ENVIRONMENTAL & ENGINEERING

REPORT

VANDABYTE (PTY) LTD

VISUAL IMPACT ASSESSMENT (VIA)

REPORT REF: 19-695-SPS

(PORTIONS 1, 2 AND THE REMAINING EXTENT OF THE FARM DUNBAR 189 IS, PORTION 1 OF THE FARM MIDDELKRAAL 50 IS, PORTION 6 OF THE FARM HALFGEWONNEN 190 IS. - MPUMALANGA PROVINCE.)

VERSION CC

Document and Quality Control:

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The specialist - was independent and performed the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the application; have expertise in conducting environmental impact assessments or undertaking specialist work as required, including knowledge of the Act, these Regulations and any guidelines that have relevance to the proposed activity; ensure compliance with these Regulations;

Take into account, to the extent possible, the matters referred to in regulation 18 when preparing the application and any report, plan or document relating to the application; disclose to the proponent or applicant, registered interested and affected parties and the competent authority all material information in the possession of the EAP and, where applicable, the specialist, that reasonably has or may have the potential of influencing-

The findings, results, observations, conclusions and recommendations provided in this report are based solely on the information provided to Eco Elementum (Pty) Ltd by the Client and other external sources (including previous site investigation data and external scientific studies). The opinions expressed herein apply to the site conditions and features which existed at the time of commencement of the investigations and production of this report.

The author has utilised his/her best scientific and professional knowledge in preparing this report and the content herein contained is and remains confidential in nature, save where otherwise ordered by a Court of law.

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EXECUTIVE SUMMARY

Vandabyte (Pty) Ltd (hereafter the applicant) has appointed Enviro-Insight CC as the Environmental Assessment Practitioner (EAP) to undertake environmental authorisations (EAs) associated with the proposed Dunbar Coal Mine. The applicant has obtained a Prospecting Right (reference number MP 30/5/1/1/2/10737 PR) on 22 May 2014 from the Mpumalanga Department of Mineral Resources (DMR) to prospect for coal in an area of 1 797 ha on a Portion of Portion 1, Portion 2 and the remaining extent of the Farm Dunbar 189 IS, Portion 1 of the Farm Middelkraal 50 IS and Portion 6 of the Farm Halfgewonnen 190 IS located in Mpumalanga Province. The mining right application lodged on 9 May 2019 to the DMR (reference number MP30/5/1/2/2/10237MR) includes the abovementioned properties and extent.

Enviro-Insight appointed Eco-Elementum (Pty) Ltd to undertake the Air Quality Impact Assessment for the Dunbar Coal project.

The proposed project involves the development of two new open pit coal mines and the associated supporting infrastructure. The coal resource will be mined using open pit methods due to the seemly depth of the coal reserve. For this specific project the mining of coal by means of surface mining methods are viable due to the fact that the resource is situated close enough to the surface to make it economically mineable. Typical surface mining methods include: strip mining and open pit mining, as well as dredge, placer and hydraulic mining in riverbeds, terraces and beaches. These activities always disrupt the surface and this, in turn, affects soils, surface water and near-surface ground water, fauna, flora and all alternative types of land-use.

The generally low strip ratios and wide surface area of the project area makes it ideal for the opencast truck and shovel mining method. Also, the mining method applicability is driven by technical applicability, economic viability, safety, equipment and infrastructure.

The scope of work for this Visual Impact Assessment will include:

1. Describe the existing visual characteristics of the proposed sites and its environs;
2. Viewshed and viewing distance using GIS analysis up to 15 km from the proposed structures; and
3. Visual Exposure Analysis.

Summary of Findings

The construction and operation phase of the proposed Dunbar Coal project related activities and its associated infrastructure will have a MODERATE visual impact on the natural scenic resources and the topography. However, with the correct mitigation measures the impact might decrease to a point where the visual impact can be seen as less significant. The moderating factors of the visual impact of the proposed mining operations in close range are the following:

- Number of human inhabitants located in the area;
- Natural topography and vegetation;
- Mitigation measures that will be implemented such as the establishment of barriers or screens;
- The size of the operation; and
- Medium absorption capacity of the landscape.

In light of the above mentioned factors that reduce the impact of the facility, the visual impact is assessed as MODERATE VISUAL IMPACT after mitigation measures have been implemented.

Table 1: The overall Assessment of the Visual Impact

Nature of impact: The overall Assessment of the Visual Impact of the area.			
		Unmitigated	**Mitigated**
Assessment Criteria	**Severity** [Insignificant / non-harmful (1); Small / potentially harmful (2); Significant / slightly harmful (3); Great / harmful (4); Disastrous / extremely harmful / within a regulated sensitive area (5)]	**2**	**2**
	Spatial Scale [Area specific (at impact site) (1); Whole site (entire surface right) (2); Local (within 5km) (3); Regional / neighbouring areas (5km to 50km) (4); National (5)]	**4**	**2**
	Duration [One day to one month (immediate) (1); One month to one year (Short term) (2); One year to 10 years (medium term) (3); Life of the activity (long term) (4); Beyond life of the activity (permanent) (5)]	**4**	**4**
	Frequency of Activity [Annually or less (1); 6 monthly (2); Monthly (3); Weekly (4); Daily (5)]	**5**	**5**
	Frequency of Incident/Impact [Almost never / almost impossible / >20% (1); Very seldom / highly unlikely / >40% (2); Infrequent / unlikely / seldom / >60% (3); Often / regularly / likely / possible / >80% (4); Daily / highly likely / definitely / >100% (5)	**4**	**3**
	Legal Issues [No legislation(1); Fully covered by legislation (5)]	**1**	**1**
	Detection [Immediately(1); Without much effort (2); Need some effort (3); Remote and difficult to observe (4); Covered (5)]	**3**	**3**
Consequence	Severity + Spatial Scale + Duration	**10**	**8**
Likelihood	Frequency of Activity + Frequency of impact + Legal issues + Detection	**13**	**12**
Risk	Consequence * Likelihood	**MODERATE (130)**	**MODERATE (96)**
Mitigation:	The visual impact can be minimized by the creation of a visual barrier.		
Cumulative Impact:	Construction of proposed Dunbar Coal structures with its associated infrastructure will increase the cumulative visual impact of agriculture and mining character within the region. In context of the existing character, added structures will contribute to a regional increase in small and heavy vehicles on the roads.		

The Visual Impact due to mining activities and associated infrastructure can be seen as having a MODERATE impact on the surrounding environment and inhabitants before mitigation measures are implemented. After mitigation, the visual impact can be seen as MODERATE. The visual impact from the mining activities can be sufficiently mitigated to a point where it can be seen as insignificant. Thus, mitigation measures are very important and one of the most significant mitigation measures are the rehabilitation of the area after mining has been concluded. If the rehabilitation of the impact is not done correctly and the final landform do not fit into the surrounding area then the visual impact will remain high and become a concern. However, with correct rehabilitation, the impact will be minimal and there should be no visual impact after the landform has been restored.

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Definition of Terms

Assessment	A systematic, independent and documented review of operations and practises to ensure that relevant requirements are met.
Construction	The time period that corresponds to any event, process, or activity that occurs during the Construction phase (e.g., building of site, buildings, and processing units) of the proposed project. This phase terminates when the project goes into full operation or use.
Critical viewpoints	Important points from where viewers will be able to view the proposed or actual development and from where the development may be significant.
Cumulative Impacts	The summation of the effects that result from changes caused by a development in conjunction with the other past, present or reasonably foreseen actions (The landscape Institute, Institute of Environmental Management & Assessment. 2002)
Decommissioning	to remove or retire (a mine, etc.) from active service.
Environmental Component	An attribute or constituent of the environment (i.e., air quality; marine water; waste management; geology, seismicity, soil, and groundwater; marine ecology; terrestrial ecology, noise, traffic, socio-economic) that may be impacted by the proposed project.
Environmental Impact	A positive or negative condition that occurs to an environmental component as a result of the activity of a project or facility. This impact can be directly or indirectly caused by the project's different phases (i.e., Construction, Operation, and Decommissioning).
Field of view:	The field of view is the angular extent of the observable world that is seen at any given moment. Humans have an almost 180º forward-facing field of view. Note that human stereoscopic (binocular) vision only covers 140º of the field of view in humans; the remaining peripheral 40º have no binocular vision due to the lack of overlap of the images of the eyes. The lower the focal length of a lens (see below), the wider the field of view.
Landscape Integrity	Landscape integrity is visual qualities represented by the following qualities, which enhance the visual and aesthetic experience of the area
Mitigation	
(in the context of Visual Impact Assessment):	
	Any action taken or not taken in order to avoid, minimise, rectify, reduce, eliminate, or compensate for actual or potential adverse visual impacts.
Operation	The time period that corresponds to any event, process, or activity that occurs during the Operation (i.e., fully functioning) phase of the proposed project or development. (The Operation phase follows the Construction phase, and then terminates when the project or development goes into the Decommissioning phase.)
Record of Decision	Is an environmental authorisation issued by a state department.
Scenic value	Degree of visual quality resulting from the level of variety, harmony and contrast among the basic visual elements.
Sense of place	the character of a place, whether natural, rural or urban, it is allocated to a place or area through cognitive experience by the user.
Visual absorption capacity	
(VAC):	The ability of elements of the landscape to "absorb" or mitigate the visibility of an element in the landscape. Visual absorption capacity is based on factors such as vegetation height (the greater the height of vegetation, the higher the absorption capacity), structures (the larger and higher the intervening structures, the higher the absorption capacity) and topographical variation (rolling topography presents opportunities to hide an element in the landscape and therefore increases the absorption capacity).
Visual character	the overall impression of a landscape created by the order of the patterns composing it; the visual elements of these patterns are the form, line, colour and texture of the landscape's components. Their interrelationships are described in terms of dominance, scale, diversity and continuity. This characteristic is also associated with land use.
Visual Exposure	Visual exposure is based on distance from the project to selected viewpoints. Visual exposure or visual impact tends to diminish exponentially with distance. The visibility or visual exposure of any structure or activity is the point of departure for the visual impact assessment. It stands to reason that if the proposed mine activities and associated infrastructure were not visible, no visual impact would occur. Visual exposure is determined by the Viewshed or the view catchment being the area within which the proposed development will be visible.
Visual Integrity	Visual sensitivity can be determined by a number of factors in combination, such as prominent topographic or other scenic features, including high points, steep slopes and axial vistas
Visually sensitive	Areas in the landscape from where the visual impact is readily or excessively encountered.

Abbreviations

CA:	Competent Authority
DEA:	Department of Environmental Affairs (The former Department of Environmental Affairs and Tourism)
DMR:	The Department of Mineral Resources (The former Department of Minerals and Energy)
DWA:	Department of Water Affairs (Is now referred to the Department of Water and Sanitation – DWS)
EIA:	Environmental Impact Assessment
EMP:	Environmental Management Plan
EMPr:	Environmental Management Programme
I&AP's:	Interested and Affected Parties
IWUL:	Integrated Water Use License
IWWMP:	Integrated Water and Water Management Plan
MPRDA:	Mineral and Petroleum Resources Development Act, 28 of 2002
NAAQS:	National Ambient Air Quality Standards
NEMA:	National Environmental Management Act, 107 of 1998
NEMAQA:	National Environmental Management: Air Quality Act, 39 of 2004
NEMBA:	National Environmental Management: Biodiversity Act, 10 of 2004
NEMWA:	National Environmental Management: Waste Act, 59 of 2008
NHRA:	National Heritage Resources Act, 25 of 1999
NWA:	National Water Act, 36 of 1998
ROD:	Record of Decision
VAC:	Visual Absorption Capability
VIA:	Visual Impact Assessment
WSA:	Water Services Act, 108 of 1997
WUL*:*	Water Use Licence

PROJECT INFORMATION

Table 2: Applicant Details

Name of Applicant:	Vandabyte (Pty) Ltd
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File Reference Number DMR:	MP 30/5/1/12/2/ 10237MR

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Table 4: Specialist Details

Specialist Company:	Eco Elementum (Pty) Ltd
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Contact Person:	Vernon Siemelink
Contact Number:	012 807 0637
Email:	vernon@ecoe.co.za info@ecoelementum.co.za
Website:	www.ecoelementum.co.za

SPECIALIST DECLARATION OF INDEPENDENCE

In support of an application in terms of the National Environmental Management Act 107 of 1998 (GNR983, GNR984 and GNR985, GG38282 of 4 December 2014 ("Listed Activities") that will require an environmental authorisation if triggered. As amended by GNR 327, GNR 325 and GNR 324.

I, **Neel Breitenbach** as specialist, has been appointed in terms of regulation 12(1) or 12(2), and can confirm that I shall —

a. Be independent;
b. have expertise in undertaking specialist work as required, including knowledge of the Act, these Regulations and any guidelines that have relevance to the proposed activity;
c. ensure compliance with these Regulations;
d. perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the application'
e. take into account, to the extent possible, the matters referred to in regulation 18 when preparing the application and any report, plan or document relating to the application; and
f. disclose to the proponent or applicant, registered interested and affected parties to the proponent or applicant, registered interested and affected parties and the competent authority all material information in the possession of the EAP and, where applicable, the specialist, that reasonably has or may have the potential of influencing –
g. any decision to be taken with respect to the application by the competent authority in terms of these Regulations; or
h. the objectivity of any report, plan or document to be prepared by the EAP or specialist, in terms of these Regulations for submission to the competent authority;
i. Unless access to that information is protected by law, in which case it must be indicated that such protected information exists and is only provided to the competent authority.

Neel Breitenbach	[signature]
Name and Surname	Signature
07-08-2019	**George**
Date	Signed at

1. INTRODUCTION

Vandabyte (Pty) Ltd (hereafter the applicant) has appointed Enviro-Insight CC as the Environmental Assessment Practitioner (EAP) to undertake environmental authorisations (EAs) associated with the proposed Dunbar Coal Mine. The applicant has obtained a Prospecting Right (reference number MP 30/5/1/1/2/10737 PR) on 22 May 2014 from the Mpumalanga Department of Mineral Resources (DMR) to prospect for coal in an area of 1797 ha on a Portion of Portion 1, Portion 2 and the remaining extent of the Farm Dunbar 189 IS, Portion 1 of the Farm Middelkraal 50 IS and Portion 6 of the Farm Halfgewonnen 190 IS located in Mpumalanga Province. The mining right application lodged on 9 May 2019 to the DMR (reference number MP30/5/1/2/2/10237MR) includes the abovementioned properties and extent.

Enviro-Insight appointed Eco-Elementum (Pty) Ltd to undertake the Visual Impact Assessment for the Dunbar Coal project.

The Integrated Environmental Authorisation (IEA) application includes the above-mentioned properties where the proposed mining blocks identified and associated infrastructure will be located on Portion 2 of the Farm Dunbar 189 IS. Further invasive drilling and exploration activities on the remainder of the prospecting right is still required and based on new geological information becoming available will likely result in the mining layouts to be updated to ensure optimal mining and utilisation of the available coal resources throughout the proposed mining right area.

There is sufficient data available for Dunbar West to make an initial assessment of its potential. Both Seams 4 and 2 occur on the PR area with Seam 4 reaching a maximum thickness of 5.89 m and Seam 2 a maximum of 9.95 m. In the shallowest parts, Seam 4 starts at a depth of 2.45 m and goes as deep as 100.9 m with Seam 2 at depths from 29.80 to 122.70 m. Seam 5 is thin and not regarded as economical. A low-quality thermal coal will be produced from the different coal seams that are proposed to be mined. Open cast coal mining is the preferred method in this case from an economical view as it will recover a greater proportion of the coal deposit than underground methods, as more of the coal seams in the strata may be exploited.

The proposed project involves the development of two new open pit coal mines and the associated supporting infrastructure. The coal resource will be mined using open pit methods due to the seemly depth of the coal reserve. For this specific project the mining of coal by means of surface mining methods are viable due to the fact that the resource is situated close enough to the surface to make it economically mineable. Typical surface mining methods include: strip mining and open pit mining, as well as dredge, placer and hydraulic mining in riverbeds, terraces and beaches. These activities always disrupt the surface and this, in turn, affects soils, surface water and near-surface ground water, fauna, flora and all alternative types of land-use.

The generally low strip ratios and wide surface area of the project area makes it ideal for the opencast truck and shovel mining method. Also, the mining method applicability is driven by technical applicability, economic viability, safety, equipment and infrastructure.

The proposed mining method and sequence comprised of the following main mining activities for both waste and coal:

- Initial topsoil and soft overburden removal which will be stockpiled to ensure it can be replaced back in the initial box cut;
- The physical mining of the coal seam which includes drilling of hard overburden material, charging and blasting;
- The coal is loaded into trucks and hauled to the crushing and screening facility;
- Discard coal will be extracted and replaced in the bottom of the opencast pit, while the product will be taken to the weighbridge via trucks and then removed off site;
- The overburden is replaced back into the pit as mining progresses leaving a minimum area open at a single time;
- The topsoil which was stripped and stockpiled separately before mining commenced is then replaced. The findings of the land capability study will determine the optimal composition to ensure pre-mining conditions for utilisation.

The proposed mining layout is based on a 100 m x 50 m mining block size. The purpose of a square mining layout is to increase the ease of strategic mine scheduling. The start of the mining block layout was based on the mining boundary. The size and scale of the open-pit mine entails that small and conventional truck and shovel mining equipment is used to mine both waste material and coal.

Key infrastructure includes:

- Access & Haul roads (with necessary security) including the upgrading of the access point to the gravel road;
- Contractor's Yard with septic/chemical ablution facilities;

- Offices;
- Weighbridge, workshop and stores (with septic/chemical ablution facilities);
- Rail Siding;
- Diesel facilities and a hardstand;
- Power and Water;
- Boxcut;
- Stockpiles (topsoil, overburden, subsoil/softs, ROM);
- Surface water management measures (stormwater diversion berms and trenches, pollution control dams etc.); and
- Crushing & screening facility.

Table 5: Project Locality

Farm Name:	PORTIONS 1, 2 AND THE REMAINING EXTENT OF THE FARM DUNBAR 189 IS PORTION 1 OF THE FARM MIDDELKRAAL 50 IS PORTION 6 OF THE FARM HALFGEWONNEN 190 IS MPUMALANGA PROVINCE
Application Area:	1 797 ha for the mining right of which approximately 200 ha identified for current mining operations
Magisterial District:	Nkangala District Municipality, Steve Tshwete Local Municipality, Gert Sibande District Municipality, Govan Mbeki Local Municipality Mpumalanga Province South Africa
Distance and direction from nearest town:	The Project Area is ~ 4 km south of Meerlus, ~ 9 km south-east of Komati and ~ 13 km west of Hendrina.

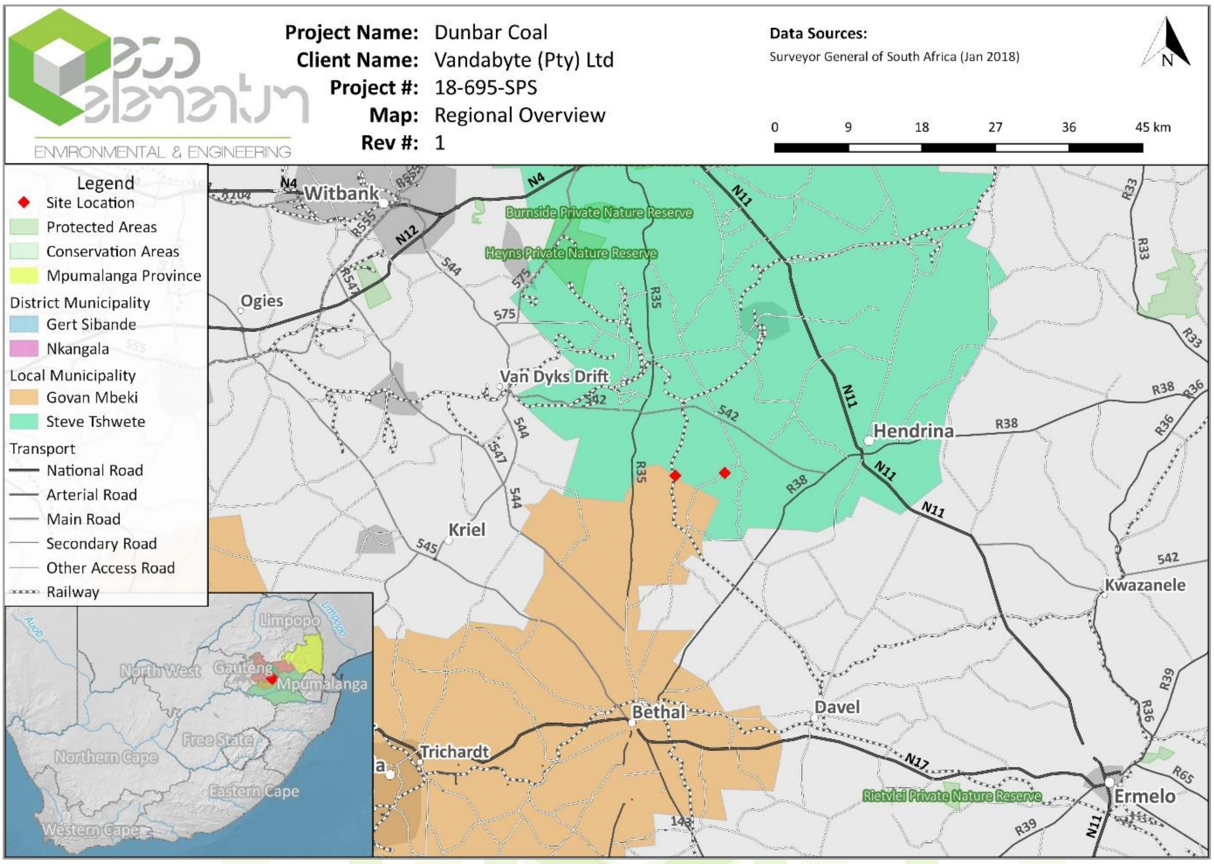

Figure 1: Locality map indicating the regional overview of the proposed Dunbar Coal project

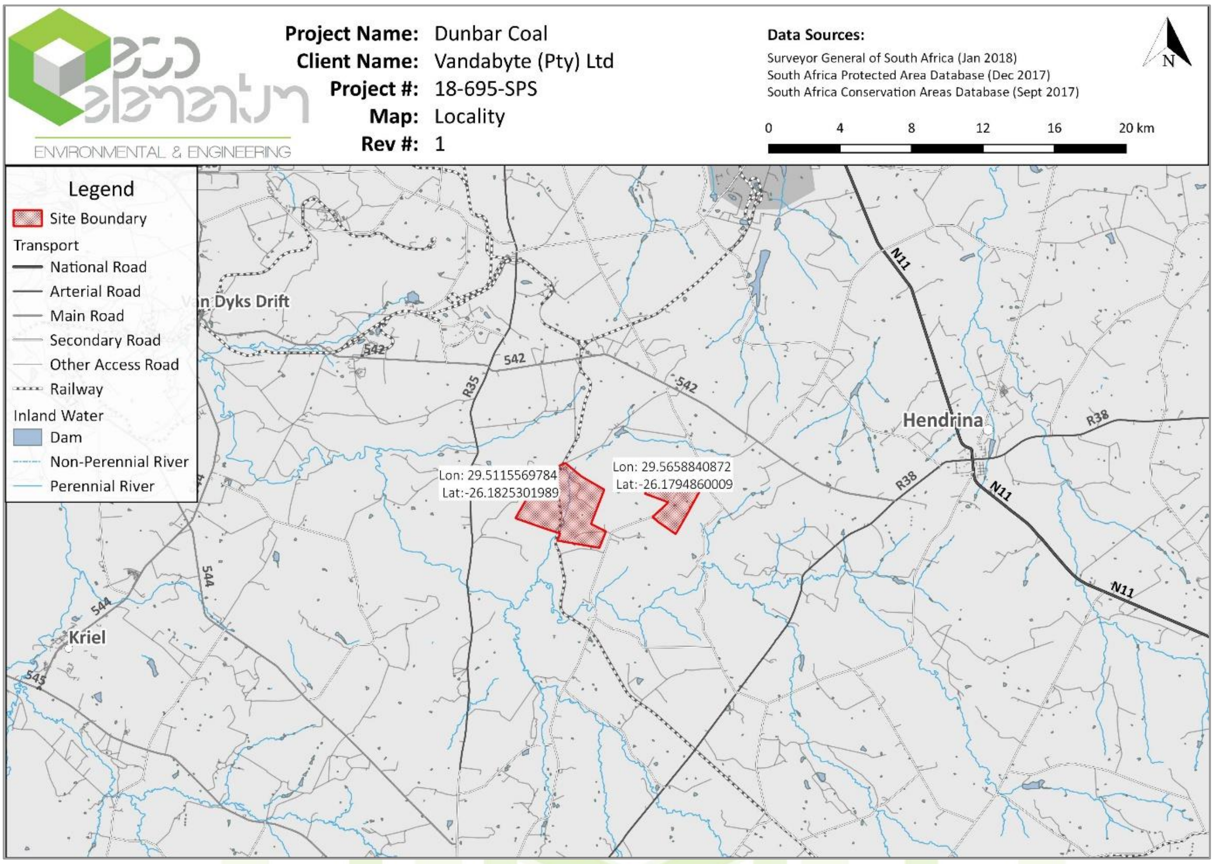

Figure 2: Locality map of the proposed Dunbar Coal project.

2. SCOPE OF WORK

The scope of work for this Visual Impact Assessment will include:

1. Describe the existing visual characteristics of the proposed sites and its environs;
2. Viewshed and viewing distance using GIS analysis up to 15 km from the proposed structures.
3. Visual Exposure Analysis comprising the following aspects:

- Terrain Slope;
  - Slope angle is determined from the Digital Terrain Model (DTM) and the location of the proposed structures given a ranking depending on the steepness of the slope;
- Aspect of structure location;
  - Aspect of the slope where the structures are to be built, are calculated from the DTM and given a ranking determined by the Sun angle.
- Landforms;
  - Landform of the location of the proposed structures are determined from the DTM and ranked according to the type of landform. Structures built on certain landforms, e.g. ridges, will be more visible than structures built in valleys.
- Slope Position of structure;
  - Using GIS analysis, the position of the proposed structure is determined and ranked according to the position on the slope the structure is to be built.
- Relative elevation of structure;
  - Using the DEM the elevation of the proposed structure relative to the surrounding elevation is determined and ranked according to the difference in height of the surrounding areas.
- Terrain Ruggedness;
  - The terrain ruggedness is determined from the DEM and given a ranking based on the homogeneousness of the terrain.
- Viewer Sensitivity;
  - The Viewer sensitivity ranking of the surrounding areas is determined using various land cover and land use datasets and ranked according to the sensitivity of the related structures to the environment.
- Overall Visual Impact;
  - Combing all the above dataset a final visual impact of the proposed structures is calculated.

3. DESCRIPTION OF AFFECTED AREA AND ENVIRONMENT

This section of the report provides a description of the current status of the environment. This provides a baseline context for assessment of the proposed structures.

3.1 LOCATION

3.1.1 Population

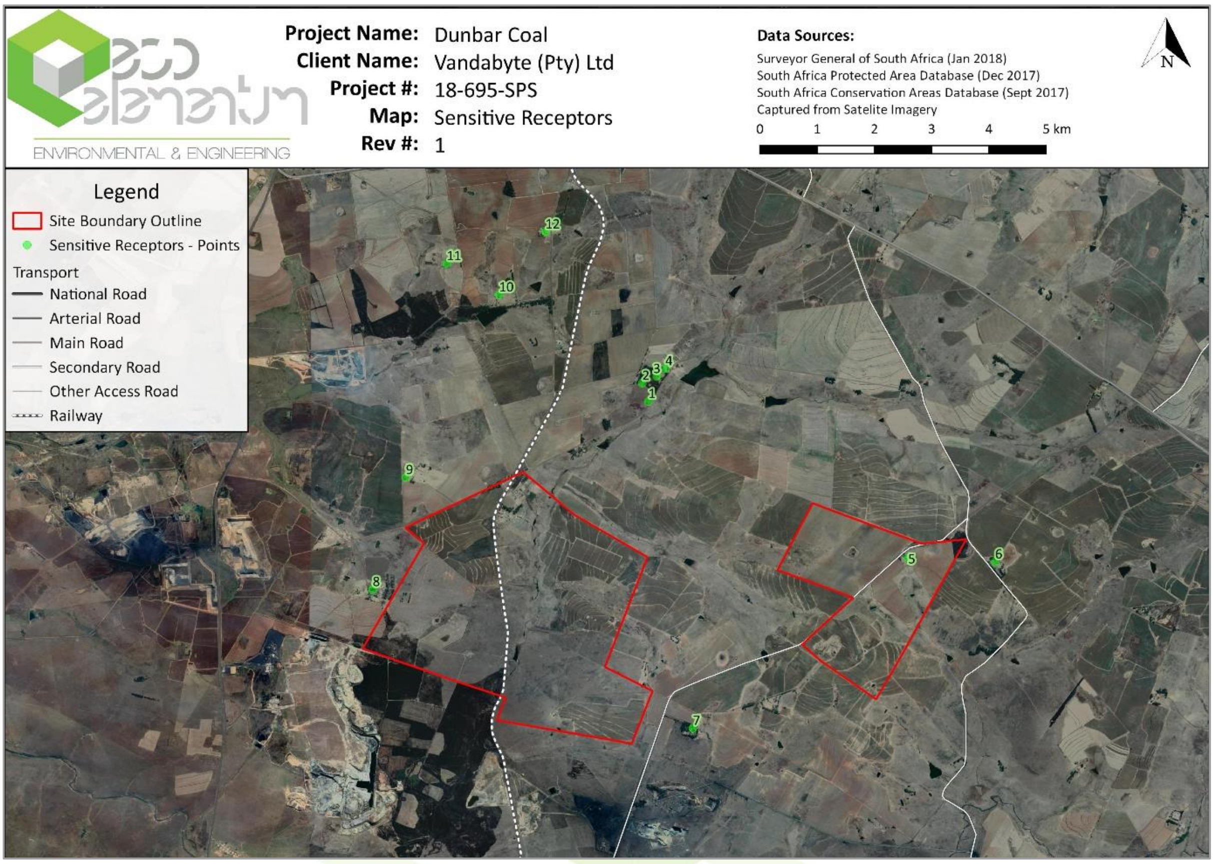

Figure 3: Population areas within close proximity of the proposed Dunbar Coal project.

The project area is situated in predominant agriculture area with dispersed home steads in the immediate vicinity of the proposed project area. Scattered mining areas can also be found in the area. The sensitive receptors as shown above was captured using a desktop study, it may thus differ from actual conditions.

3.1.2 Topography

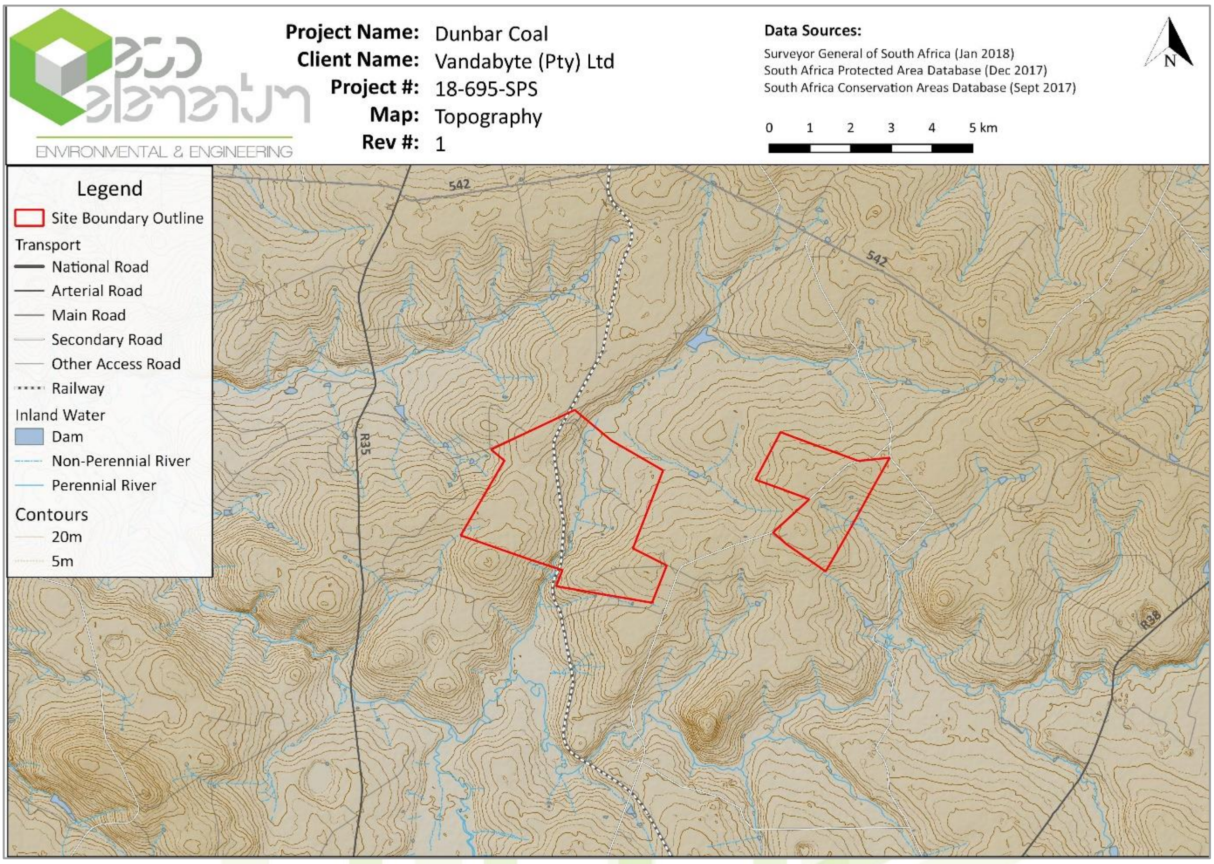

Figure 4: Map showing the Topography surrounding the proposed Dunbar Coal project.

The proposed Dunbar Coal project area is situated in an area with undulating hills.

3.2 NEW INFRASTRUCTURE

The proposed Dunbar Coal project will comprise of various newly built structures. Some of the highest structures are included in this report. It must be noted that no complete detail of the exact structures were available at the time of this report and general height and location assumptions were made where applicable.

Table 6: Maximum Height of the Relevant Proposed Structures.

Description	Height (m)
Stockpile - ROM	15
Stockpile – ROM Washed	10
Stockpile - Topsoil	15
Stockpile - OVB	30
Opencast Pit	3
Haul Roads	1
Offices	3
PCD	3
Plant Area	10
Workshop	6
Opencast Pit	3

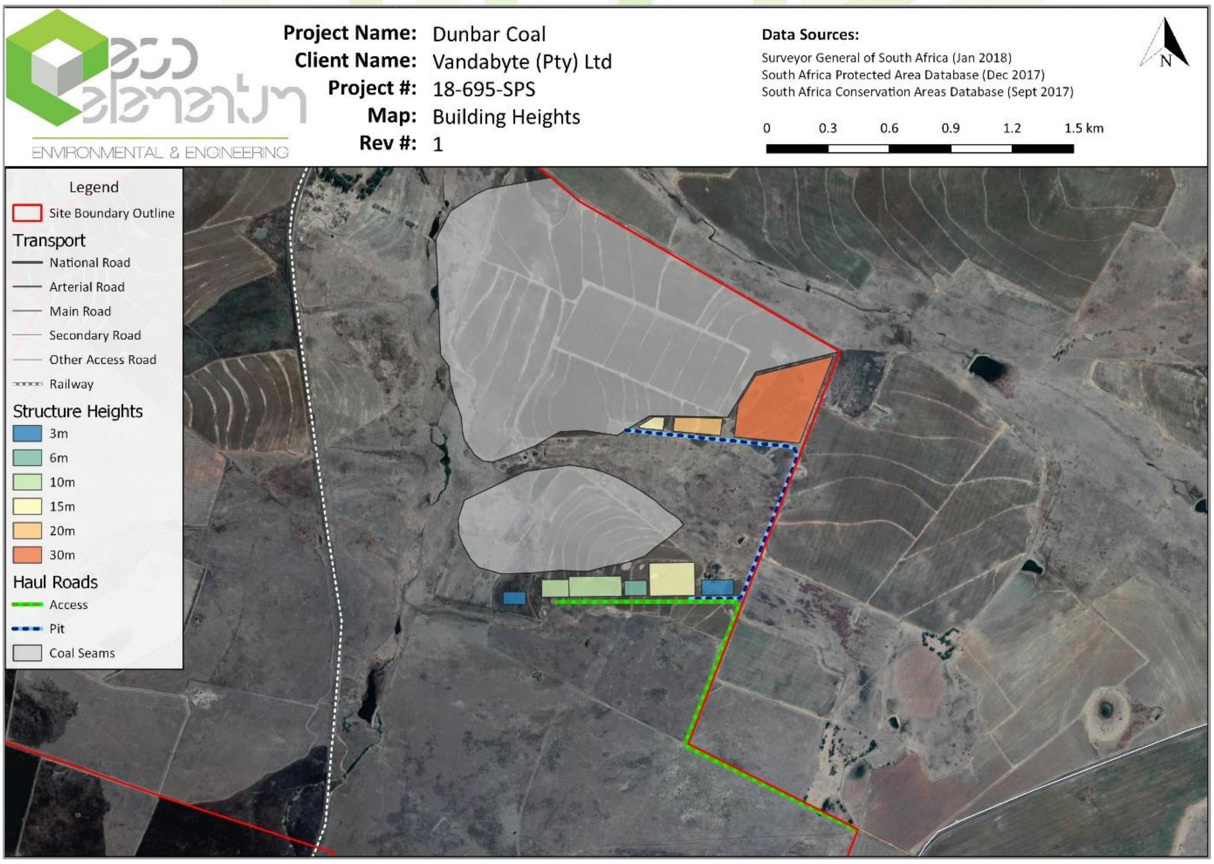

Figure 5: Infrastructure surface heights

3.3 Sense Of Place

The concept of “a Sense of Place” does not equate simply to the creation of picturesque landscapes or pretty buildings, but to recognize the importance of a sense of belonging. Embracing uniqueness as opposed to standardization attains quality of place. In terms of the natural environment, it requires the identification, a response to and the emphasis of the distinguishing features and characteristics of landscapes. Different natural landscapes suggest different responses. The sense of place is created by the predominant agriculture and mining activities in the area.

4. METHODOLOGY

The following sequence was employed in this Visual Assessment Report:

1. Viewshed and viewing distance using GIS analysis up to 15 km from the proposed structures.
2. In order to model the decreasing visual impact of the structures, concentric radii zones of 1 km to 15 km from the mine activities were superimposed on the viewshed to determine the level of visual exposure. The closest zone to the proposed structures indicates the area of most significant impact, and the zone further than 10 km from the structures indicates the area of least impact. The visual ratings of the zones have been defined as follows:
    - <1 km (very high);
    - 1 - 2 km (high);
    - 2 - 5 km (moderate);
    - 5 -10 km (low); and
    - > 15 km (insignificant).
3. A Visual Exposure Analysis were conducted that included the following parameters:
    - Terrain Slope;
        - Slope angle is determined from the Digital Terrain Model (DTM) and the location of the proposed structures given a ranking depending on the steepness of the slope;
        - Structures built on steep slopes are assumed to be more visible and exposed than those on flat surfaces.
    - Aspect of structure location;
        - Aspect of the slope where the structures are to be built, are calculated from the DTM and given a ranking determined by the Sun angle.
        - Structures on flat surface are illuminated by the sun the whole day and thus visible from all directions. In the southern hemisphere structures on North facing slopes are less visible from the south, structures on East and West facing slopes are only illuminated during half of the day thus less visible where structures on the southern slopes are mostly in the shade.
    - Landforms;
        - Landform of the location of the proposed structures are determined from the DTM and ranked according to the type of landform. Structures built on certain landforms, e.g. ridges, will be more visible than structures built in valleys.
    - Slope Position of structure;
        - Using GIS analysis, the position of the proposed structure is determined and ranked according to the position on the slope the structure is to be built.
    - Relative elevation of structure;
        - Using the DEM the elevation of the proposed structure relative to the surrounding elevation is determined and ranked according to the difference in height of the surrounding areas. Structures built on higher ground are more visible than those built in low lying areas.
    - Terrain Ruggedness;
        - The terrain ruggedness is determined from the DEM and given a ranking based on the homogeneousness of the terrain. Rugged terrain has a tendency to increase the visual absorption characteristics of the terrain.
    - Visual Absorption Capacity;
        - To simulate the Visual Absorption Capacity (VAC) of the landscape, land cover data of the area were assigned a VAC ranking. The Visual Exposure results and VAC rankings of the landscape were use in an algorithm to determine a quantitative visual exposure for each sensitive receptor.

- Overall Visual Impact;
  - Combing all the above dataset a final visual exposure ranking was determined for each of the identified sensitive receptor areas.

4.1 Assumptions

- The core study area can be defined as an area with a radius of not more than 10 km from the structures and a total study area with a radius of 15 km from the structures. This is because the visual impact of structures beyond a distance of 10 km would be so reduced that it can be considered negligible even if there is direct line of sight.
- It is assumed that there are no alternative locations for the structures and that the visual assessment, therefore, assessed only the proposed site.
- The height of the VIA is based on the heights as stipulated in Table 6.
- Geographic location within the mining boundary of infrastructure.
- The assessment was undertaken during the planning stage of the project and is based on the information available at that time.

4.2 Limitations

- Visual perception is by nature a subjective experience, as it is influenced largely by personal values. For instance, what one-viewer experiences as an intrusion in the landscape, another may regard as positive. Such differences in perception are greatly influenced by culture, education and socio-economic background. A degree of subjectivity is therefore bound to influence the rating of visual impacts. In order to limit such subjectivity, a combination of quantitative and qualitative assessment methods were used. A high degree of reliance has been placed on GIS-based analysis viewshed, visibility analysis, and on making transparent assumptions and value judgements, where such assumptions or judgements are necessary.
- The viewshed generated in GIS cannot be guaranteed as 100% accurate. Some viewpoints, which are indicated on the viewshed as being inside of the viewshed, can be outside of the viewshed. This is due to the change of the natural environment by surrounding activities as well as natural vegetation that play a significant role and can have a positive or negative influence on the viewshed.

4.3 Legal Requirements

There are no specific legal requirements for visual impact assessment in South Africa. Visual impacts are, however required to be assessed by implication when the provisions of relevant acts governing environmental impacts management are considered.

5. CRITERIA USED IN THE ASSESSMENT OF VISUAL IMPACTS

5.1 View Points And View Corridors

Viewpoints have been selected based on prominent viewing positions in the area. The selected viewpoints and view corridors are used as a basis for determining potential visual ability and visual impacts of the proposed structures.

5.2 Visual Exposure

Visual exposure is based on distance from the project to selected viewpoints. Visual exposure or visual impact tends to diminish exponentially with distance. The visibility or visual exposure of any structure or activity is the point of departure for the visual impact assessment. It stands to reason that if the proposed structures were not visible, no visual impact would occur. Visual exposure is determined by the following variables:

- Slope angle;
- Aspect of slope;
- Landforms;
- Slope Position of structure;
- Relative Elevation of structure; and
- Terrain Ruggedness.

5.3 Landscape Integrity

Landscape integrity is visual qualities represented by the following qualities, which enhance the visual and aesthetic experience of the area:

- Intactness of the natural and cultural landscape;
- Lack of visual intrusions or incompatible structures; and
- Presence of a 'sense of place'.

5.4 Determine The Visual Absorption Capacity (VAC)

The VAC is the capacity of the receiving environment to absorb the potential visual impact of the proposed facility. The VAC is primarily a function of the vegetation, and will be high if the vegetation is tall, dense and continuous. Conversely, low growing, sparse and patchy vegetation will have a low VAC. Topography and built forms have the capacity to 'absorb' visual impact.

The digital terrain model utilised in the calculation of the visual exposure of the facility does not incorporate potential visual absorption capacity (VAC). It is therefore necessary to determine the VAC by means of the interpretation of the vegetation cover, topography and structures. Land cover is used in the ranking of the VAC.

6. VIEWSHED

6.1 SLOPE

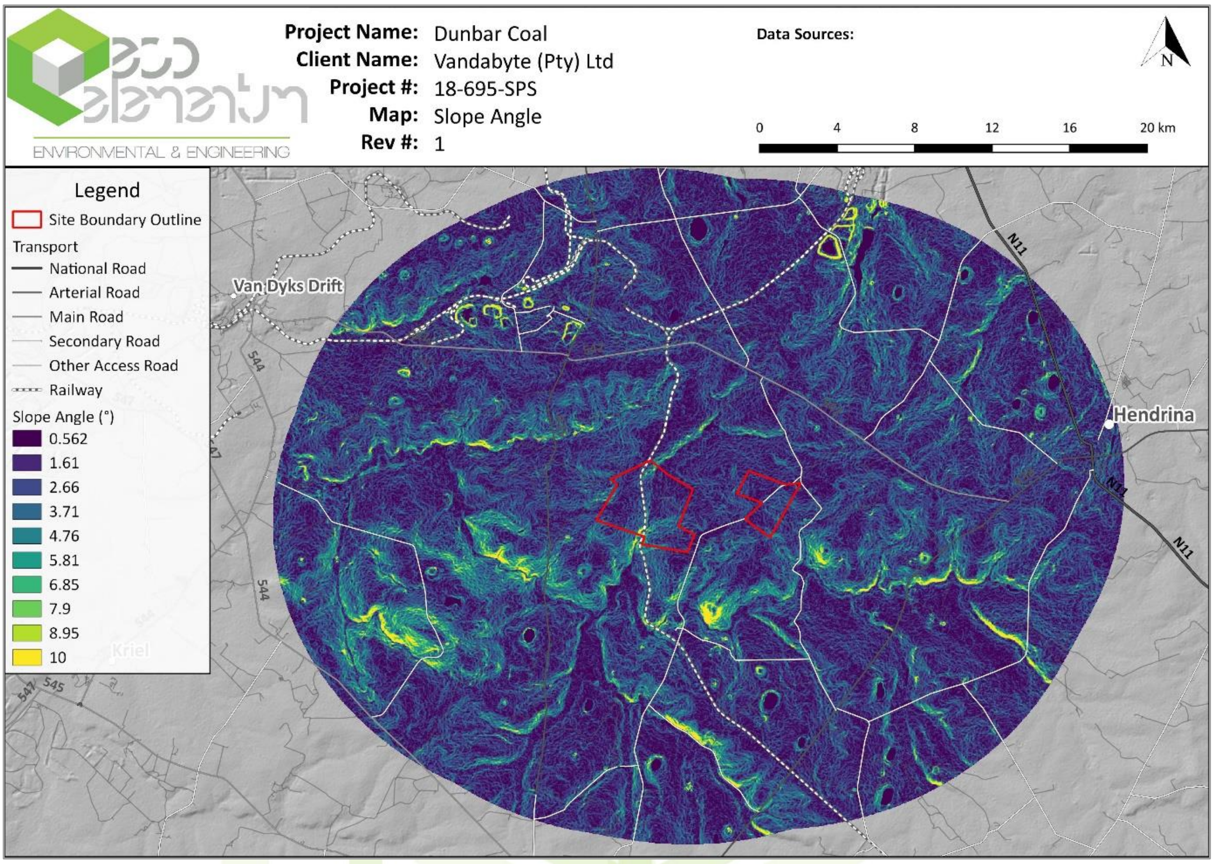

Figure 6: Slope angles of the terrain in the 15 km buffer area surrounding the proposed Dunbar Coal project

6.2 Aspect

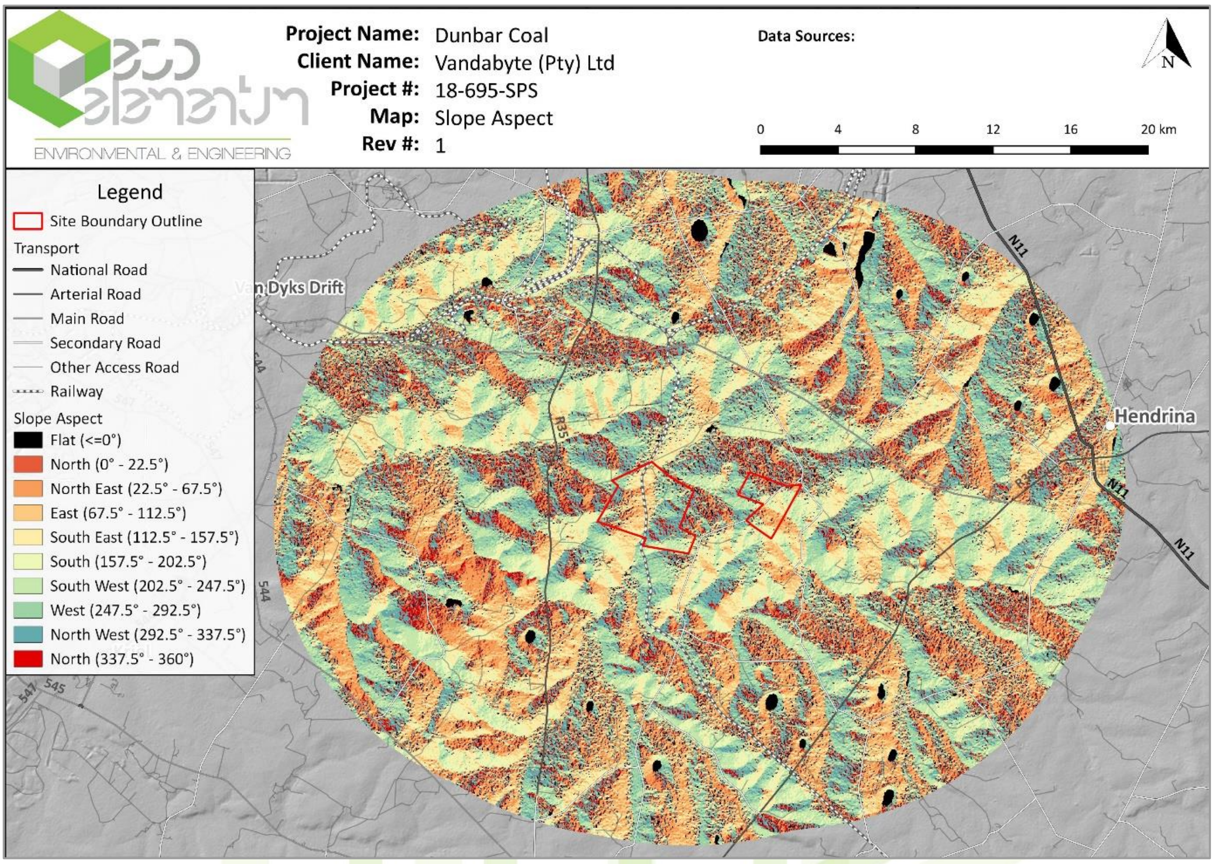

Figure 7: Aspect direction of the terrain in a 15 km buffer area surrounding the proposed Dunbar Coal project

6.3 Terrain Ruggedness

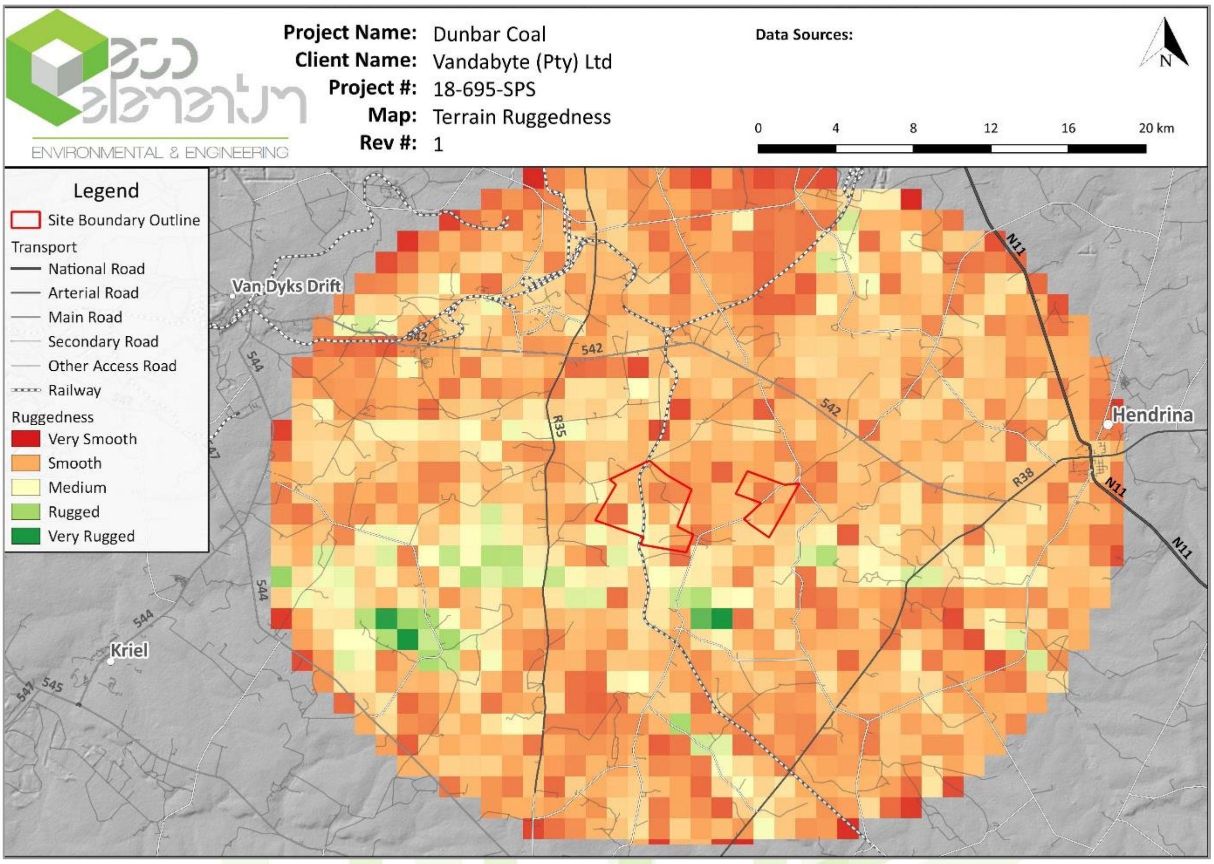

Figure 8: Terrain ruggedness in a 15 km buffer area surrounding the proposed Dunbar Coal project

6.4 Relative Elevation

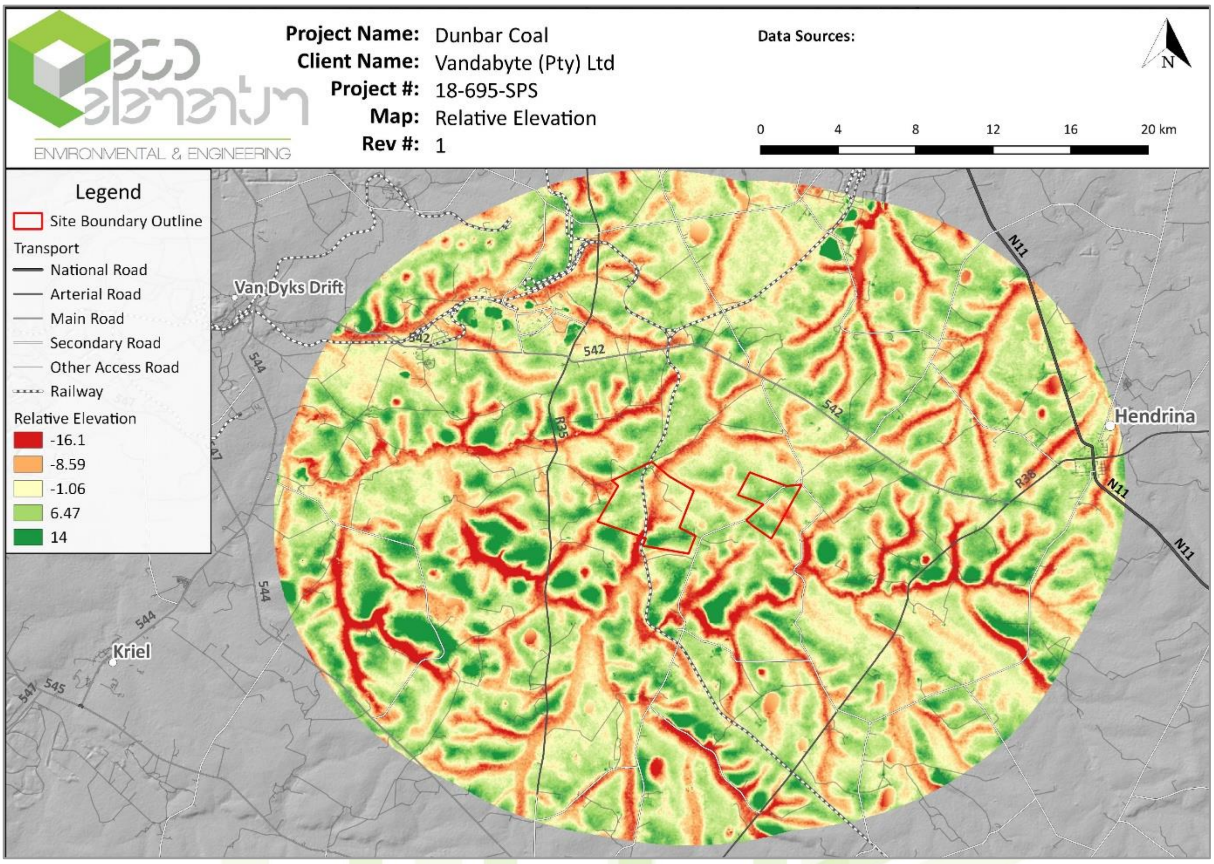

Figure 9: Relative Elevation of terrain in a 15 km buffer area surrounding the proposed Dunbar Coal project

6.5 LANDFORMS

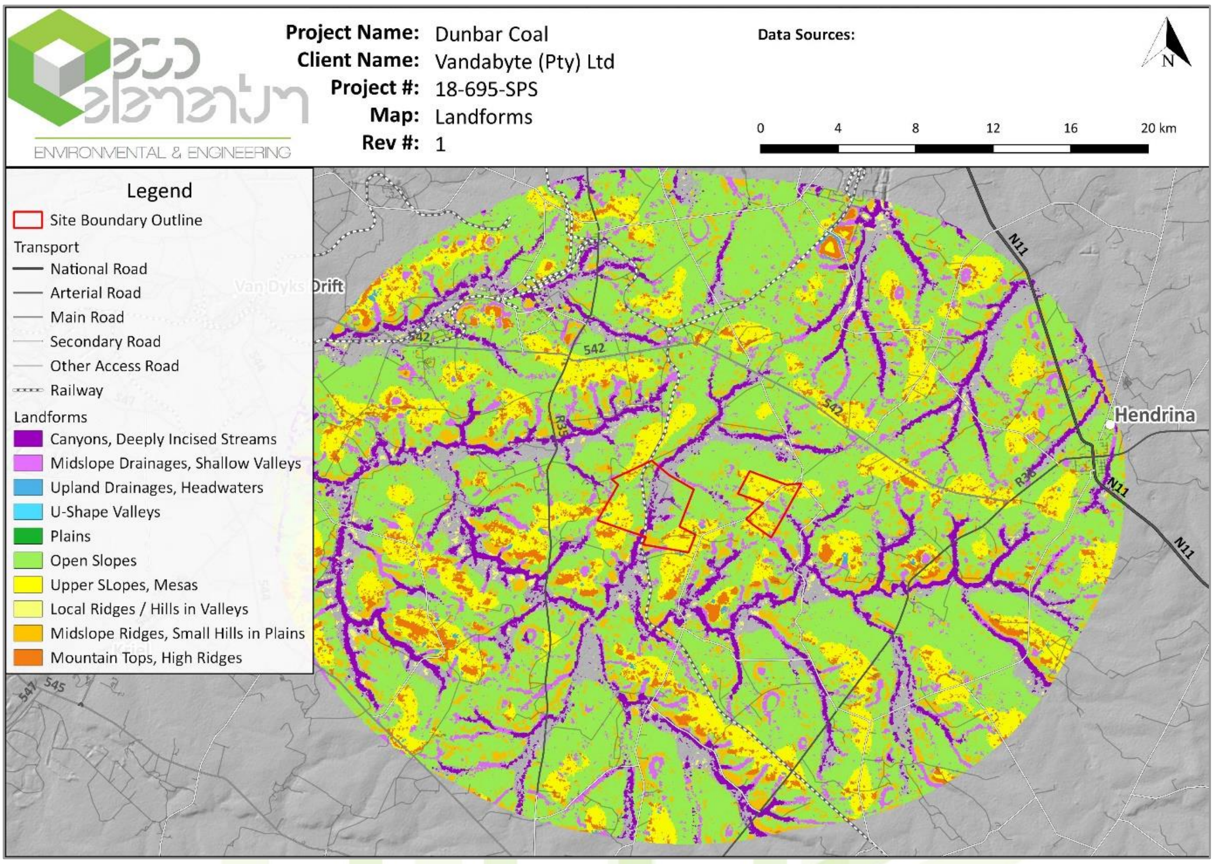

Figure 10: **Landforms in a 15 km buffer area surrounding the proposed Dunbar Coal project**

6.6 Slope Position

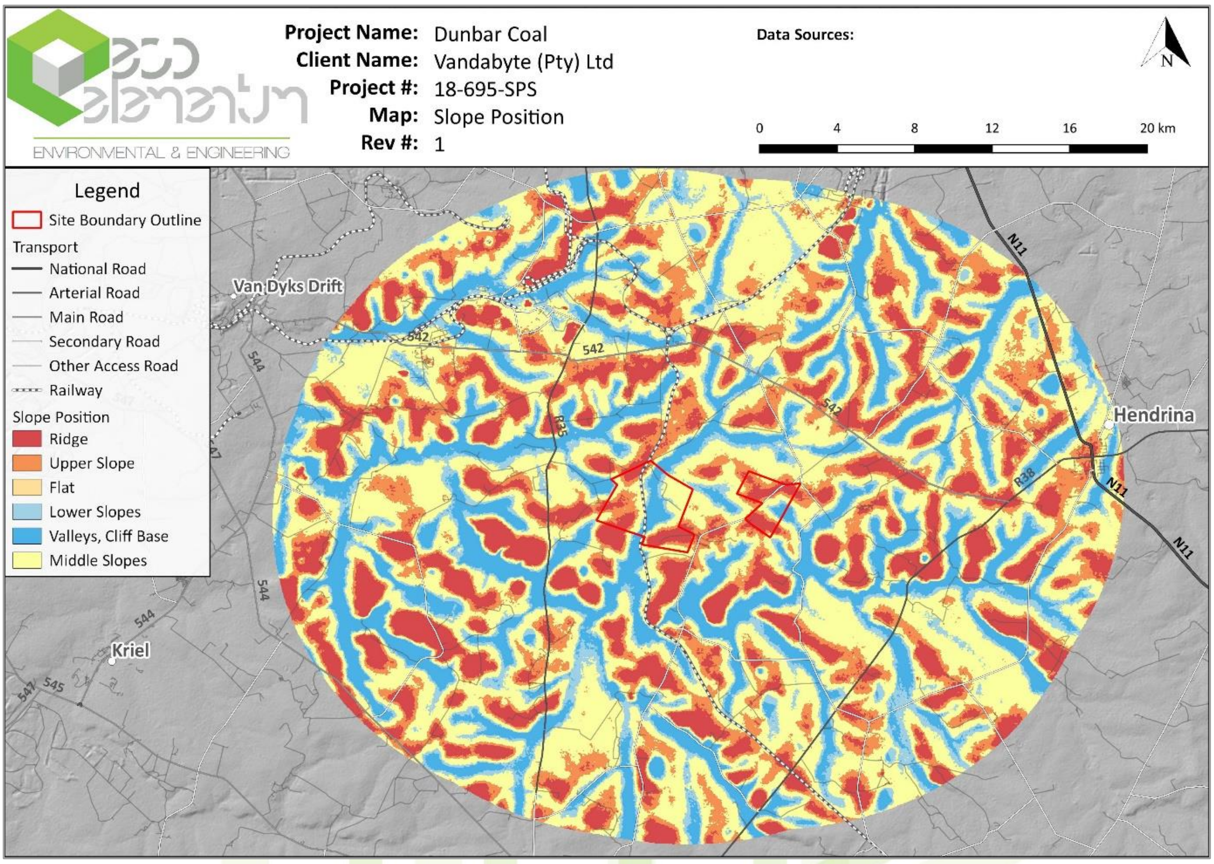

Figure 11: Slope Positions in a 15 km buffer area surrounding the proposed Dunbar Coal project

6.7 Landcover VAC

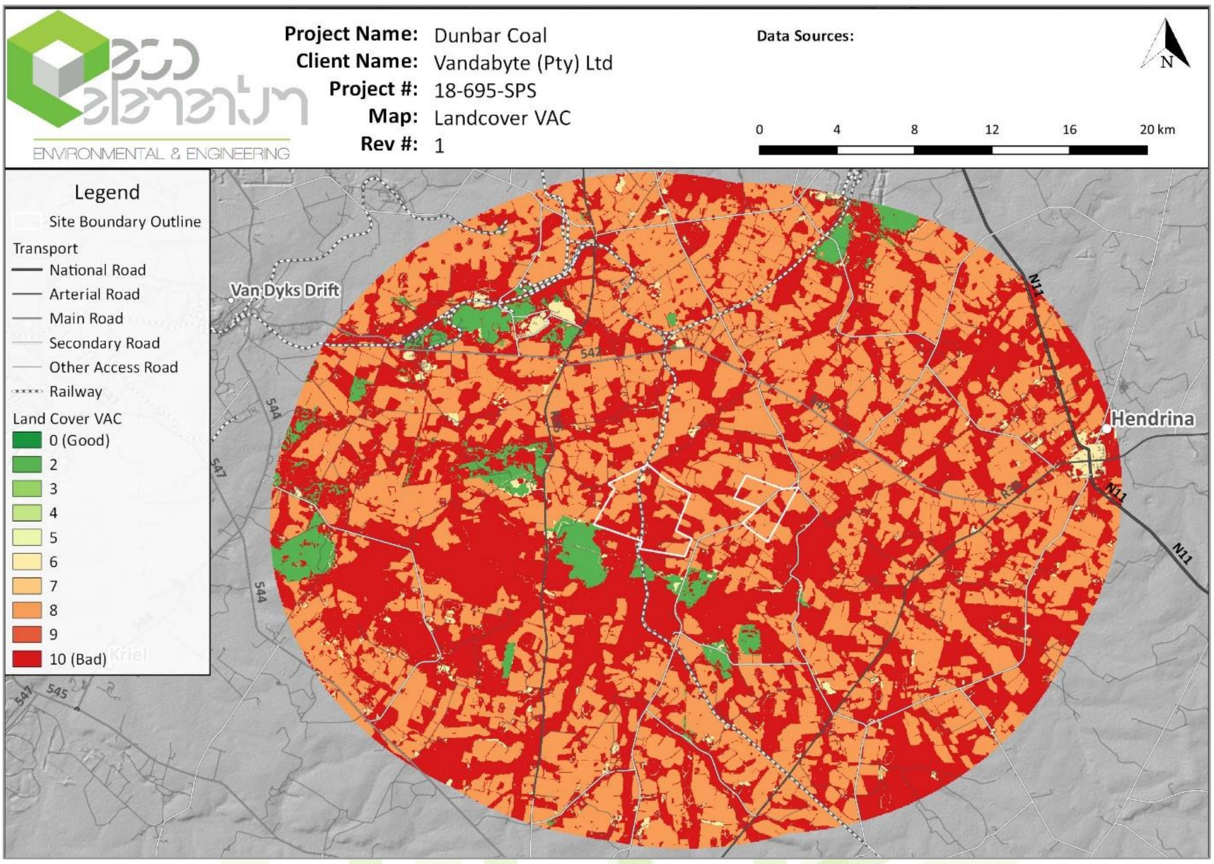

Figure 12: Possible VAC of the Landcover in a 15 km buffer area surrounding the proposed Dunbar Coal project

6.8 Viewshed Visibility

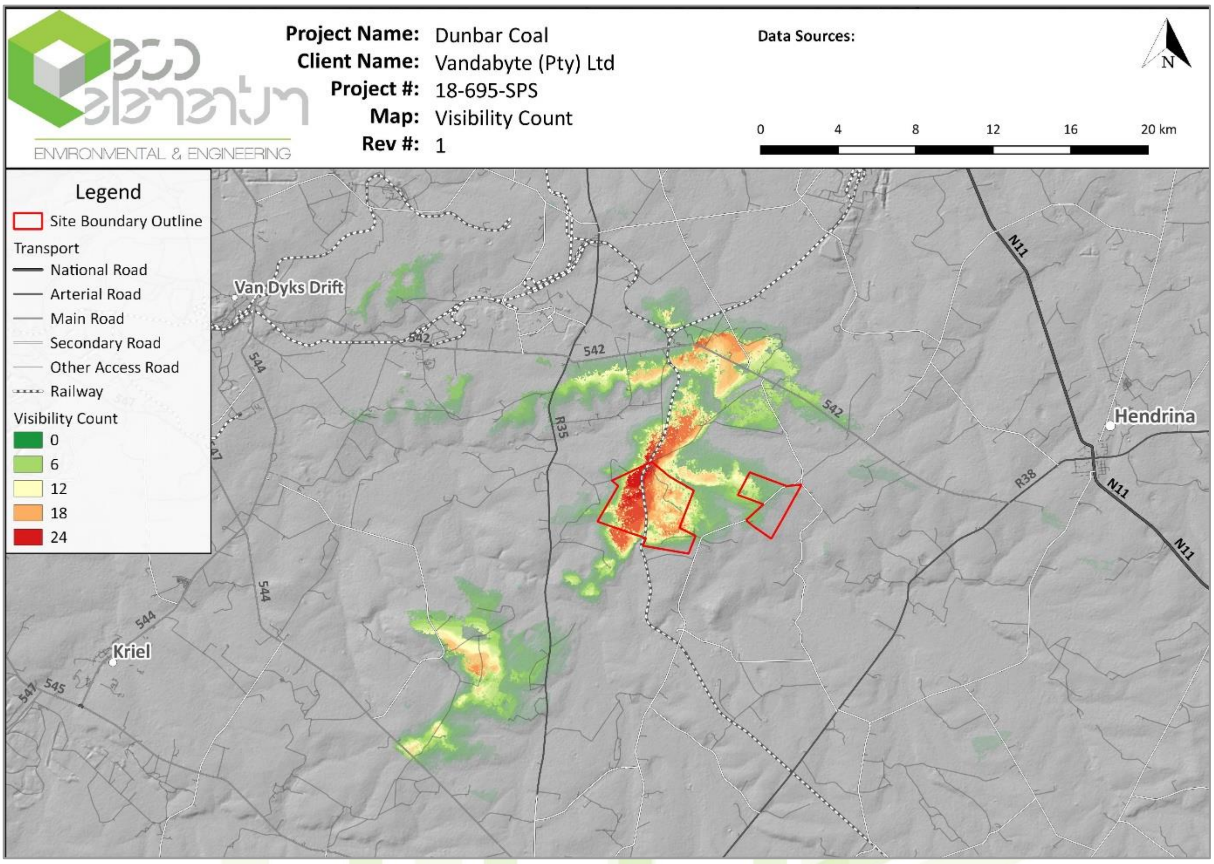

Figure 13: Viewshed of proposed Dunbar Coal project – Visibility Count (How many surface infrastructure locations can be seen from any location on the map)

For the assessment of the visibility of the area, the viewshed has been calculated for the amount of surface infrastructure features that can be seen from any point on the map. The Haul Roads have been split up in multiple positions to simulate how much of the roads are visible.

Table 7: Visibility Rating – Count of infrastructure visible of the proposed development

1 - 4 Structures	Very Low
5 - 9 Structures	Low
10 - 14 Structures	Medium
15 - 19 Structures	High
20 - 25 Structures	Very High

6.9 Viewshed Visibility – Distance Ranking

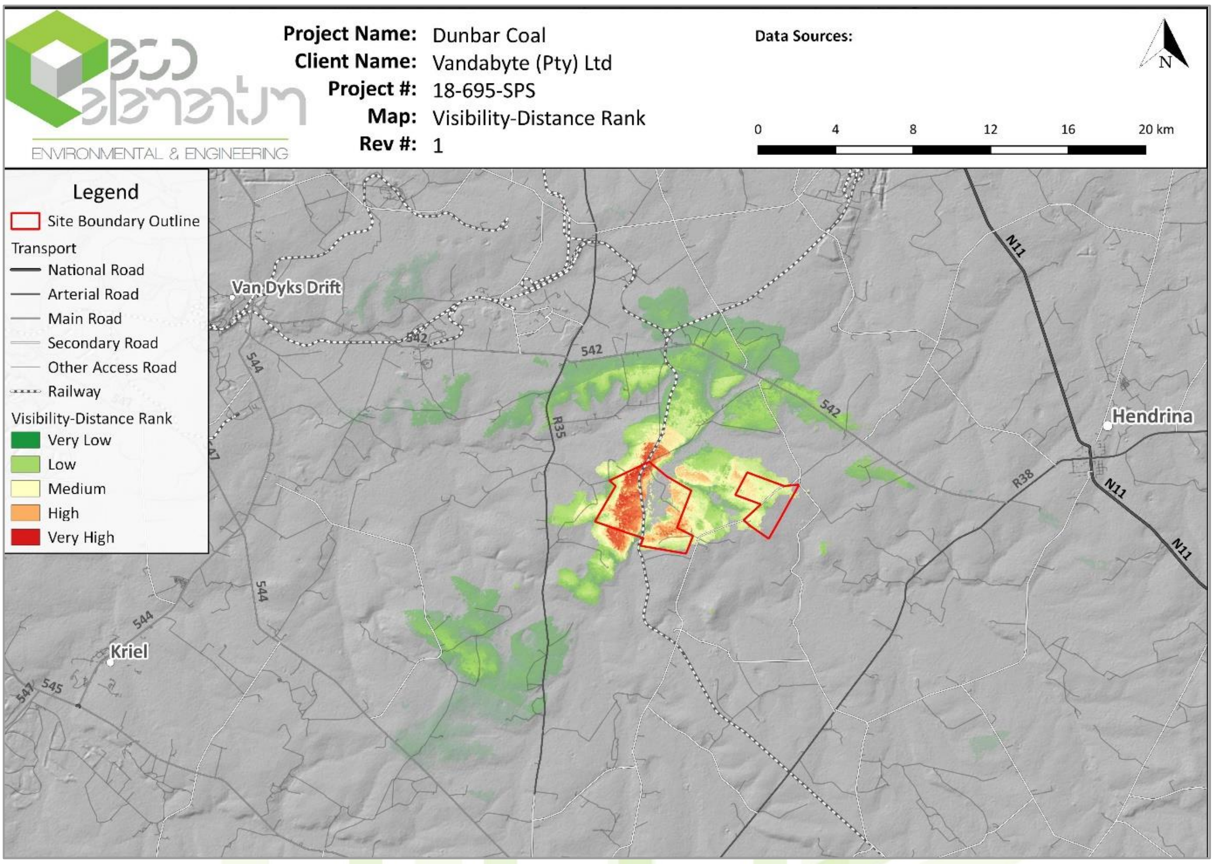

Figure 14: Viewshed of proposed Dunbar Coal project – Visibility Count (How many surface infrastructure locations can be seen from any location on the map) ranked according to distance from source

The View Counts from the visibility section above is then further ranked based on distance from the centre of the proposed infrastructure site. Distances are ranked according to the table below.

Table 8: Visibility rating – Distance from proposed infrastructure development

12 – 15 km	Very Low
9 – 12 km	Low
6 – 9 km	Medium
3 – 6 km	High
0 – 3 km	Very High

6.10 Visual Exposure Ranking

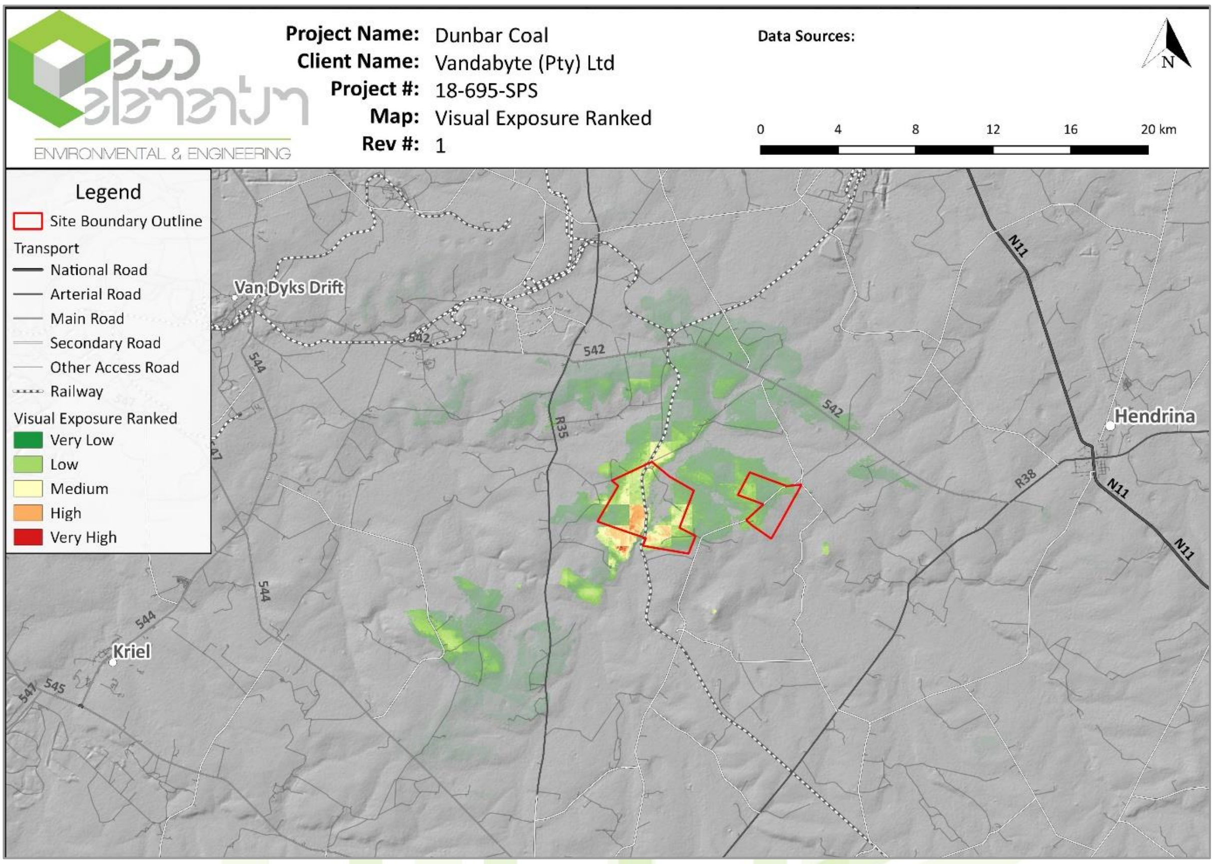

Figure 15: Visual Exposure ranking within a 15 km radius of the proposed Dunbar Coal project

The visible infrastructure count is combined with the distance from the source ranking together with the VAC of the land cover types, the slope, aspect, ruggedness, relative elevation, landforms and slope position to get a quantitative Visual Exposure ranking of all the areas where it may be possible to see the proposed development.

Table 9: Visibility rating – Distance from Proposed Infrastructure Development

1	Very Low
2	Low
3	Medium
4	High
5	Very High

6.11 View Points

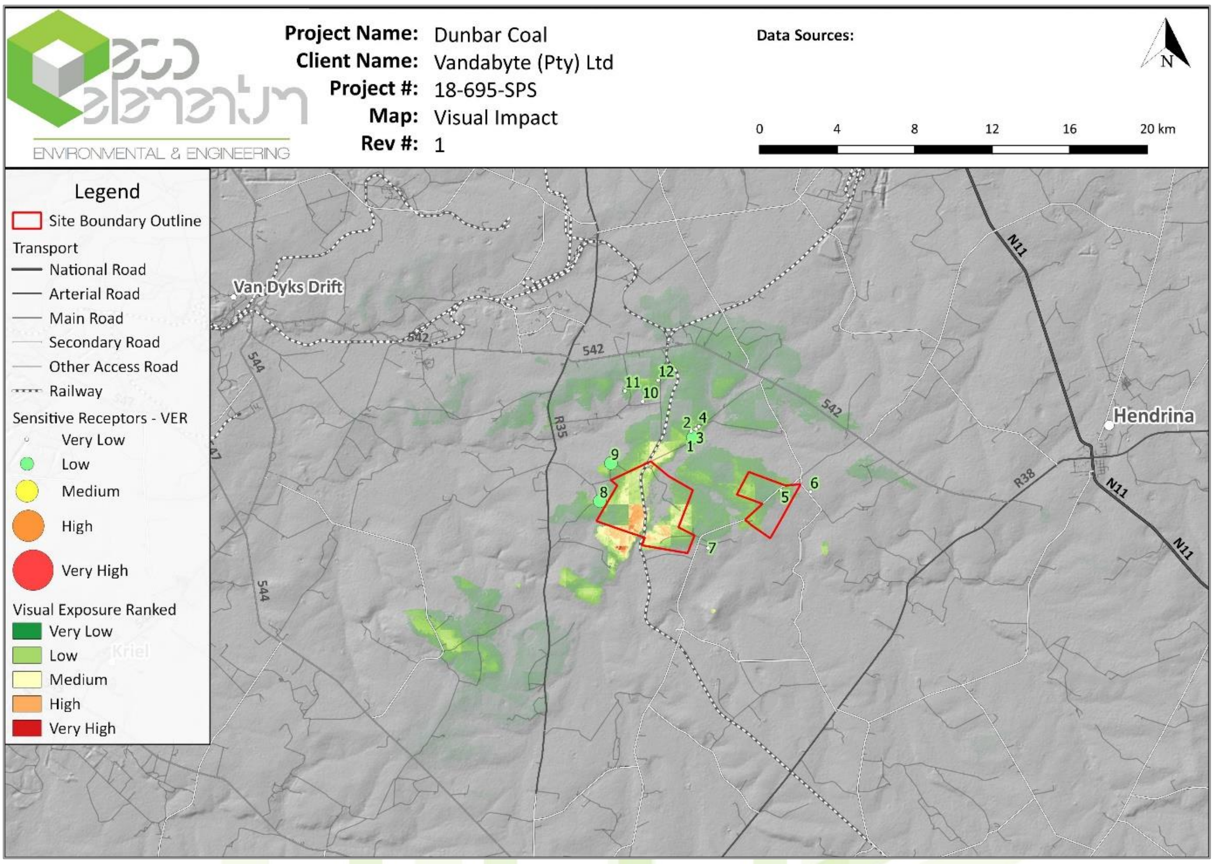

Figure 16: Viewpoint sensitive receptors overlaid on the Visual Exposure Ranking

Each identified sensitive receptor is then overlaid on the Visual Exposure Ranking and the value extracted to that pixel to give a quantitative ranking for each of the identified sensitive receptors. Ranking is done from 1 to 10, 1 being very low and 10 very high.

Due to fact that topographic modification can take place by agricultural, vegetation and other activities in the area, the viewshed is only a theoretical study. The viewpoints have been identified based on the sensitivity of the areas to visual disturbance and areas that can be negatively impacted by the related structures.

Table 10: Quantified ranking of the Visual Exposure each identified sensitive receptor may have due to the proposed infrastructure

Visibility ratings	
ID	**Rating**
1	2.25
2	1.88
3	1.58
4	1.07
5	1.84
8	2.75
9	2.27
11	0.85
12	1.14

The above table display the results as calculated by the GIS. Only locations that did not receive a 0 are shown. Ratings are ranked 1 - 10, 1 being very low and 10 very high. The system only takes into account the variables as described in this report and the amount of infrastructure that would be visible. Factors like real time and micro scale vegetation are not taken into account, thus the actual rating may be lower or higher depending on the updated land use in the vicinity or latest vegetation growth or height on a micro and macro scale.

The table is by no means a rating of visual quality; it is rather used to determine the likelihood that the proposed infrastructure will be seen from the viewpoint receptors.

6.12 Visual Impact Criteria

Once a potential impact has been determined it is necessary to identify which project activity will cause the impact, the probability of occurrence of the impact, and its magnitude and extent (spatial and temporal). This information is important for evaluating the significance of the impact, and for defining mitigation and monitoring strategies. Direct and indirect impacts of the impacts identified during the specialist investigations were assessed in terms of five standard rating scales to determine their significance.

The rating system used for assessing impacts (or when specific impacts cannot be identified, the broader term issue should apply) is based on six criteria, namely:

1. **Status** of the impact determines whether the potential impact is positive (positive gain to the environment), negative (negative impact on the environment), or neutral (i.e. no perceived cost or benefit to the environment). Take note that a positive impact will have a low score value as the impact is considered favourable to the environment;
2. **Spatial Scale** determines the spatial scale of the impact on a scale of localised to global effect. Many impacts are significant only within the immediate vicinity of the site or within the surrounding community, whilst others may be significant at a local or regional level. Potential impact is expressed numerically on a scale of 1 (site-specific) to 5 (national);
3. ***Duration*** - The lifetime of the impact, measured in relation to the lifetime of the proposed development;
4. ***Frequency of the Activity*** – How often do the activity take place. The more frequent an activity, the more potential there is for a related impact to occur;
5. ***Severity*** of the impact quantifies the impact in terms of the magnitude of the effect on the baseline environment, and includes consideration of the following factors:
    - The reversibility of the impact;

- The sensitivity of the receptor to the stressor;
- The impact duration, its permanency and whether it increases or decreases with time;
- Whether the aspect is controversial or would set a precedent;
- The threat to environmental and health standards and objectives;

6. ***Probability*** of impact quantifies the impact in terms of the likelihood of the impact occurring on a percentage scale <5% (improbable) to >95% (definite);

Table 11: Assessment criteria

STATUS	
Positive	+
Neutral	N
Negative	-
SPATIAL SCALE	
Area specific (at impact site)	1
Whole site (entire surface right)	2
Local (within 5 km)	3
Regional / neighbouring areas (5 km to 50 km)	4
National	5
DURATION	
One day to one month (immediate)	1
One month to one year (Short term)	2
One year to 10 years (medium term)	3
Life of the activity (long term)	4
Beyond life of the activity (permanent)	5
FREQUENCY OF THE ACTIVITY	
Annually or less	1
6 monthly	2
Monthly	3
Weekly	4
Daily	5
SEVERITY	
Insignificant / non-harmful	1
Small / potentially harmful	2
Significant / slightly harmful	3
Great / harmful	4
Disastrous / extremely harmful / within a regulated sensitive area	5
PROBABILITY	
Highly Improbable; <5%	1
Improbable; 5-35%	2
Possible; 35-65%	3

Probable; 65-95%	4
Highly Probable; >95%	5

The impacts that are generated by the development can be minimised if measures are implemented in order to reduce the impacts. The mitigation measures ensure that the development considers the environment and the predicted impacts in order to minimise impacts and achieve sustainable development.

6.12.1 Consequence

Consequence is determined by the following equation after the assessment of each impact.

Consequence = Severity + Spatial Scale + Duration.

6.12.2 Likelihood

The Likelihood of the activity is then calculated based on frequency of the activity and impact, how easily it can be detected and whether the activity is governed by legislation. Thus:

Likelihood = Frequency of activity + frequency of impact

6.12.3 Risk

The risk is then based on the consequence and likelihood.

Risk = Consequence x likelihood

6.12.4 Significance Ratings

The sum of the first three criteria (spatial scope, duration and severity) provides a collective score for the consequence of each impact. The sum of the last two criteria (frequency of activity and frequency of impact) determines the likelihood of the impact occurring. The product of consequence and likelihood leads to the assessment of the significance of the impact, shown in the significance matrix below in Table 12:

Table 12: Significance Assessment Matrix

	Consequence (Severity + Spatial Scope + Duration)														
Likelihood (Frequency of Activity + Frequency of Impact)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	2	4	6	8	10	12	14	16	08	20	22	24	26	28	30
	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105
	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120
	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150

Table 13: Positive and Negative Impact Mitigations Ratings

Colour Code	Significance Rating	Value	Negative Impact Management Recommendation	Positive Impact Management Recommendation
	Very High	126-150	Improve Current Management	Maintain Current Management
	High	101-125	Improve Current Management	Maintain Current Management
	Medium-High	76-100	Improve Current Management	Maintain Current Management
	Low-Medium	51-75	Maintain Current Management	Improve Current Management
	Low	26-50	Maintain Current Management	Improve Current Management
	Very Low	1-25	Maintain Current Management	Improve Current Management

The model outcome is then assessed in terms of impact certainty and consideration of available information. Where a particular variable rationally requires weighting or an additional variable requires consideration the model outcome is adjusted accordingly.

7. VISUAL IMPACT ASSESSMENT

The previous section identified specific areas where, and likelihood of, the potential visual impact would occur. This section will attempt to quantify these visual impacts in their respective geographic locations and in terms of the identified issues related to the visual impact.

7.1 Potential Construction Phase Visual Impact Of The Structures

Visibility is determined by a line of sight where nothing obscures the view of an object. Exposure is defined by the degree of visibility, in other words "how much" of it can be seen. This is influenced by topography and the incidence of objects such as trees and buildings that obscure the view partially or in total.

Potential construction phase visual impact on the Viewpoints is expected to have a LOW impact before mitigation and LOW significance after mitigation, as indicated in the table below. Although the construction will be LOW visible from the Viewpoints, the time of exposure is minimal and thus the impact on the users will remain LOW.

Table 14: Summarizing the significance of visual impacts on the viewpoint with an Exposure rating for the Construction phase.

Nature of impact: Potential visual impact on the viewpoints that had a visual exposure rating for the construction phase.			
		Unmitigated	**Mitigated**
Assessment Criteria	**Severity** [Insignificant / non-harmful (1); Small / potentially harmful (2); Significant / slightly harmful (3); Great / harmful (4); Disastrous / extremely harmful / within a regulated sensitive area (5)]	**2**	**2**
	Spatial Scale [Area specific (at impact site) (1); Whole site (entire surface right) (2); Local (within 5km) (3); Regional / neighbouring areas (5km to 50km) (4); National (5)]	**1**	**1**
	Duration [One day to one month (immediate) (1); One month to one year (Short term) (2); One year to 10 years (medium term) (3); Life of the activity (long term) (4); Beyond life of the activity (permanent) (5)]	**2**	**2**
	Frequency of Activity [Annually or less (1); 6 monthly (2); Monthly (3); Weekly (4); Daily (5)]	**4**	**4**
	Frequency of Incident/Impact [Almost never / almost impossible / >20% (1); Very seldom / highly unlikely / >40% (2); Infrequent / unlikely / seldom / >60% (3); Often / regularly / likely / possible / >80% (4); Daily / highly likely / definitely / >100% (5)	**4**	**3**
Consequence	Severity + Spatial Scale + Duration	**5**	**5**
Likelihood	Frequency of Activity + Frequency of impact	**8**	**7**
Risk	Consequence * Likelihood	**LOW (40)**	**LOW (35)**
Mitigation:	The visual impact can be minimized creating a visual barrier. The construction area will be cleared as soon as construction of the infrastructure is finished.		
Cumulative Impact:	The construction of the proposed Dunbar Coal project with its associated infrastructure will increase the cumulative visual impact of mining type infrastructure within the region. In context of the existing agriculture character, the construction phase of the Dunbar Coal structures will contribute to a regional increase in heavy vehicles on the roads in the region, with construction activity noticeable.		

The impact on the surrounding farmers and land users will be more significant but can still be seen as MODERATE because of the short time the proposed activity will be undertaken. Although the construction activities will be highly visible, the time of exposure is short and thus the impact on the users will be low after mitigation measures have been implemented.

7.2 Potential Permanent Visual Impact Of The Structures

Visibility is determined by a line of sight where nothing obscures the view of an object. Exposure is defined by the degree of visibility, in other words "how much" of it can be seen. This is influenced by topography and the incidence of objects such as trees and buildings that obscure the view partially or in total.

Potential permanent visual impact on the Viewpoints is expected to have a MEDIUM-HIGH impact before mitigation and LOW-MEDIUM significance after mitigation, as indicated in the table below. The structures will be LOW-MEDIUM visible from the Viewpoints, the time of exposure is permanent and thus the impact on the users will still remain LOW-MEDIUM.

Table 15: Impact table summarising the significance of the structures on users of roads and land-users

Nature of impact: Potential visual impact on the viewpoints that had a visual exposure rating.			
		Unmitigated	**Mitigated**
Assessment Criteria	**Severity** [Insignificant / non-harmful (1); Small / potentially harmful (2); Significant / slightly harmful (3); Great / harmful (4); Disastrous / extremely harmful / within a regulated sensitive area (5)]	**2**	**2**
	Spatial Scale [Area specific (at impact site) (1); Whole site (entire surface right) (2); Local (within 5km) (3); Regional / neighbouring areas (5km to 50km) (4); National (5)]	**4**	**2**
	Duration [One day to one month (immediate) (1); One month to one year (Short term) (2); One year to 10 years (medium term) (3); Life of the activity (long term) (4); Beyond life of the activity (permanent) (5)]	**4**	**4**
	Frequency of Activity [Annually or less (1); 6 monthly (2); Monthly (3); Weekly (4); Daily (5)]	**5**	**5**
	Frequency of Incident/Impact [Almost never / almost impossible / >20% (1); Very seldom / highly unlikely / >40% (2); Infrequent / unlikely / seldom / >60% (3); Often / regularly / likely / possible / >80% (4); Daily / highly likely / definitely / >100% (5)	**4**	**3**
Consequence	Severity + Spatial Scale + Duration	**10**	**8**
Likelihood	Frequency of Activity + Frequency of impact	**9**	**8**
Risk	Consequence * Likelihood	**MEDIUM-HIGH (90)**	**LOW-MEDIUM (64)**
Mitigation:	The visual impact can be minimized by the creation of a visual barrier.		
Cumulative Impact:	The construction of the proposed Dunbar Coal structures with its associated infrastructure will increase the cumulative visual impact of agriculture type infrastructure within the region. In context of the existing Agricultural and mining character, the added structures will contribute to a regional increase in small and heavy vehicles on the roads.		

The permanent impact on the surrounding farmers and land users will be increased due to the extra mining structures added to the area.

The modelling of visibility is merely conceptual. Being based on DEM and Land cover data, it does not take into account the real world effect of buildings, trees etc. that could shield the structures from being visible or could have changed over time.

The viewshed analysis therefore signifies a worst-case scenario. The immediate landscape surrounding the observer has a determining influence on long distance views. It is expected that different land cover may offer some degree of visual screening, especially where tall trees occur around farmsteads. This influence was quantified using the land cover data, it must however be noted that this can change on a micro scale or land cover may have changed over time.

The viewshed analysis was generated and refined to reflect the visual exposure of the development according to its actual position in the landscape, as per the general assumed mining related infrastructure.

7.3 Cumulative Impacts

Cumulative landscape and visual effects (impacts) result from additional changes to the landscape or visual amenity caused by the proposed development in conjunction with other developments (associated with or separate to it), or actions that occurred in the past, present or are likely to occur in the foreseeable future. They may also affect the way in which the landscape is experienced. Cumulative effects may be positive or negative. Where they comprise of a range of benefits, they may be considered to form part of the mitigation measures.

Cumulative effects can also arise from the inter-visibility (visibility) of a range of developments and / or the combined effects of individual components of the proposed development occurring in different locations or over a period of time. The separate effects of such individual components or developments may not be significant, but together they may create an unacceptable degree of adverse effects on visual receptors within their combined visual envelopes. Inter-visibility depends upon general topography, aspect, tree cover or other visual obstruction, elevation and distance, as this affects visual acuity, which is also influenced by weather and light conditions. (Institute of Environmental Assessment and The Landscape Institute, 1996).

- The cumulative visual intrusion of the proposed Dunbar Coal structures, will be LOW-MEDIUM as it is a surface mining operation. The site location is also next to other mining operations which decreases the visual impact further. The visual impact and impact on sense of place of the proposed project will contribute to the cumulative negative effect on the aesthetics of the study area.

However, it is recommended that the environmental authorities consider the overall cumulative impact on the agricultural and mining character and the areas sense of place before a final decision is taken with regard to the optimal number of mining activities in the area.

7.4 Mitigation Measures

Mitigation measures may be considered in two categories:

- Primary measures that intrinsically comprise part of the development design through an iterative process. Mitigation measures are more effective if they are implemented from project inception when alternatives are being considered.
- Secondary measures designed to specifically address the remaining negative effects of the final development proposals.

Primary measures that will be implemented will mainly be measures that will minimise the visual impact by softening the visibility of the structures by “blending” with the surrounding areas. Such measures will include rehabilitation of the mining area by re-vegetation of the mining site and surrounding area.

Secondary measures will include final rehabilitation, after care and maintenance of the vegetation and to ensure that the final landform is maintained.

In addition the following measures are recommended:

- Plant some indigenous trees to create a barrier between the neighbours and roads;
- Dust from Stockpile areas, roads and other activities must be managed by means of dust suppression to prevent excessive dust;
- A wind barrier system that encloses the stockpiles;
- Rehabilitation of the area must be done once mining is completed.

8. CONCLUSION

The construction and operation phase of the proposed Dunbar Coal project related activities and its associated infrastructure will have a MODERATE visual impact on the natural scenic resources and the topography. However, with the correct mitigation measures the impact might decrease to a point where the visual impact can be seen as less significant. The moderating factors of the visual impact of the proposed mining operations in close range are the following:

- Number of human inhabitants located in the area;
- Natural topography and vegetation;
- Mitigation measures that will be implemented such as the establishment of barriers or screens;
- The size of the operation; and
- Medium absorption capacity of the landscape.

In light of the above mentioned factors that reduce the impact of the facility, the visual impact is assessed as LOW-MEDIUM VISUAL IMPACT after mitigation measures have been implemented.

Table 16: The overall Assessment of the Visual Impact

Nature of impact: The overall Assessment of the Visual Impact of the area.			
		Unmitigated	**Mitigated**
Assessment Criteria	**Severity** [Insignificant / non-harmful (1); Small / potentially harmful (2); Significant / slightly harmful (3); Great / harmful (4); Disastrous / extremely harmful / within a regulated sensitive area (5)]	**2**	**2**
	Spatial Scale [Area specific (at impact site) (1); Whole site (entire surface right) (2); Local (within 5km) (3); Regional / neighbouring areas (5km to 50km) (4); National (5)]	**4**	**2**
	Duration [One day to one month (immediate) (1); One month to one year (Short term) (2); One year to 10 years (medium term) (3); Life of the activity (long term) (4); Beyond life of the activity (permanent) (5)]	**4**	**4**
	Frequency of Activity [Annually or less (1); 6 monthly (2); Monthly (3); Weekly (4); Daily (5)]	**5**	**5**
	Frequency of Incident/Impact [Almost never / almost impossible / >20% (1); Very seldom / highly unlikely / >40% (2); Infrequent / unlikely / seldom / >60% (3); Often / regularly / likely / possible / >80% (4); Daily / highly likely / definitely / >100% (5)	**4**	**3**
Consequence	Severity + Spatial Scale + Duration	**10**	**8**
Likelihood	Frequency of Activity + Frequency of impact	**9**	**8**
Risk	Consequence * Likelihood	**MEDIUM-HIGH (90)**	**LOW-MEDIUM (64)**
Mitigation:	The visual impact can be minimized by the creation of a visual barrier.		
Cumulative Impact:	Construction of proposed Dunbar Coal structures with its associated infrastructure will increase the cumulative visual impact of agriculture and mining character within the region. In context of the existing character, added structures will contribute to a regional increase in small and heavy vehicles on the roads.		

The Visual Impact due to mining activities and associated infrastructure can be seen as having a MEDIUM-HIGH impact on the surrounding environment and inhabitants before mitigation measures are implemented. After mitigation, the visual impact can be seen as LOW-MEDIUM. The visual impact from the mining activities can be sufficiently mitigated to a point where it can be seen as insignificant. Thus, mitigation measures are very important and one of the most significant mitigation measures are the rehabilitation of the area after mining has been concluded. If the rehabilitation of the impact is not done correctly and the final landform do not fit into the surrounding area then the visual impact will remain MEDIUM-HIGH and become a concern. However, with correct rehabilitation, the impact will be minimal and there should be no visual impact after the landform has been restored.

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