of a parabolic trough facility immediately west of the town of Noupoort and an authorised wind farm to the town's east. The development is expected to not add significantly to the visual impact associated with the already authorised wind farm project and the existing urban setting, including a railway line. It therefore has to be assumed that whilst it currently appears relatively natural, for the proposed development the landscape may be further disturbed.

Category 1 development:
e.g. nature reserves, nature-related recreation, camping, picnicking, trails and minimal visitor facilities.

Category 2 development:
e.g. low-key recreation / resort / residential type development, small-scale agriculture / nurseries, narrow roads and small-scale infrastructure.

Category 3 development:
e.g. low density resort / residential type development, golf or polo estates, low to medium-scale infrastructure.

Category 4 development:
e.g. medium density residential development, sports facilities, small-scale commercial facilities / office parks, one-stop petrol stations, light industry, medium-scale infrastructure.

Category 5 development:
e.g. high density township / residential development, retail and office complexes, industrial facilities, refineries, treatment plants, power stations, wind energy farms, power lines, freeways, toll roads, large-scale infrastructure generally. Large-scale development of agricultural land and commercial tree plantations. Quarrying and mining activities with related processing plants.

From reference to the categorisation of development included in the Western Cape Guidelines as indicated in the table above, the proposed development if standing on its own should be considered as a Category 5 development. However, it is a relatively small addition to larger scale existing and authorised developments.

Based on the predicted visual impacts described in this report, and on the basis that the proposed new facility, it seems that the proposed development could have significant local impacts. Because of this it is proposed that a **Level 3 Assessment** is undertaken in accordance with the Western Cape Guidelines.

In accordance with the Western Cape Guidelines, a Level 3 Assessment requires the following input:

- Verification of issues raised in scoping phase, and site visit;
- Description of the receiving environment and the proposed project;
- Establishment of viewshed catchment area and receptors;
- Indication of potential visual impacts using established criteria;
- Inclusion of potential lighting impacts at night;
- Description of alternatives, mitigation measures and monitoring programmes; and
- Review by independent, experienced visual specialist (if required).

6.2 DETAILED METHODOLOGY

As indicated above, confirmation of the following is required in order to investigate and finalise the issues and impacts highlighted by this initial VIA scoping exercise:

a) Confirmation of the layout of the facility
b) A site visit is required.

The following methodology will be used in preparation of the VIA report.

6.2.1 Identification of issues raised in scoping phase, and site visit

Likely issues have already been identified in this scoping analysis. These issues will be verified from a site visit as well as responses from stakeholders to the scoping documentation.

6.2.2 Description of the receiving environment and the proposed project

The receiving environment has been described and categorised. This will be verified from a site visit.

6.2.3 Establishment of view catchment area, view corridors, viewpoints and receptors

Zones of theoretical visibility and visual receptors have been established from GIS analysis. These will be verified from a site visit. Existing large scale industrial development should help to provide a useful guide as to likely visibility of the proposed development.

Viewpoints will be identified from a site visit to represent views of visual receptors.

6.2.4 Indication of potential visual impacts using established criteria

Areas of likely visual impacts have been identified and described from this scoping exercise. These impacts will be verified from a site visit.

It is possible that additional impacts might be identified form the site visit and from comments by stakeholders.

Types of identified impacts include:

- The area and nature of impacts associated with the proposed development will be overlaid and an assessment made as to how these impacts are likely to change general landscape character.
- Change to the views of visual receptors. These impacts might relate to visual obstruction and / or intrusion. The assessment will make judgements as to how changes in view are likely impact on land uses.
- Ocular impacts associated with glint and glare. These are only likely to the south, east and west, where the development is visible to a receptor. Comment will be made with regard to likelihood of impacts based on the location of receptors as well as the existence of screening vegetation / landform. An analysis for each possible receptor will be undertaken using the analytical glare estimation tool on the Sandia Laboratories web site (https://share.sandia.gov/phlux). It should be noted that the Sandia Laboratories web site has been unavailable recently so it may not be possible to utilize this facility. In which case, the assessment will provide comment based on the likely direction and angle of reflections during early morning and late afternoon will be prepared.

Impacts will be assessed using a numerical assessment system that has been adopted by Savannah Environmental for the overall EIA assessment.

Mitigation and monitoring measures will be developed during the preparation of the VIA report.

6.2.5 Inclusion of potential lighting impacts at night

The impact of lighting at night will be included in the assessment using the above criteria.

6.2.6 Description of alternatives, mitigation measures and monitoring programmes.

The alternatives that have been identified for this project as well as the "no go" alternative will be considered in the assessment.

Mitigation and monitoring measures will be developed during the preparation of the VIA report.

6.2.7 Review by independent, experienced visual specialist (if required).

Confirmation of this requirement is needed.

7 CONCLUSIONS

The desk-top scoping assessment indicates that the construction of the proposed CSP project on its site will impact to a limited extent on relatively natural areas surrounding the development area. However, the character of affected areas will change which will have the effect of **industrialising the character** of the landscape surrounding it. As the site is located immediately adjacent to a town centre and there is a wind farm already under construction in close proximity to the town, this change will be minimal. This will be seen in the context of an existing urban area and a railway line that runs close to the site which is likely to provide a degree of industrialisation.

The natural vegetation that covers the majority of the affected area could provide a degree of screening, particularly if trees and shrubland extend above eye-level. This screening effect could be increased or reduced subject to minor undulations that are likely to occur in the landscape. It is noted that the slope of the site appears to fall away from some likely sensitive receivers which could also help to moderate impacts.

The distance between possible sensitive receivers and the facility also means that intervening vegetation is likely to combine to provide a cumulative screening effect.

In addition, as the site is fairly large, being 3460 ha in extent, with a proposed approximate development footprint of 900 ha, i.e. approximately 26% of the site will be developed. This will provide opportunity to construct the visible structures away from sensitive receptors (toward the north-east quadrant of the site). Map 7 indicates that development of the east quadrant of the site will help to mitigate impacts on possible sensitive receivers. Extending the development across higher middle sections of the proposed site is likely to exacerbate impacts. Developing the lower western sections of the site is likely to extend the influence of development into the more natural rural landscape to the west of the proposed site.

It is possible therefore that the affected **landscape has a degree of visual absorption capacity** although the likely scale of the proposed development is likely to be such that where, vegetation is cleared, or where the facility is viewed from a slightly elevated viewpoint, it will be obvious in the landscape.

The most significant potential **visual receptors** that have been identified include;

- The N9 south of Noupoort.
- The R389, particularly immediately south of the proposed development site.
- The minor road immediately north of the proposed development site.
- A small number homesteads in close proximity to the proposed development site, particularly to the south-east.

- The town of Noupoort, particularly a residential area on the north-western edge.

In terms of the way forward in undertaking the VIA, because there are local impacts that need to be assessed in detail, it is recommended that a **Level 3 Assessment** be undertaken in accordance with the Western Cape Guidelines. If the proposed development is found to have significant impacts, then the assessment could be elevated to **Level 4**.

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APPENDIX I
ASSESSOR'S BRIEF CURRICULUM VITAE

ENVIRONMENTAL PLANNING AND DESIGN

Name	JONATHAN MARSHALL
Nationality	British
Year of Birth	1956
Specialisation	Landscape Architecture / Landscape & Visual Impact Assessment / Environmental Planning / Environmental Impact Assessment.

Qualifications

Education	Diploma in Landscape Architecture, Gloucestershire College of Art and Design, UK (1979) Environmental Law, University of KZN (1997)
Professional	Registered Professional Landscape Architect (South Africa) Chartered Member of the Landscape Institute (UK) Certified Environmental Assessment Practitioner of South Africa. Member of the International Association of Impact Assessment, South Africa

Languages

English	-	Speaking	-	Excellent
	-	Reading	-	Excellent
	-	Writing	-	Excellent

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Key Experience

Jon qualified as a Landscape Architect (Dip LA) at Cheltenham (UK) in 1979. He has also been a Certified Environmental Assessment Practitioner of South Africa since 2009.

During the early part of his career (1981 - 1990) He worked with Clouston (now RPS) in Hong Kong and Australia. During this period he was called on to undertake visual impact assessment (VIA) input to numerous environmental assessment processes for major infrastructure projects. This work was generally based on photography with line drawing superimposed to illustrate the extent of development visible.

He has worked in the United Kingdom (1990 - 1995) for a major supermarket chain and prepared CAD based visual impact assessments for public enquiries for new green field store development. He also prepared the VIA input to the environmental statement for the Cardiff Bay Barrage for consideration by the UK Parliament in the passing of the Barrage Bill.

His more recent VIA work (1995 to present) includes a combination of CAD and GIS based work for a new international airport to the north of Durban, new heavy industrial operations, overhead electrical transmission lines, mining operations in West Africa and numerous commercial and residential developments.

VIA work undertaken during the last eighteen months includes assessments for proposed new mine developments in Ghana and Guinea, numerous solar plant projects for Eskom and private clients, proposed wind farm development and a proposed tourism development within the Isimangaliso Wetland Park World Heritage Site .

Jon has also had direct experience of working with UNESCO representatives on a candidate World Heritage Site and has undertaken VIAs within and adjacent to other World Heritage Sites.

Relevant Visual Impact Assessment Projects

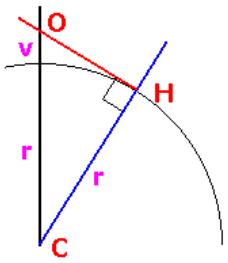
1. **Isundu Sub- Station Development -** Visual impact assessment for a new major sub – station in KwaZulu-Natal for Eskom.
2. **Bhangazi Lake Tourism Development** – Visual impact assessment for a proposed lodge development within the Isimangaliso Wetland Park World Heritage Site. This work is ongoing.
3. **Quarry Development for the Upgrade of Sani Pass –** Visual Impact Assessments for two proposed quarry developments on the edge of the uKhalamba-Drakensburg World Heritage Site.
4. **Mtubatuba to St Lucia Overhead Power Line** – Visual Impact Assessment for a proposed power line bordering on the Isimangaliiso Wetland Park World Heritage Site for Eskom.
5. **St Faiths 400/132 kV Sub-Station and Associated Power Lines** - Visual Impact Assessment for a proposed new major sub-station and approximately 15 km of overhead power line for Eskom.
6. **Clocolan to Ficksburg Overhead Power Line** – Visual Impact Assessment for a proposed power line for Eskom.
7. **Solar Plant Projects including Photovoltaic and Concentrating Solar Power Plants** – Numerous projects for Eskom and private clients in the Northern Cape, Limpopo, Mpumalanga and the Free State.
8. **Moorreesburg Wind Farm.** Visual impact assessment for a proposed new wind farm in the Western Cape.
9. **AngloGold Ashanti, Dokyiwa (Ghana)** – Visual Impact Assessment for proposed new Tailings Storage Facility at a mine site working with SGS as part of their EIA team.
10. **Camperdown Industrial Development** - Visual Impact Assessment for proposed new light industrial area to the north o Camperdown for a private client.
11. **Wild Coast N2 Toll Highway** – Peer review of VIA undertaken by another consultant.
12. **Gamma to Grass Ridge 765kv transmission line** – Peer review of VIA undertaken by another consultant.
13. **Gateway Shopping Centre Extension (Durban)** – Visual Impact Assessment for a proposed shopping centre extension in Umhlanga, Durban.
14. **Kouroussa Gold Mine (Guinea)** – Visual impact assessment for a proposed new mine in Guinea working with SGS as part of their EIA team.
15. **Mampon Gold Mine (Ghana)** - Visual impact assessment for a proposed new mine in Ghana working with SGS as part of their EIA team.
16. **Telkom Towers** – Visual impact assessments for numerous Telkom masts in KwaZulu Natal
17. **Dube Trade Port, Durban International Airport** – Visual Impact Assessment for a new international airport.
18. **Sibaya Precinct Plan** – Visual Impact Assessment as part of Environmental Impact Assessment for a major new development area to the north of Durban.
19. **Umdloti Housing** – Visual Impact Assessment as part of Environmental Impact Assessment for a residential development beside the Umdloti Lagoon to the north of Durban.
20. **Tata Steel Ferrochrome Smelter** - Visual impact assessment of proposed new Ferrochrome Smelter in Richards Bay as part of EIA undertaken by the CSIR.
21. **Diamond Mine at Rooipoort Nature Reserve near Kimberley** – Visual impact assessment for a proposed diamond mine within an existing nature reserve for De Beers.
22. **Durban Solid Waste Large Landfill Sites –** Visual Impact Assessment of proposed development sites to the North and South of the Durban Metropolitan Area. The project utilised 3d computer visualisation techniques.

23. **Hillside Aluminium Smelter, Richards Bay -** Visual Impact Assessment of proposed extension of the existing smelter. The project utilised 3d computer visualisation techniques.
24. **Estuaries of KwaZulu-Natal Phase 1 and Phase 2 –** Visual character assessment and GIS mapping as part of a review of the condition and development capacity of eight estuary landscapes for the Town and Regional Planning Commission. The project was extended to include all estuaries in KwaZulu-Natal.
25. **Signage Assessments** – Numerous impact assessments for proposed signage developments for Blast Media.
26. **Signage Strategy** – Preparation of an environmental strategy report for a national advertising campaign on National Roads for Visual Image Placements.
27. **Zeekoegatt, Durban** - Computer aided visual impact assessment. Acted as advisor to the Province of KwaZulu-Natal in an appeal brought about by a developer to extend a light industrial development within a 60 metre building line from the National N3 Highway.
28. **La Lucia Mall Extension** - Visual impact assessment using three dimensional computer modelling / photo realistic rendering and montage techniques for proposed extension to shopping mall for public consultation exercise.
29. **Redhill Industrial Development** - Visual impact assessment using three dimensional computer modelling / photo realistic rendering and montage techniques for proposed new industrial area for public consultation exercise.
30. **Avondale Reservoir** - Visual impact assessment using three dimensional computer modelling / photo realistic rendering and montage techniques for proposed hilltop reservoir as part of Environmental Impact Assessment for Umgeni Water.
31. **Hammersdale Reservoir** - Visual impact assessment using three dimensional computer modelling / photo realistic rendering and montage techniques for proposed hilltop reservoir as part of Environmental Impact Assessment for Umgeni Water.
32. **Southgate Industrial Park, Durban** - Computer Aided Visual Impact Assessment and Landscape Design for AECI.
33. **Sainsbury's Bryn Rhos (UK)** - Computer Aided Visual Impact Assessment/ Planning Application for the development of a new store within the Green Wedge North of Swansea.
34. **Ynyston Farm Access (UK)** - Computer Aided Impact Assessment of visual intrusion of access road to proposed development in Cardiff for the Land Authority for Wales.
35. **Cardiff Bay Barrage (UK)** - Concept Design, Detail Design, Documentation, and Visual Input to Environmental Statement for consideration by Parliament in the debate prior to the passing of the Cardiff Bay Barrage Bill. The work was undertaken for Cardiff Bay Development Corporation.
36. **A470, Cefn Coed to Pentrebach (UK)** - Preparation of frameworks for the assessment of the impact of the proposed alignment on the landscape for The Welsh Office.
37. **Sparkford to Illchester Bye Pass (UK)** - The preparation of the landscape framework and the draft landscape plan for the Department of Transport.
38. **Green Island Reclamation Study (Hong Kong)** - Visual Impact Assessment of building massing, Urban Design Guidelines and Masterplanning for a New Town extension to Hong Kong Island.
39. **Route 3 (Hong Kong)** - Visual Impact Assessment for alternative road alignments between Hong Kong Island and the Chinese Border.
40. **China Border Link (Hong Kong)** - Visual Impact Assessment and initial Landscape Design for a new border crossing at Lok Ma Chau.
41. **Route 81, Aberdeen Tunnel to Stanley (Hong Kong)** - Visual Impact Assessment for alternative highway alignments on the South side of Hong Kong Island.

APPENDIX II
CALCULATION OF APPROXIMATE VISUAL HORIZON

The Mathematics behind this Calculation

This calculation should be taken as a guide only as it assumes the earth is a perfect ball 6378137 metres radius. It also assumes the horizon you are looking at is at sea level. A triangle is formed with the centre of the earth (C) as one point, the horizon point (H) is a right angle and the observer (O) the third corner. Using Pythagoras's theorem we can calculate the distance from the observer to the horizon (OH) knowing CH is the earth's radius (r) and CO is the earth's radius (r) plus observer's height (v) above sea level.



Sitting in a hotel room 10m above sea level a boat on the horizon will be 11.3km away. The reverse is also true, whilst rowing across the Atlantic, the very top of a mountain range 400m high could be seen on your horizon at a distance of 71.4 km assuming the air was clear enough.