PROPOSED COAL-FIRED POWER STATION IN THE WITBANK AREA

VISUAL IMPACT ASSESSMENT

Eskom Holdings Limited
Generation Division
PO Box 1091
Johannesburg
2000
Tel: 011 800 8111
Fax: 011 800 3111

Prepared by:

STRATEGIC ENVIRONMENTAL FOCUS PTY (LTD)
PO Box 74785,
Lynnwood Ridge
0040

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SEF REF: 500227

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EXECUTIVE SUMMARY

Ninham Shand Consulting Services was appointed by Eskom Holdings Limited Generation Division, as the independent environmental consultant to undertake the Environmental Impact Assessment (EIA) for a proposed new power station between Witbank and Bronkhorstspruit.

Strategic Environmental Focus (Pty) Ltd (SEF) was appointed by Ninham Shand Consulting Services as a sub-consultant to complete a Visual Impact Assessment. This Visual Impact Assessment (VIA) is a specialist study that forms part of the EIA and addresses the visual affects of the proposed power station on the receiving environment.

This VIA report conforms to the requirements of a level four assessment which requires the realisation of the following objectives (adapted from Oberholzer (2005) :

- Determination of the extent of the study area;
- Identification of issues observed during the site visit;
- A description of the proposed project and the receiving environment;
- A discussion on the visual affect of the proposed project and an assessment of the anticipated landscape and visual impacts;
- Recommendations of mitigation measures to reduce and/or alleviate the potential adverse landscape - and visual impacts; and
- Photomontage simulations of the proposed power station on the proposed sites providing a realistic impression of the potential visual impact on the receiving environment.

PROJECT DESCRIPTION

In order to meet the growing demand for electricity, Eskom has proposed to construct a new coal-fired power station in the western part of Mpumalanga Province between Witbank and Bronkhorstspruit. The proposed power station will make use of either direct dry-cooling or indirect dry-cooling technology. A direct dry-cooling system requires less water and no cooling towers are constructed. An indirect dry-cooling system requires cooling towers, one for each boiler (six). The inclusion of cooling towers increases the footprint and visual magnitude of the power station considerably.

The study area is located in the western part of Mpumalanga Province. Two locations for a power station have been identified. Both project sites are located approximately 30 km west of the town of Witbank between the N4 and N12 highways. The two sites are referred to as Site X and Y of which Site X is the larger of the two.

The following project components and activities are expected to cause visual impacts and alter the landscape character:

- Construction activities and associated elements;
- Power station structure;
- Coal stockyard;
- Ash dump;
- Conveyor system;
- Water supply pipeline;
- Perimeter and outdoor lighting; and
- Emission from the flue stacks during operational phase.

The sizes of the major visible elements of the project are expected to be as follows:

- Six boiler units: Approximately 100 m in height;
- Six cooling towers: Approximately 180 m in height (only for indirect dry-cooling system);
- Two flue stacks: Approximately 280 m in height;
- Coal stockyard : Approximately 20 Ha and varying between 3 – 4 m in height; and
- Ash dump: Progressively growing in size. Rate of deposition is expected to be approximately 6 million tons/y.

ALTERNATIVE POWER STATION CONFIGURATIONS

The main difference between a direct- and an indirect dry-cooling system is the absence and presence of cooling towers respectively. Eskom is also considering whether the boilers should be clad and unclad boilers. An unclad boiler will expose the inside steel framework and pipes of the structure (Figure 3) which is typically enclosed in IBR galvanised cladding (Figure 2).

The operational phase will be recognised by the presence and the operation of the completed infrastructure. During operation of the power station, gasses and water vapour will be released from the flue stacks. To mitigate atmospheric pollution which is caused by sulphur emissions, the flue stacks may be equipped with a Flue-Gas-Desulphurisation (FGD) scrubber. This technology will reduce air pollution. However, it will result in highly discernable water vapour plumes emitting from the flue stacks. Where no FGD scrubbers are used, the emissions are barely noticeable, however they contain toxic gasses which contribute to atmospheric pollution.

The size of the coal stockyard will fluctuate during operation as electricity production varies. The ash dump will steadily increase in size during the operations and are expected to be rehabilitated progressively.

A conveyor belt will be constructed between the coal resource and the coal stockyard. It will be enclosed in a non-reflective metal cap and will follow the natural curvature of the topography, maintaining a similar height above ground level over its length. It is expected that a gravel road will parallel the conveyor system to provide access for regular maintenance. The completed conveyor system is anticipated to be approximately 6 km and 2 km to Site Y and Site X respectively.

A power station of this nature will require extensive external lighting. Spot lights will illuminate the area around the power station and security lighting will line the perimeter fence. Unclad boilers will have numerous lights present on the structure that will be otherwise concealed if the boilers are clad. Regularly spaced lights will also be placed on the conveyor system.

DESCRIPTION OF THE RECEIVING ENVIRONMENT

Landscape and visual impacts may result from changes to the landscape. A distinction should be made between impacts on the visual resource and on the viewers (visual receptors). The former are impacts on the physical landscape that may result in changes to the landscape character while the latter are impacts on the viewers themselves and the views they experience.

The study area is characterised by a rolling, undulating landscape with relatively little topographic variation. Agricultural activities in the form of cultivated fields are readily seen on the plains and are the dominant land use. Mining activity is encroaching from the east and manifests itself through the presence of open cast mines, large stockpiles and severe scarring of the landscape. The landscape character can generally be classified as a disturbed rural landscape.

FINDINGS AND RECOMMENDATIONS

The significance of impacts is a comparative function relating to the severity of the identified impacts on the respective receptors. The significance of an impact is considered high should a highly sensitive receptor be exposed to a highly severe impact.

SIGNIFICANCE OF LANDSCAPE IMPACT

The sensitivity of the landscape character is an indication of "…the degree to which a particular landscape can accommodate change from a particular development, without detrimental effects on its character" (GLVIA, 2002).

The study area is characterised by extensive cultivation throughout and a concentration of mining activity on the east. The existing Kendal Power station is a visually dominant feature in the landscape and is clearly visible on the plains due to its scale. Power lines transect the landscape and mining activities steadily encroach on the study area from the east. These elements severely degrade the visual quality of the regional landscape.

The study area is near Witbank's Industrial Development Zone (IDZ). There is an association with the IDZ due to the visual proximity to the alternative sites. The landscape is also under increasing pressure from mineral extraction. It can therefore be stated that the study area is in a transitional phase and is steadily converting from an agricultural land use to a mixed use mining activity.

The landscape character can generally be classified as a disturbed rural landscape. It can be concluded that the existing landscape character is *moderately* sensitive and is reasonably tolerant to change, whether over an extensive area or intensive change over a limited area, which may cause limited alterations to the landscape character.

The severity of the landscape impact refers to the magnitude of change in the landscape character resulting from the proposed project. Table 1 provides a summary of the anticipated impacts on the landscape character, resulting from the different project components and activities.

Table 1: Summary of impacts on the landscape character

Activity	Nature of Impact	Extent of Impact	Duration of Impact	Severity of Impact	Probability of Impact	Significance	
						WOM	WM
Construction phase							
Construction of the power station and preparation of the ash dump and coal stockyard	Negative – Causing surface disturbance, removing elements common to the study area and replacing it with elements contrasting with the landscape character.	Regional	Temporary	High	Definite	Moderate	Moderate
Construction of the conveyor system	Negative – Causing a linear surface disturbance and introducing a foreign linear element in the landscape.	Regional	Temporary	Moderate	Definite	Moderate	Low
Construction of the water pipeline	Negative – Causing a linear surface disturbance.	Regional	Temporary	Moderate	Definite	Moderate	Low
Operational phase							
Operation of the completed power station	Negative - Altering the prevailing landscape character	Regional	Permanent	High	Definite	Moderate	Moderate
Operation of the completed conveyor system	Negative – Adding a linear element to the landscape with foreign characteristics	Regional	Permanent	Moderate	Probable	Moderate	Low

A relative large footprint will be modified during the construction of the power station and its ancillary components. This will inherently cause a localised change in land use which is considered incompatible with the prevailing rural and agricultural land use of the study area.

The potential alternatives described in Section 3.2 will not significantly aggravate or mitigate the anticipated landscape impacts. The severity of landscape impacts will remain essentially the same, but marginal fluctuations are discussed below.

The choice between a direct- or indirect dry cooling systems are anticipated to have the greatest affect in terms of the impact on the landscape character. The presence of cooling towers greatly magnifies the disturbance footprint and the visual prominence of the power station, compared to the direct dry cooling system without cooling towers. A direct dry cooling system would be preferred.

Clad and unclad boilers are considered to have a less influential affect on the change in impacts. A clad boiler will appear simpler and less industrialised than an unclad boiler. An unclad boiler will further reduce the visual quality of the region and enhance an industrial character.

The FGD technology will produce highly visible emissions from the flue stacks. The presence of a plume will further amplify an industrial character which is considered incompatible with the prevailing rural landscape character. Conversely, the absence of FGD technology will cause a much less visible plume, however the health risks associated with it are greater.

SIGNIFICANCE OF VISUAL IMPACT

Viewers (visual receptors) within the study area visually experience the proposed sites in different ways. To determine viewer sensitivity a commonly used rating system (outlined in APPENDIX 1), is utilised. This is a generic classification of viewers and enables the visual impact specialist to establish a logical and consistent viewer sensitivity rating for visual receptors who are involved in different activities without engaging in extensive public surveys.

- **Residents** of the affected environment are classified as visual receptors of *high* sensitivity owing to their sustained visual exposure to the proposed development as well as their attentive interest towards their living environment;
- **Recreational users** involved in outdoor recreational activities are classified as visual receptors of *moderate* sensitivity. They utilise the landscape for enjoyment purposes and are aware of the qualities of the landscape which often include the visual quality that is associated with the landscape; and
- **Motorists** are classified as visual receptors of *low* sensitivity due to their momentary view and experience of the proposed development. As a road user's speed increases, the sharpness of lateral vision declines and the road user tends to focus on the line of travel (USDOT, 1981). This adds weight to the assumption that under normal conditions motorist will show *low* levels of sensitivity as their attention is focused on the road.

Severity of visual impact refers to the magnitude of change to specific visual receptor's views. Severity of visual impact is influenced by the following factors:

- The **viewer's exposure** to the project:
  - Distance of observers from the proposed project;
  - The visibility of the proposed project;
  - Number of affected viewers; and
  - Duration of views to the proposed project.
- Degree of **visual intrusion** created by the project.

In order to assess the extent and degree of visibility in the visual envelope, a Geographical Information System (GIS) was utilised. A frequency or cumulative visibility analysis was performed which provides the following information (Figure 7 - Figure 10):

- The areas within the visual envelope that may experience views of the proposed project; and
- The degree of visibility in terms of the percentage of the proposed project that will be visible from a specific location.

The following tables provide a summary of the visual impacts that the three viewer groups may experience:

Table 2: Summary of visual impacts on residents

Activity	Nature of Impact	Extent of Impact	Duration of Impact	Severity of Impact	Probability of Impact	Significance	
						WOM	WM
Construction phase							
Construction of the power station and preparation of the ash dump and coal stockyard	Negative – Intruding on existing views of the landscape	Local increasing to regional	Temporary	High	Definite	High	High
Construction of the conveyor system and water pipeline	Negative – Intruding on existing views of the landscape	Local	Temporary	Low	Probable	Moderate	Low
Obtrusive lighting during night time construction	Negative – Disturbing existing night time activities	Local	Temporary	Low	Probable	Moderate	Low
Operational phase							
Operation of the completed power station	Negative – Causing major alterations to existing views	Regional	Permanent	High	Definite	High	High
Operation of the completed conveyor system	Negative – Causing alterations to existing views	Local	Permanent	Moderate	Probable	Moderate	Low
Obtrusive lighting during night time	Negative – Disturbing existing night time activities	Local	Permanent	Low	Probable	Moderate	Low

Table 3: Summary of visual impacts on recreational users

Activity	Nature of Impact	Extent of Impact	Duration of Impact	Severity of Impact	Probability of Impact	Significance	
						WOM	WM
Construction phase							
Construction of the power station	Negative – Intruding on existing views of the landscape	Local	Temporary	Low to none	Probable	Low to none	Low to none
Operational phase							
Operation of the completed power station	Negative – Causing slight alterations to existing views	Local	Permanent	Low	Probable	Low	Low

Table 4: Summary of visual impacts on motorists

Activity	Nature of Impact	Extent of Impact	Duration of Impact	Severity of Impact	Probability of Impact	Significance	
						WOM	WM
Construction phase							
Construction of the power station and ancillary components	Negative – Intruding on existing views of the landscape	Regional	Temporary	Low	Probable	Low	Low
Operational phase							
Operation of the completed power station	Negative – Causing major alterations to existing views	Regional	Temporary	Low	Probable	Low	Low

Generally, the degree of visual intrusion will be highly severe due to a large scale structure in a mostly undeveloped rural landscape. Visual receptors in the immediate vicinity of the proposed sites, i.e. experiencing views of the power station in their fore- and middle ground, will be most severely affected. These viewers are limited to farm residents and motorists on the farm roads within approximately 10 km from the sites.

Viewers on the perimeter of the study area will experience much less visual intrusion as a result of the considerable decrease in visual size of the power station. The power station will only be discernible on very clear days but will make part of the far background, subsequently reducing visual intrusion considerably.

The conveyor system, underground pipeline, ash dump and coal stockyard will have a more localised impact than the power station. These elements are much smaller in scale and are expected to have less visual intrusion.

CONCLUSION

Preferred site for the proposed power station

The differences in landscape and visual impacts between Sites X and Y are marginal. The visibility analyses (Figure 9 & Figure 10) indicate a similar ZVI with the only differences relating to the more pronounced intensities of visibility on different areas in the study area. The visibility for Site X (Figure 9) indicates high visibility intensity over a smaller area within 10 km as opposed to Site Y (Figure 10), which indicates high visibility intensity over a greater area.

Farm residents within 10 km from the proposed sites, will experience major visual intrusion during both the construction and operational stages, due to their proximity to and the relative large visual magnitude of the proposed power station in their visual field. Visual receptors outside the 10 km threshold are expected to experience less severe visual intrusion due to the reduced visual magnitude resulting from the greater viewing distances.

The impact on the landscape character, between the two alternative sites, is similar. Site X is closer to the coal resource which will require a shorter conveyor system. The impact on the landscape character will be less due to the shorter route and the limited surface disturbance. Site X is marginally closer to the highly disturbed mining areas on the eastern side of the study area. The landscape nearer to the Bronkhorstspruit Dam (Site Y) is less disturbed, although highly cultivated.

It can be concluded that the preferred site is Site X as it is the furthest away from the Bronkhorstspruit Dam which is considered to have high recreational potential and a higher visual quality. In addition, the cumulative visibility analysis of Site X indicates high visibility intensity over a smaller area within 10 km as opposed to Site Y.

Alternative power station configurations and technologies

The alternative configurations will not significantly aggravate or mitigate the anticipated landscape impacts. Marginal variations in landscape impacts are discussed in the following paragraph and pertain mostly to the difference in direct- and indirect dry cooling systems.

The choice between a direct- or indirect dry cooling systems will have the greatest affect in terms of the impact on the landscape character. An indirect dry cooling system will result in a higher landscape impact, compared to a direct dry cooling system. The presence of cooling towers will greatly increase the disturbance footprint and the visual prominence of the power station.

The affect on visual receptors are as follows:

An indirect dry cooling system with associated cooling towers will bring forth a much larger power station oppose to a direct dry cooling system. The increased visual size of a power station with cooling towers will emphasise visual intrusion to a fair degree. The severity of visual impact for both systems is considered *high*. The indirect dry cooling system will result in a larger structure which will yield a marginally magnified impact.

Unclad boilers are considered to be more unsightly than clad boilers due to the exposed structural framework and pronounced industrial character. Additionally, an unclad boiler may contribute to higher levels of obtrusive lighting conditions due to the absence of screening that are typically provided by IBR sheeting.

The implementation of FGD technology will will increase the visibility of emissions from the flue stacks. FGD technology removes sulphur from the emissions which reduces health risks. A negative perception still persists among the general public that any visible emissions contribute to pollution despite the technological advancement and the reduction in pollutants. From a health perspective, FGD technology is the preferred option, but will create a greater degree of visual intrusion oppose to the absence of FGD scrubbers. To mitigate the impact that may be created by the presence of FGD technology, awareness need to be raised in order to enlighten the public and terminate the negative connotation and perception that prevail.

The preferred combination of alternatives will be the construction of the proposed power station on Site X, with clad boilers, along with a direct dry cooling system. The absence of FGD technology will cause the least impacts from a visual stand point, but considering the reduction in air pollution, FGD technology will be the preferred alternative from a health perception.

Very little can be done to reduce the impact of the power station on the landscape character and affected viewers. The recommended mitigation relies on the use of muted colours on the façade and the sensitive use of glass.

The remainder of the mitigation is more focussed on the ancillary project components to reduce the visibility of objects such as the ash dump, coal stockyard and conveyor system. These project components can be mitigated with greater success and the associated impacts can be reduced effectively.

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LIST OF ABBREVIATIONS

EIA	Environmental Impact Assessment.
FGD	Flue-Gas-Desulphurisation
FHWA	Federal Highway Administration of the United States Department of Transportation. The publishers of the guide "*Visual Impact Assessment for High Projects*" (1981).
GIS	Geographical Information System.
GLVIA	Guidelines to Landscape and Visual Impact Assessment
LCA	Landscape Character Assessment.
VAC	Visual Absorption Capacity.
VIA	Visual Impact Assessment.
WM	With Mitigation.
WOM	With out Mitigation.
ZVI	Zone of Visual Influence.

1. INTRODUCTION

Ninham Shand Consulting Services was appointed by Eskom Holdings Limited Generation Division, as independent environmental consultant to undertake the Environmental Impact Assessment (EIA) for a proposed new power station between Witbank and Bronkhorstspruit.

Strategic Environmental Focus (Pty) Ltd (SEF) was appointed by Ninham Shand Consulting Services as a sub-consultant to complete a Visual Impact Assessment. This Visual Impact Assessment (VIA) is a specialist study that forms part of the EIA and addresses the visual affects of the proposed power station on the receiving environment.

1.1. STUDY AREA

The study area is located in the western part of Mpumalanga Province. Two locations for the proposed power station have been identified, both of which are located approximately 30 kilometres west of the town of Witbank between the N4 and N12 highways.

The study area is typically referred to as the Highveld which is dominated by grassland vegetation and large areas of cultivated fields. The existing Kendal Power station is located approximately 20 km south of the two proposed sites.

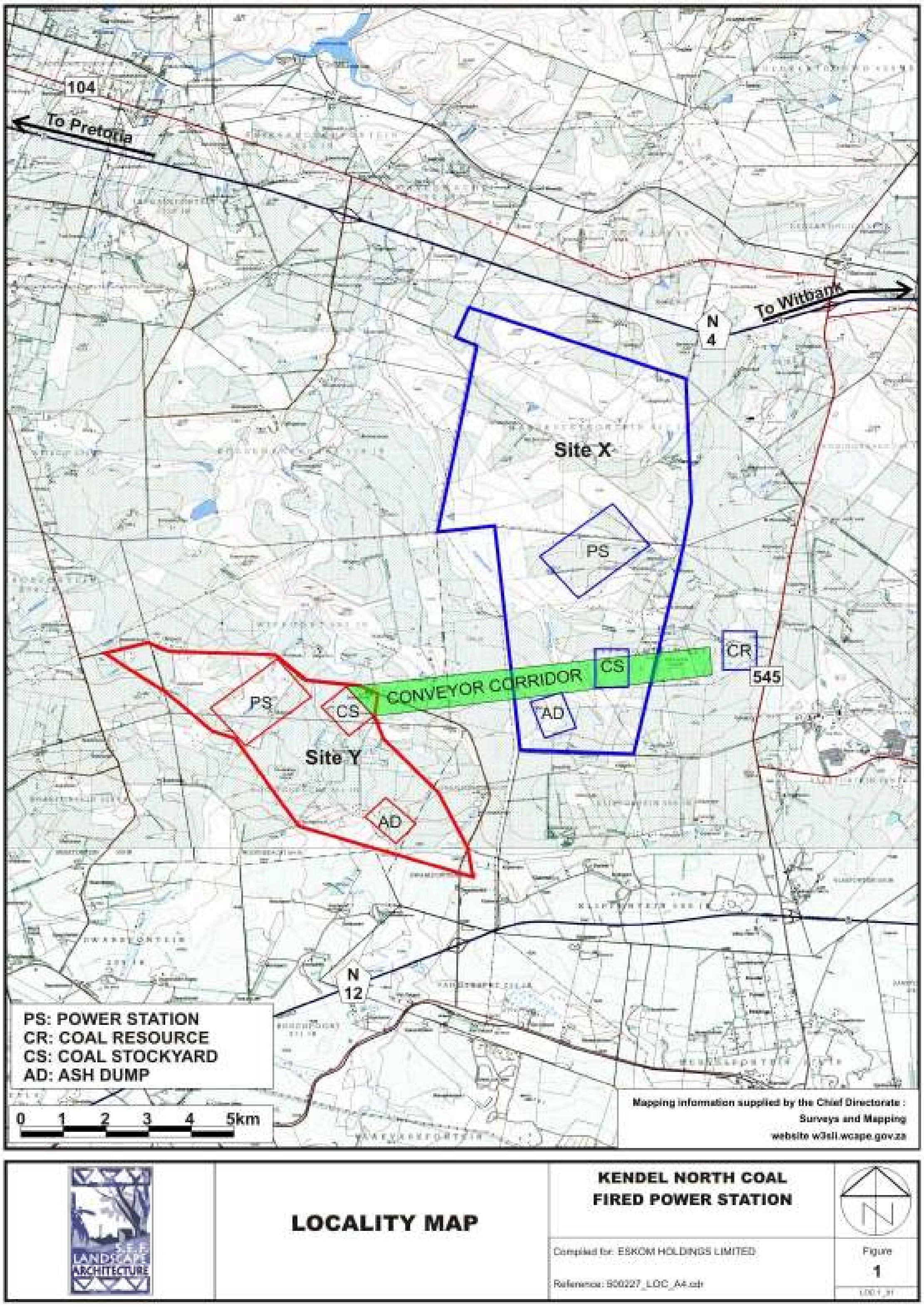
1.1.1. SITE X

Site X is located approximately 1 km south of the N4 highway, and 3 km west of the R545 route. The site extends over two farms namely Klipfontein 566 JR and Hartbeestfontein 537 JR.

1.1.2. SITE Y

Site Y is located approximately 3 km north of the N12 highway on the border of Gauteng and Mpumalanga. The site includes the following farms: Nooitgedacht 564 JR and Dwaalfontein 565 JR.

Figure 1: Locality Plan



2. STUDY APPROACH

2.1. INFORMATION BASE

This assessment was based on information from the following sources:

- Topographical maps and GIS generated data were sourced from the Surveyor General, Surveys and Mapping in Mowbray, Cape Town and SEFGIS (2006) respectively;
- Observations made and photographs taken during site visits;
- Conceptual zoning plan received from the client;
- Professional judgement based on experience gained from similar projects; and
- Literature research on similar projects.

2.2. ASSUMPTIONS AND LIMITATIONS

This assessment was undertaken during the conceptual stage of the project and is based on information available at the time. The following assumptions and limitations are stated below:

- The duration of the construction phase is anticipated to continue for approximately 4 - 6 years. The expected progression of construction is discussed in Section 3;
- No example of the construction of a power station could be assessed during the compilation of this report to explore the visual characteristics. The assessment is based on experience from other construction projects and professional judgement. The findings of the impact assessment during construction is appraised with less confidence due to the lack of detailed information,
- No dimensional or design information was available with regards to the conveyor system at the time of the report compilation. The type of conveyor system which is proposed between the coal source and the proposed coal stockyard of the two alternative sites, is expected to be similar in appearance than the conveyor system that is utilised for the Kendal Power station. An example of a typical conveyor system is shown in Section 3;
- A water supply pipeline will be constructed between the existing Kendal Power station and the proposed power station. The pipeline is anticipated to be underground and will thus only cause impacts during the construction stage; and
- The power station will be operational for 24 hours and will require external lighting at night around the activity areas for safe operation. No lighting plan/layout was available at the time of the assessment and the lighting impact is compared and assessed after a brief assessment of a similar power station facility in the region.

2.3. METHODOLOGY

A broad overview of the approach and methodology used in this assessment is provided below:

- The extent of the study area is limited to a radius of 20 km;
- The site is visited to establish a photographic record of the site, views and areas of particular visual quality and or -value;
- The project components and activities are described and assessed as elements that may cause visual impacts and changes to the prevailing landscape character;
- A Landscape Character Assessment (LCA) is conducted of the study area;
- Viewers (visual receptors) that may be affected by the proposed project are identified and described;
- The sensitivity of the landscape character and visual receptors is assessed;
- The severity of the change to the landscape character and visual impacts is determined;

- The significance of the visual and landscape impacts is assessed;
- Mitigation measures are proposed to reduce or alleviate adverse impacts; and
- A comparison of the impacts between the two alternative sites and the different power station configurations is drawn as a concluding statement.

2.4. LEVEL OF CONFIDENCE

The level of confidence assigned to the findings of this assessment is based on:

- The level of information available and/or understanding of the study area (rated 3); and
- The information available and/or knowledge and experience of the project (rated 2).

The findings in this VIA are rated with a confidence level of 6. This rating indicates that the author's confidence in the accuracy of the findings is *high* (Table 5).

Table 5: Confidence level chart and description

CONFIDENCE LEVEL CHART				
		Information, knowledge and experience of the **project**		
Information, and knowledge of the **study area**		3b	2b	1b
	3a	9	6	3
	2a	6	4	2
	1a	3	2	1

- 3a – A *high* level of information is available of the **study area** in the form of recent aerial photographs, GIS data, documented background information and a thorough knowledge base could be established during site visits, surveys etc. The study area was readily accessible.
- 2a – A *moderate* level of information is available of the **study area** in the form of aerial photographs GIS data and documented background information and a moderate knowledge base could be established during site visits, surveys etc. Accessibility to the study area was acceptable for the level of assessment.
- 1a – *Limited* information is available of the **study area** and a poor knowledge base could be established during site visits and/or surveys, or no site visit and/or surveys were carried out.
- 3b – A *high* level of information and knowledge is available of the **project** in the form of up-to-date and detailed engineering/architectural drawings, site layout plans etc. and the visual impact assessor is well experienced in this type of project and level of assessment.
- 2b – A *moderate* level of information and knowledge is available of the **project** in the form of conceptual engineering/architectural drawings, site layout plans etc. and/or the visual impact assessor is moderately experienced in this type of project and level of assessment.
- 1b – *Limited* information and knowledge is available of the **project** in the form of conceptual engineering/architectural drawings, site layout plans etc. and/or the visual impact assessor has a low experience level in this type of project and level of assessment. (Adapted from Oberholzer. B, 2005)

3. PROJECT DESCRIPTION

3.1. OVERVIEW OF THE PROJECT

In order to meet the growing demand for electricity, Eskom has proposed to construct a new coal-fired power station in the western part of Mpumalanga Province between Witbank and Bronkhorstspruit.

3.2. PROJECT COMPONENTS AND ACTIVITIES

The proposed power station may make use of either a direct dry-cooling or indirect dry-cooling technology. The main difference between a direct- and an indirect dry-cooling system is the presence of cooling towers where direct dry cooling has no cooling towers. Eskom is also exploring alternative options with regards to clad and unclad boilers. An unclad boiler will expose the inside steel framework and pipes of the structure (Figure 3) which is typically enclosed in IBR galvanised cladding (Figure 2).

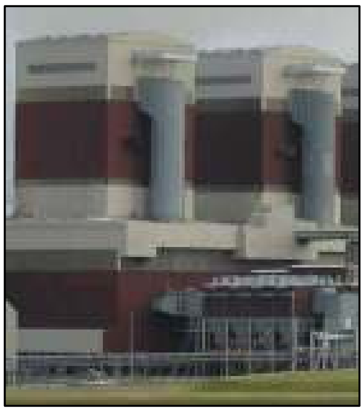


Figure 2: Typical clad boiler

Sourced from Eskom Holdings Limited (2006)

Figure 3: Typical unclad boiler

Sourced from Eskom Holdings Limited (2006)

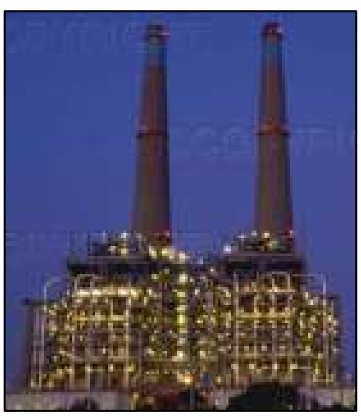


Figure 4: Typical unclad boiler at night

Sourced from Eskom Holdings Limited (2006)

Figure 5: Typical conveyor system

The following project components and activities are expected to cause visual impacts and alter the landscape character:

- Construction activities and associated elements;
- Power station structure (direct- or indirect dry-cooling) (clad or unclad boilers);
- Coal stockyard;
- Ash dump;

- Conveyor system;
- Water supply pipeline;
- Perimeter and outdoor lighting; and
- Emissions from flue stacks during operational phase.

The project will be discussed in two phases, namely the construction and operational phases.

3.2.1. CONSTRUCTION PHASE

The appearance of the construction site will progressively develop from the initial site clearance and preparation to the final completed facility. The construction phase is expected to continue for approximately 4 - 6 years and is expected to progress as follows:

- Construction of new roads to gain access to the site. Existing roads will be utilised as far as possible;
- The footprint of the project will be cleared of vegetation, after which earthworks will prepare the construction area;
- Construction materials will be off-loaded and stockpiled on site;
- Over time, the buildings and infrastructure will be erected. Cranes, scaffolding and numerous ancillary equipment and infrastructure will be present during the duration of the construction phase;
- It is expected that the majority of the power station will be constructed within the first four years which will include the first boiler. Subsequently the other five boilers will be installed over a period of two years until the power station is fully operational;
- Conveyor systems will be installed to transport coal from the coal source to the coal stock yard and between the power station and the ash dump (Figure 5); and
- An underground water supply pipeline will be constructed from the existing Kendal Power station to the proposed site.

3.2.2. OPERATIONAL PHASE

The sizes of the major visible elements of the project are expected to be as follows:

- Six boiler units: Approximately 100 m in height;
- Six cooling towers: Approximately 180 m in height (only for indirect dry-cooling system);
- Two flue stacks: Approximately 280 m in height;
- Coal stockyard : Approximately 20 Ha and varying between 3 – 4 m in height; and
- Ash dump: Progressively growing in size. Rate of deposition is expected to be approximately 6 million tons/y.

The operational phase will be characterised by the presence and the operation of the completed infrastructure. During operation of the power station, emissions will be released from the flue stacks.

To mitigate the atmospheric pollution which is caused by sulphur emissions, the flue stacks may be equipped with a Flue-Gas-Desulphurisation (FGD) scrubber. This technology will considerably reduce air pollution but will cause a highly discernable water vapour plume emitting from the flues. Where no FGD scrubbers are used the emissions from the flues are barely noticeable, however they contain sulphur and other gasses which contribute to atmospheric pollution. The technology used in the indirect dry-cooling system will result in no visible water vapour escaping from the cooling towers.

The size of the coal stockyard will fluctuate during operation as electricity production varies. The ash dump will steadily increase in size during the operations and are expected to be rehabilitated progressively.

A conveyor belt system will transport coal between the coal resource and the coal stockyard. It will be enclosed in a non-reflective metal cap to prevent rain water and debris from entering the system. It is expected that the conveyor system will be constructed in a relative straight line which implies a limited number of transfer points. A transfer point is typically a small shed-like structure which houses the transfer unit (see example in Figure 5). The conveyor system will follow the natural curvature of the topography, maintaining a similar height above ground level over its length. It is expected that a gravel road will parallel the conveyor line to provide access for occasional servicing. The anticipated length of the conveyor system to Site X is 2 km and to Site Y is 6 km.

A power station of this nature will require extensive external lighting. Spot lights will illuminate the area around the buildings of the power station and security lighting will line the perimeter fence. Unclad boilers will have numerous lights present on the structure that will be otherwise concealed if the boilers are clad. Regularly spaced lights will also be placed on the conveyor system.

4. DESCRIPTION OF THE RECEIVING ENVIRONMENT

Landscape and visual impacts may result from changes to the landscape. A distinction should be made between impacts on the **visual resource** and on the **viewers** (visual receptors). The former are impacts on the physical landscape that may result in *changes to the landscape character* while the latter are *impacts on the viewers* themselves and the views they experience.

4.1. VISUAL RESOURCE

4.1.1. LANDSCAPE CHARACTER ASSESSMENT

Landscape Character Assessment (LCA) is concerned primarily with the observable elements, components or features within a landscape that individually and collectively define the landscape characteristics.

Topography: The study area is characterised by a rolling, undulating landscape with relatively little topographic variation. Small drainage lines meander through the landscape and cause shallow incisions. Numerous farm dams are situated in the drainage lines. Different sized pans are irregularly spaced on the higher lying areas. During the rainy seasons, the pans hold water, but are usually dry in winter.

Land use: The study area is dominated by agricultural activities and cultivated fields extending across the plains. Isolated farmsteads are widely distributed across the landscape and are usually associated with a group of Eucalyptus trees. Mining activity is encroaching from the east and manifests itself through the presence of open cast mines, large stockpiles and severe scarring of the landscape.

Built development: The existing Kendal Power station is a highly visible structure in this largely undeveloped and open landscape. Infrastructure from the mining activity is particularly noticeable west of the proposed sites. The industrial development on the western perimeter of Witbank is also visible in the background and is often covered by dense haze hanging over the landscape (Figure 6).

Figure 6: Landscape Character

EXISTING ASH DUMP OF KENDAL POWER STATION IN A TYPICAL WINTER LANDSCAPE.
NOTE THE POOR AIR QUALITY RESULTING IN POOR VISIBILITY.

CULTIVATED LAND TRANSECTED BY POWERLINES AND DOMINATED BY THE KENDAL POWER STATION. TYPICAL SUMMER LANDSCAPE CHARACTER.

RURAL CHARACTER AND SCATTERED FARM HOUSES IN A TYPICAL WINTER LANDSCAPE.

S.E.F LANDSCAPE ARCHITECTURE	**LANDSCAPE CHARACTER**	**PROPOSED COAL FIRED POWER STATION**	
		Compiled for: ESKOM HOLDINGS LIMITED Reference: 500227_LOC_A4.cdr	Figure 2

4.1.2. VISUAL CHARACTER

Visual character is based on human perception and the observer's response to the relationships between and composition of the landscape, the land uses and identifiable elements in the landscape. The description of the visual character includes an assessment of the scenic attractiveness regarding those landscape attributes that have aesthetic value and contribute significantly to the visual quality of the views, vistas and/or viewpoints of the study area.

Gentle undulating plains and low-lying valleys dominate the regional topography. The lines are smooth, extending into the horizon. The smoothly textured and uniform grassland vegetation is interrupted with regularly shaped cultivated fields. The colour of the landscape is dictated by seasonal change. It cycles between lush green and rich colours during summer and dull yellow and browns during winter.

The region is relatively undeveloped, with the exception of the existing Kendal Power station which is a dominant feature in the landscape, towering above the horizon line in the distance. Its scale is unsurpassed and exceeds the size of any other element within the landscape. The study area is also recognised for low intensity mining activities, sparsely spaced farmsteads and dirt roads traversing the landscape. The visual character of the landscape is exclusively rural with an element of industrialisation encroaching from the east.

4.1.2.1 Visual quality

Visual quality is a qualitative evaluation of the composition of landscape components and their influence on scenic attractiveness. Many factors contribute to the visual quality of the landscape and are grouped under the following three main categories (Table 6) that are internationally accepted indicators of visual quality (FHWA, 1981).

Table 6: Criteria of Visual Quality (FHWA, 1981)

INDICATOR	CRITERIA
Vividness	The memorability of the visual impression received from contrasting landscape elements as they combine to form a striking and distinctive visual pattern.
Intactness	The integrity of visual order in the natural and man-built landscape, and the extent to which the landscape is free from visual encroachment.
Unity	The degree to which the visual resources of the landscape join together to form a coherent, harmonious visual pattern. Unity refers to the compositional harmony of inter-compatibility between landscape elements.

The landscape is allocated a rating from an evaluation scale of 1 to 7 and divided by 3 to get an average. The evaluation scale is as follows: Very Low =1; Low =2; Moderately Low =3; Moderate =4; Moderately High =5; High =6; Very High =7;

The regional landscape is assessed against each indicator separately. All three indicators should be *high* to indicate *high* visual quality. The evaluation is summarised in Table 7.

Table 7: Visual Quality of the regional landscape

VIVIDNESS	INTACTNESS	UNITY	VISUAL QUALITY
2	4	3	Moderately Low

A higher visual quality can be attributed to areas with less human intervention and with natural features. In this case, the pans, natural drainage lines and isolated rocky outcrops can be classified as higher quality features which contribute to both ecological importance and visual interest in the landscape. However, the dominance of agricultural practices and the encroachment of the mining activity are impacting the regional visual quality, which is classified as *moderately low*.

5. SIGNIFICANCE OF POTENTIAL IMPACTS

The **significance of impacts** is a comparative function relating to the severity of the identified impacts on the respective receptors. The significance of an impact is considered high should a highly **sensitive receptor** be exposed to a highly **severe impact** (Table 8).

Table 8: Impact significance table

RECEPTOR SENSITIVITY	IMPACT SEVERITY		
	LOW	MEDIUM	HIGH
LOW	No significance	Low	Low
MEDIUM	Low	Medium	Medium
HIGH	Low	Medium	High

5.1. LANDSCAPE CHARACTER SENSITIVITY

The sensitivity of the landscape character is an indication of "…the degree to which a particular landscape can accommodate change from a particular development, without detrimental effects on its character" (GLVIA, 2002). A landscape with a *high* sensitivity would be one that is valued for its aesthetic attractiveness and/or have ecological, cultural or social importance through which it contributes to the inherent character of the visual resource.

The study area is characterised by extensive cultivation. The existing Kendal Power station is a visually prominent feature and is clearly visible on the plains due to its scale. A number of power lines transect the landscape and mining activities steadily encroach on the study area from the east. These elements severely degrade the visual quality of the regional landscape, although areas of less human intervention reflect a higher naturalness and visual appeal.

Air quality in the area is generally poor and results in unsightly smog hanging over the landscape, especially in winter. The study area is near Witbank's IDZ and due to the visual proximity to the alternative sites, there is an association between the IDZ and the study area. The landscape is also under increasing pressure from mineral extraction. It can therefore be stated that the study area is in a hypothetical transitional phase and is steadily being converted from an agricultural land use to a mixed use intertwined with mining activity.

The landscape character can generally be classified as a disturbed rural landscape. It can be concluded that the existing landscape character is *moderately* sensitive and is reasonably tolerant to change, whether over an extensive area or intensive change over a limited area, which may cause limited alterations to the landscape character.

5.2. SEVERITY OF POTENTIAL LANDSCAPE IMPACTS

The severity of the landscape impact refers to the magnitude of change in the landscape character resulting from the proposed project. In accordance with the density, extent and scale of the proposed development, the severity of the landscape impact is also examined by discussing the following factors:

- Visual Absorption Capacity (VAC); and
- Visual contrast.

5.2.1. ALTERING THE PREVAILING LANDSCAPE CHARACTER

Table 9: Landscape impact

Activity	Nature of Impact	Extent of Impact	Duration of Impact	Severity of Impact	Probability of Impact	Significance	
						WOM	WM
Construction phase							
Construction of the power station and preparation of the ash dump and coal stockyard	Negative – Causing surface disturbance, removing elements common to the study area and replacing it with elements contrasting with the landscape character.	Regional	Temporary	High	Definite	Moderate	Moderate
Construction of the conveyor system	Negative – Causing a linear surface disturbance and introducing a foreign linear element in the landscape.	Regional	Temporary	Moderate	Definite	Moderate	Low
Construction of the water pipeline	Negative – Causing a linear surface disturbance.	Regional	Temporary	Moderate	Definite	Moderate	Low
Operational phase							
Operation of the completed power station	Negative - Altering the prevailing landscape character	Regional	Permanent	High	Definite	Moderate	Moderate
Operation of the completed conveyor system	Negative – Adding a linear element to the landscape with foreign characteristics	Regional	Permanent	Moderate	Probable	Moderate	Low

VAC of the study area

The VAC of the study area is considered extremely low and provides very limited screening capacity for a project of this scale. The low VAC relates to the unvaried topography and predominantly low vegetation. The regular forms and associated vertical posture of the power station are unlike the undulating and horizontal appearance of the topography. In addition, the scale of the power station is unsurpassed by any other element in the landscape, making it a dissociated feature in the predominantly rural landscape. The silhouette of the proposed power station will be much pronounced above the skyline which will greatly enhance the prominence of the structure over great distances.

The less prominent project components such as access roads, conveyor system and water pipeline are expected to be visually absorbed to a greater degree in the landscape. The relative modest scale and extent of the project components are more readily accepted and will not create major alterations to the landscape character.

Ash dump and coal stockyard

The ash dump will have a distinct colour contrast with the rest of the landscape. The freshly placed ash will appear light grey, contrasting with the green or dull yellow colours of the surrounding landscape. The coal stock yard will be physically smaller and thus create less contrast. The dark colour of the coal stock yard will create a distinct colour contrast with the grassland around it and will be clearly visible. It is however possible to mitigate the visual contrast and the associated impacts through strategic planting around the coal stock yard and through progressive rehabilitation of the ash dump.

Conveyor system

The conveyor system will be a linear element transecting the landscape. Currently the corridor is proposed along a straight line. A linear element which is unsympathetic towards the gentle undulating topography has the tendency to appear more pronounced and in contrast with the smooth lines created by the landscape. The conveyor system between the coal resource and the coal stockyards of the respective sites, will create a prominent line in the landscape, contributing to the degree of human intervention in the study area.

Water pipeline

The construction of the water pipeline will require major earthworks to dig a trench. The exposed soil from the trench will cause a greater colour contrast during the summer season when the prevailing colour is green. In winter most cultivated lands are fallow which evidently means less colour contrast with the exposed soil. These project components are expected to have a moderate to low significance rating.

Conclusion

A relatively large footprint will be modified during the construction of the power station and its ancillary components. This will cause a localised change in land use which is considered incompatible with the prevailing rural and agricultural land use of the study area.

The severity of impact during the construction and operational stages of the power station will be *high,* as a result of the scale and extent of the proposed project. The intensity of change over a relatively large area and the permanent nature of the project are responsible for a *moderate* significance rating in terms of altering the landscape character.

Alternative power station configurations and technologies

The potential alternatives described in Section 3.2 will not significantly aggravate or mitigate the anticipated landscape impacts. The severity of landscape impacts will remain essentially the same, but marginal changes in the severity are discussed below.

The choice between a direct- or indirect dry cooling systems will have the greatest affect in terms of the impact on the landscape character. The presence of cooling towers greatly magnifies the disturbance footprint and the visual prominence of the power station, compared to the direct dry cooling system without cooling towers. A direct dry cooling system would be preferred.

Clad and unclad boilers are considered to have a less influential affect on the change in landscape impacts. A clad boiler will have a simpler and less distracting form than an unclad boiler. An unclad boiler will further reduce the visual quality of the region due to its highly industrialised character.

The FGD technology will produce highly visible emissions from the flue stacks and will result in a distinctive plume, which consists mostly of water vapour. The presence of a plume will promote an industrial character which is considered incompatible with the prevailing rural landscape character. Conversely, the absence of FGD technology in the system will result in a much less visible plume, however the health risks associated with it are greater due to the release of sulphur in the air.

5.3. VIEWER SENSITIVITY

Viewers (visual receptors) within the study area visually experience the proposed sites in different ways. They will be affected because of alteration to their views and are therefore identified as part of the receiving and affected environment. The viewers are grouped according to their similarities in views and activity. The viewer groups included in this study are:

- Residents;
- Viewers involved with recreational activity; and
- Motorists.

To determine viewer sensitivity a commonly used rating system (outlined in APPENDIX 1), was utilised. This is a generic classification of viewers and enables the visual impact specialist to establish a logical and consistent viewer sensitivity rating for visual receptors who are involved in different activities without engaging in extensive public surveys.

- **Residents** of the affected environment are classified as visual receptors of *high* sensitivity owing to their sustained visual exposure to the proposed development as well as their attentive interest towards their living environment.
- **Recreational users** involved in outdoor recreational activities are classified as visual receptors of *moderate* sensitivity. They utilise the landscape for enjoyment purposes and are aware of the qualities of the landscape which often include the visual quality that is associated with the landscape.
- **Motorists** are classified as visual receptors of *low* sensitivity due to their momentary view and experience of the proposed development. As a road user's speed increases, the sharpness of lateral vision declines and the road user tends to focus on the line of travel (USDOT, 1981). This adds weight to the assumption that under normal conditions motorist will show *low* levels of sensitivity as their attention is focused on the road.

5.4. SEVERITY OF POTENTIAL VISUAL IMPACTS

Severity of visual impact refers to the magnitude of change to specific visual receptor's views. Severity of visual impact is influenced by the following factors:

- The **viewer's exposure** to the project:
  - Distance of observers from the proposed project;
  - The visibility of the proposed project;
  - Number of affected viewers; and
  - Duration of views to the proposed project.
- Degree of **visual intrusion** created by the project.

5.4.1. ZONE OF VISUAL INFLUENCE (ZVI)

Empirical research has indicated that the visibility of an element in the landscape, and hence the severity of visual impact, decreases as the distance between the observer and the element increases. This is due to the fact that the further an observer is located from an element in the landscape, the less area it occupies in the observer's visual field and the less significant the element becomes in relation to the rest of the viewed landscape. The landscape and all its comprising components start to dominate this one element and the severity of visual impacts becomes negligible at a specific threshold distance.

The visual envelope demarcates the extent of visual influence (ZVI) and includes the area within which views to the proposed project are expected to be of concern. The visual envelope for the two proposed sites are limited to a 20 km radius around the location of the proposed power stations which is considered an adequate distance to assess the significance of the potential visual impact.

5.4.1.1 VISIBILITY

In order to assess the extent and degree of visibility in the visual envelope, a Geographical Information System (GIS) was utilised. A frequency or cumulative visibility analysis was performed which provides the following information (Figure 7 - Figure 10):

- The areas within the visual envelope that may experience views of the proposed project; and
- The degree of visibility in terms of the percentage of the proposed project that will be visible from a specific location.

The GIS performs an analysis for a series of elevated observer points which represents the height of the entire power station in a digital elevation model (DEM). This results in a visibility map with the degree of visibility illustrated by a colour range. Figure 7 & Figure 8 illustrates the intensity of visibility on a colour scale from red to yellow. Figure 9 & Figure 10 illustrates the same information in more interpretive manner.

The cumulative visibility analyses consider worst-case scenarios, using line-of-sight, based on topography alone. The screening capability of vegetation is not captured in the base model of the DEM and is therefore not considered in these results.

Figure 7: Visibility intensity analysis (Site X)

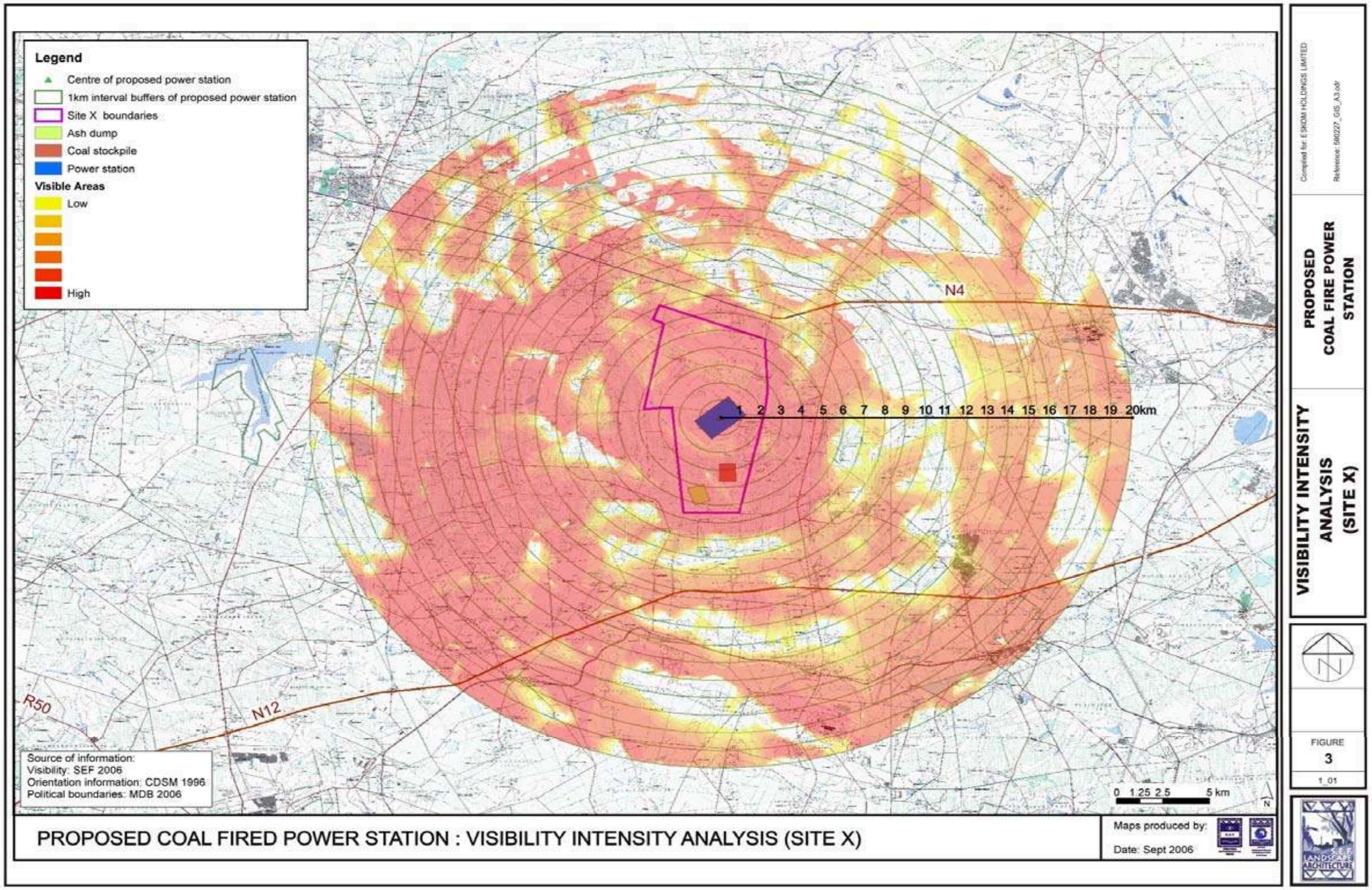


Figure 8: Visibility intensity analysis (Site Y)

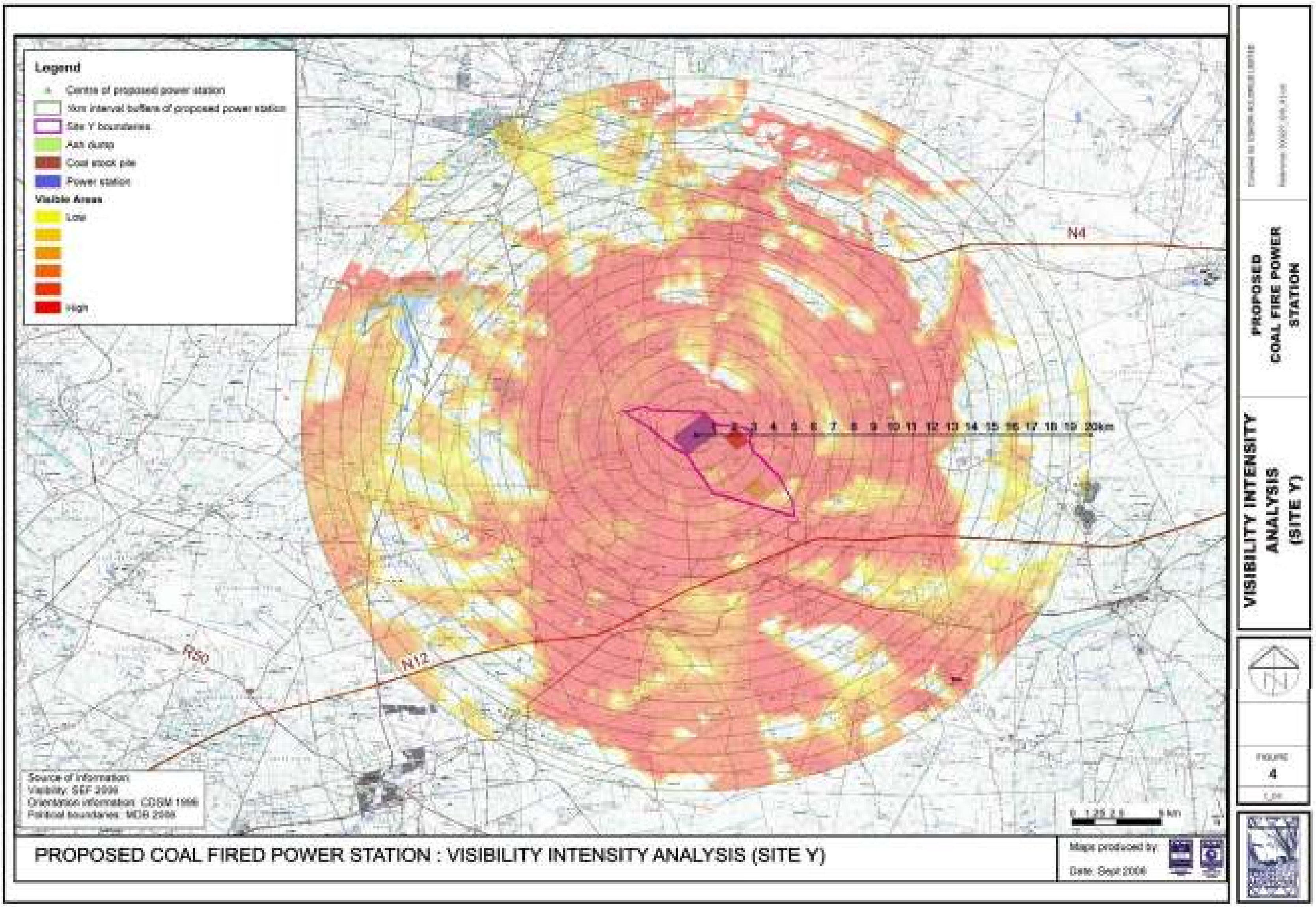


Figure 9: Cumulative visibility from site X

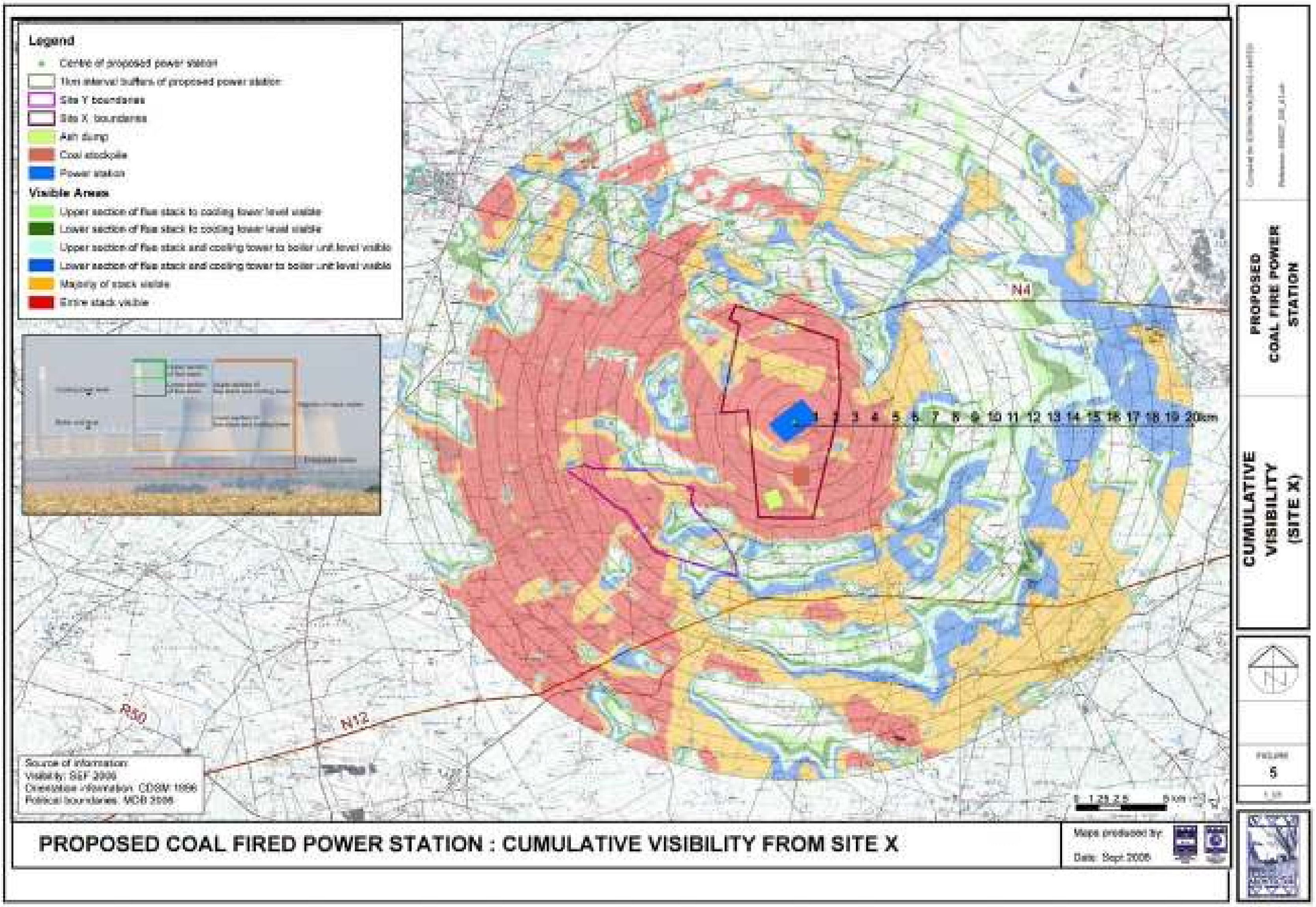
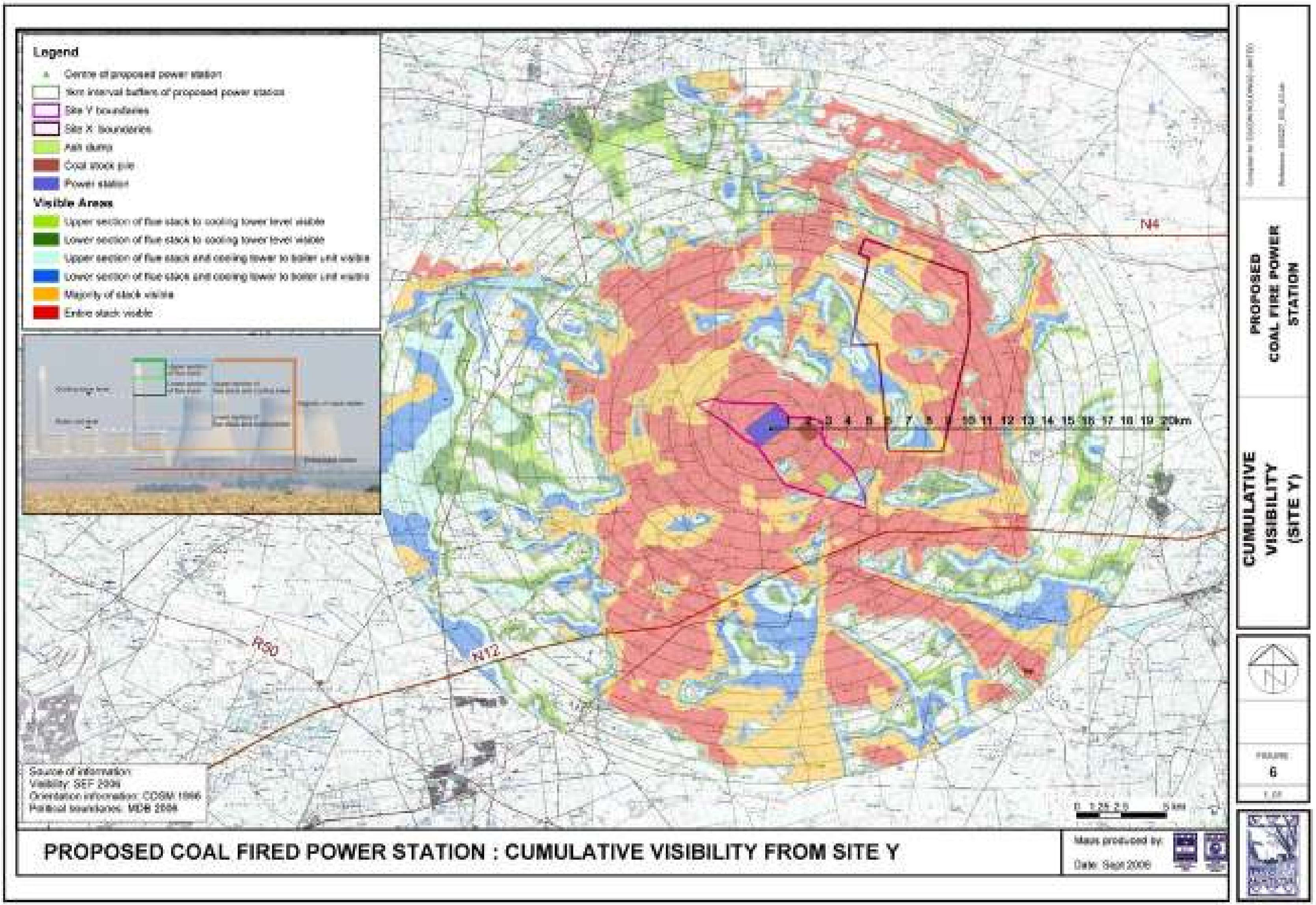


Figure 10: Cumulative visibility from site Y



5.4.2. VISUAL IMPACT ON RESIDENTS

Table 10: Visual impact on residents

Activity	Nature of Impact	Extent of Impact	Duration of Impact	Severity of Impact	Probability of Impact	Significance	
						WOM	WM
Construction phase							
Construction of the power station and preparation of the ash dump and coal stockyard	Negative – Intruding on existing views of the landscape	Local increasing to regional	Temporary	High	Definite	High	High
Construction of the conveyor system and water pipeline	Negative – Intruding on existing views of the landscape	Local	Temporary	Low	Probable	Moderate	Low
Obtrusive lighting during night time construction	Negative – Disturbing existing night time activities	Local	Temporary	Low	Probable	Moderate	Low
Operational phase							
Operation of the completed power station	Negative – Causing major alterations to existing views	Regional	Permanent	High	Definite	High	High
Operation of the completed conveyor system	Negative – Causing alterations to existing views	Local	Permanent	Moderate	Probable	Moderate	Low
Obtrusive lighting during night time	Negative – Disturbing existing night time activities	Local	Permanent	Low	Probable	Moderate	Low

Visual exposure

The majority of residents in the study area are farm residents, which are sparsely scattered across the study area. Higher density resident concentrations occur in the Bronkhorstspruit, Witbank and Delmas areas, approximately 20 km away. This is considered outside or on the outer limits of the visual envelope where visibility of the proposed power station will be severely limited due to the distance factor as discussed in section 5.4.1. Hence, the density of residents in the study area is considered extremely low which indicates a relatively low number of affected viewers as opposed to an urban area.

Figure 7 & Figure 8 indicate that due to the scale of the project, the entire or sections of the proposed power station will be visible throughout most of the study area. The topography provides little VAC to visually screen the components of the project and it can therefore be stated that the general visibility of the project will be extremely high.

During the construction stage, visual exposure to the construction activity will initially be limited and only local residents will experience views of the site preparation activity. As the structures increase in scale and height, the ZVI increases, resulting in a greater number of affected viewers and a subsequent increase in visual exposure.

Visual intrusion

During the construction stage the visual intrusion will progressively increase in severity as the power station and the ancillary components increase in scale. The cleared site, construction camp and material lay-down yards will appear unsightly and out of character. Large scale construction elements such as cranes, will be highly visible and increase awareness of the construction activity over a considerable area. The visual intrusion caused during the construction stage will be high, but will be temporary in nature.

Once the project is completed it will be considered as a permanent addition to the landscape as it is not anticipated to be decommissioned within the next 50 years. The duration of views experienced by the residents of the surrounding farming community is considered permanent, increasing the severity of visual exposure.

The visual intrusion will be highly severe as a result of the introduction of a large scale structure in a generally undeveloped rural landscape. Residents in the immediate vicinity of the proposed sites, i.e. experiencing views of the power station in their fore- and middle ground, will be most severely affected. As an example, at a 10 km distance, the existing Kendal Power station occupies 5,4 cm² of one's visual field which is the size of a 1,12 cm x 4,8 cm block held 40 cm away from one's eyes. The power station is easily recognisable even at these great distances, but visual acuity is often severely affected by poor air quality.

Viewers on the perimeter of the study area will experience much less visual intrusion as a result of the considerable decrease in visual size of the power station. At a 20 km distance, the Kendal Power station only occupies a quarter of the visual area compared to the 10 km scenario. This is similar to a 0,56 cm x 2,4 cm block held 40 cm from one's eyes. The power station will only be discernible on very clear days but will make part of the far background, subsequently reducing visual intrusion considerably.

The conveyor system, underground pipeline, ash dump and coal stockyard will have a more localised impact than the power station. These elements are much smaller in scale and are expected to have less visual intrusion. The underground pipeline is expected to cause temporary visual impact during the construction stage when major earthworks are required to dig the trench.

It can be concluded that the severity of visual impact experienced by most residents from the farming community will be *high.* The severity may diminish to a *moderate* degree when distance is factored in. This level of severity is only considered to be applicable for residents on the perimeter of the study area which is the minority. Respecting the views of closely located residents, the significance of the visual impact for both alternative sites will be *high*.

Alternative power station configurations and technologies

An indirect dry cooling system with associated cooling towers will present a much larger power station compared to a direct dry cooling system. The increased visual size of a power station with cooling towers will emphasise the visual intrusion. The severity of visual impact for both systems is considered *high*. The indirect dry cooling system will result in a larger structure which will yield a marginally magnified impact.

Unclad boilers are considered to be more unsightly than clad boilers due to the exposed structural framework and pronounced industrial character. Additionally, an unclad boiler may contribute to higher levels of obtrusive lighting conditions due to the absence of screening that are typically provided by IBR sheeting.

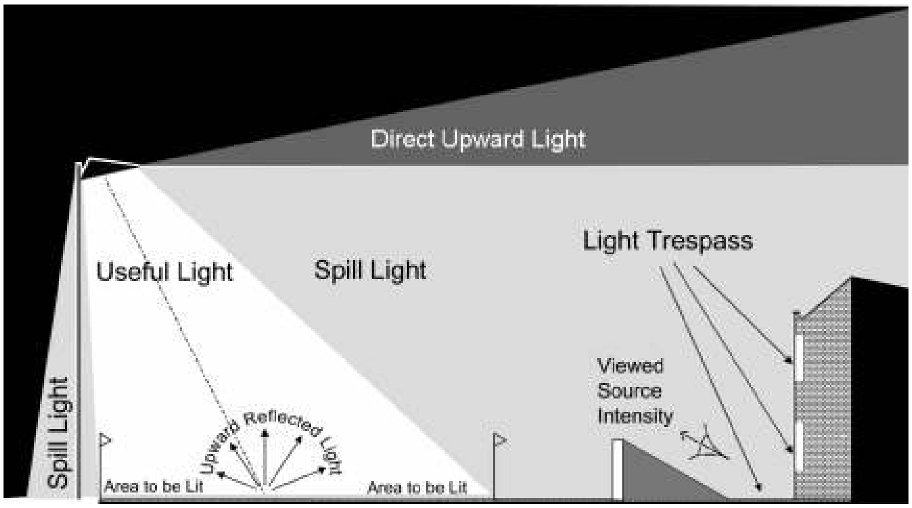
As discussed previously, the implementation of FGD technology will increase the visibility of emissions from the flue stacks. A negative perception still persists among the general public that any visible emissions contribute to pollution despite the technological advancement and the reduction in pollutants. From a health perspective, FGD technology is the preferred option, but will create a greater degree of visual intrusion oppose to the absence of FGD scrubbers. To mitigate the impact that may be created by the presence of FGD technology, awareness need to be raised in order to enlighten the public and terminate the negative connotation and perception that prevail.

A combination of a direct dry cooling system and clad boiler will be the preferred option. This will result in a smaller physical structure and a simpler form. The scale of such a development is still considered overpowering in this simple landscape and the degree of intrusion will remain *highly* severe.

5.4.2.1 *Potential obtrusive lighting conditions*

Obtrusive lighting occurs when a light source intrudes on, or interrupts visual receptors' normal night time activity to detrimental effects (Figure 11). Obtrusive lighting can be described in terms of light trespass which is a result of poor lighting design causing glare and light spillage to a degree where it may disturb neighbouring visual receptors.

Figure 11: Obtrusive lighting ((ILE, 2005)



A typical power station requires lighting on the perimeter of the power station as well as lighting around the buildings and on the boiler units. The high intensity spot lights are not strong enough to cause glare, but light spillage is a common problem. Through empirical research conducted during the site visit, it was found that stray light may adversely affect residents that live within 2-4 km from a power station. The duration of exposure to light spillage will be extended, i.e. the entire night which increases the severity of this particular impact. The obtrusive nature of light spillage diminishes rapidly over distance to a point where it becomes negligible. Generally, the severity of the impact will be *low*, due to the small sphere of influence and the subsequent low number of visual receptors that will be adversely affected.

Figure 4 shows a typical example of an unclad boiler at night. Aggravated obtrusive lighting conditions can be expected due to the increased number of light sources. The zone of adverse influence may remain within 2-4 km, but the intensity of impact is expected to be greater, thus resulting in a greater degree of intrusion.

Obtrusive lighting can be mitigated with relative ease through the use of full cut-off luminaries and screening. It can be concluded that the significance of visual impact will be *low*.

5.4.3. VISUAL IMPACT ON RECREATIONAL USERS

Table 11: Visual impact on recreational users

Activity	Nature of Impact	Extent of Impact	Duration of Impact	Severity of Impact	Probability of Impact	Significance	
						WOM	WM
Construction phase							
Construction of the power station	Negative – Intruding on existing views of the landscape	Local	Temporary	Low to none	Probable	Low to none	Low to none
Operational phase							
Operation of the completed power station	Negative – Causing slight alterations to existing views	Local	Permanent	Low	Probable	Low	Low

The nearest recognised recreational node in the study area is Bronkhorstspruit Dam which is approximately 14 km and 20 km away from Site Y and Site X respectively. The dam is located in a topographical incision which will limit views to the proposed power station from the water and the banks of the dam. The areas on the perimeter of the dam are increasingly being developed as resorts and residential estates which flags the popularity of the Bronkhorstspruit Dam as an attraction. Figure 10 indicates a higher degree of visibility on the northern banks of the dam, but due to the distance to the proposed power station on Site Y, the severity of viewer exposure and visual intrusion is expected to be minimal.

The same argument applies here as discussed in section 5.4.2. The visual size of the proposed power station will be very small and from areas directly adjacent the dam, only the top portions of the power station will be visible (Figure 9 & Figure 10). During the construction stage it is expected that the structures will only be visible once it reaches its full scale. On humid and clear days, emission plumes may be visible from the dam and surrounding areas. This is especially true for Site Y, which is the closer of the two alternative sites.

No obtrusive lighting conditions will be experienced by these viewers due to the distance factor significantly diminishing light intensity. The ash dump, coal stock yard and conveyor system is considered to be screened from views due to the local topographic variation and will thus not cause any visual impact.

Alternative power station configurations and technologies

It is expected that clad or unclad boilers will have no affect on the visual experience of the landscape as perceived by recreational users from Bronkhorstspruit Dam. According to the cumulative visibility analysis it is highly unlikely that the entire power station will be visible due to the screening created through the local topography. The top of the cooling towers and stacks may be perceivable, but the difference in severity of impact between a direct- and indirect cooling systems is considered negligible.

The implementation of FGD technology will however create a plume that will be visible from the Bronkhorstspruit Dam on most clear days. Visual intrusion is expected to increase due to the added height of the plume and the potential increase in ZVI. Despite the distance between the viewers and the proposed power station, an increase in visibility of the plume can be expected due to the silhouette effect against the sky which tends to increase visibility. The colour contrast between a whitish plume and a clear blue background will pronounce visual intrusion. The magnified visual intrusion will increase the degree of visual impact severity. The visual exposure that may be experienced by recreational users, is considered very low due to the irregular and random visibility of the plumes as well as the intermittent presence of the viewers. The significance of visual impact will remain *low*.

5.4.4. VISUAL IMPACT ON MOTORISTS

Table 12: Visual impact on motorists

Activity	Nature of Impact	Extent of Impact	Duration of Impact	Severity of Impact	Probability of Impact	Significance	
						WOM	WM
Construction phase							
Construction of the power station and ancillary components	Negative – Intruding on existing views of the landscape	Regional	Temporary	Low	Probable	Low	Low
Operational phase							
Operation of the completed power station	Negative – Causing major alterations to existing views	Regional	Temporary	Low	Probable	Low	Low

Motorists on the major transport routes such as the N4 and N12 will be able to experience high visibility of the proposed power station for both alternative sites at certain sections of the route. The minimum and maximum distances from where the majority of the power station will be visible are illustrated in Table 13.

Table 13: Viewing distances from N4 and N12

	Site X		Site Y	
Minimum and maximum distances to be viewed	**Min**	**Max**	**Min**	**Max**
N4	6 km	>20 km	13 km	14 km
N12	10 km	>20 km	8 km	14 km

These two routes carry large volumes of motorists per day which increases the number of viewers affected. However, the orientations of these routes are such that at no point within the study area either of these routes will be orientated directly towards the proposed locations of the power station. Considering the speed at which these motorists travel, their cone of vision will be relatively small and the duration of visual exposure will be short.

The proximity of the two proposed sites to Witbank and the presence of other power stations in the area, provoke a specific impression with the motorist. The landscape does not appear particularly scenic and it can be argued that motorists will not be inclined to intensely investigate the landscape as they would when meandering through a scenic landscape. For this reason the degree of visual intrusion with regards to the views motorists on the major routes experience, is considered low.

The secondary road network in the study area carries a much lower volume of motorists. Many of the roads are gravel roads which are mostly utilised by the local residents. Their duration of views will be temporary and it is expected that the visual intrusion that they will experience will be low.

The proposed conveyor corridor crosses the gravel road that defines the northern boundary of Site Y. It is still uncertain where the conveyor system will cross over or under the road, but it is assumed the conveyor system will cross underneath the road. Major earthworks will be required to construct the culvert. The temporary surface disturbance and resulting exposed soil will create localised unsightly views. Once completed, views that are in line with the orientation of the conveyor system will experience the greatest degree of intrusion. The exposure to these views will be momentarily and is therefore considered low.

It can be concluded that motorists will experience a *low* severity of impact, which also indicates a *low* significance of visual impact.

6. RECOMMENDED MITIGATION MEASURES

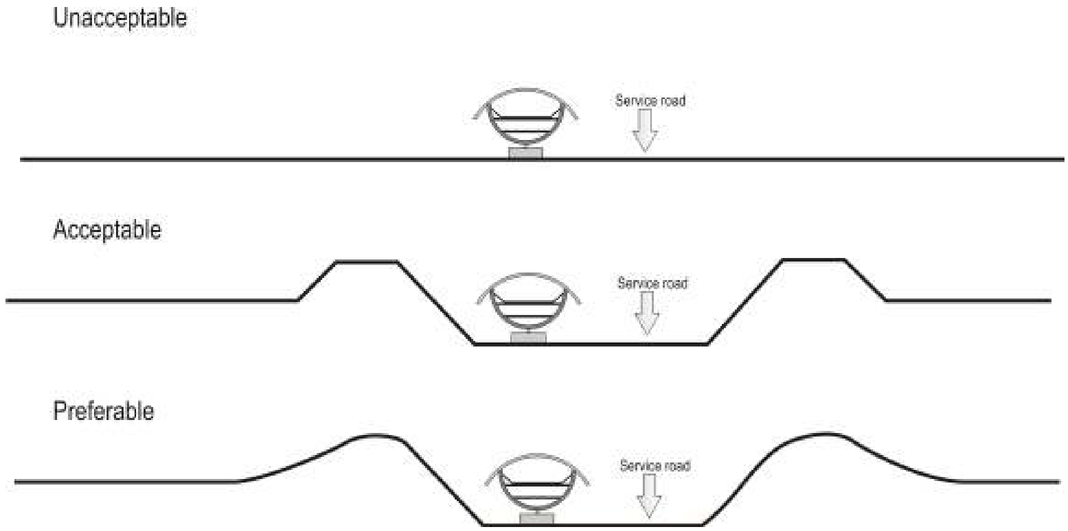
6.1. MITIGATION

The aim of mitigation is to reduce or alleviate the intrusive contrast between the proposed project components and activities, and the receiving landscape to a point where it is acceptable to visual and landscape receptors. Mitigation should be implemented as an iterative process, accompanying the design phase to mitigate predictable impacts before construction commences. This approach generates preventative measures that will influence design decisions instead of relying on cosmetic landscape remediation of a completed project.

6.1.1. DESIGN PHASE

- Treat building façades and roofs with a muted, mat paint that is similar to the prevailing colour of the landscape. The colour palette that is used for the Kendal Power station is very effective and can be used on the new proposed power station. Different shades of the same colour can be used to create visual interest and to avoid a stark mono-toned façade;
- Avoid very light and very dark coloured finishes that will increase colour contrast with the foreground and background. Always use mat paint and pastel colours which are subtle and resembles colours in the landscape;
- Avoid the use of glass or materials with a high reflectivity in the infrastructure to avoid glare and visual discomfort to viewers. It is recommended that large roof overhangs should be used to minimise glare from windows. Mat finishes should be used on external façades to reduce reflection;
- Design the conveyor system and water pipe line to follow existing linear elements or lines in the study area such as roads. Keep on the edge of the cultivated fields so as not to fragment large parcels of uniform vegetation;
- Enclose the conveyor belt with a non-reflective and muted coloured cladding to minimise potential glare and to resemble the colour of the surrounding landscape;
- As an additional mitigation measure the conveyor system can be recessed to 1 – 2 m below ground level to screen it from sensitive visual receptors and to retain unobstructed views across the landscape;

Figure 12: Mitigating conveyor system



- Locate the coal stockyard and the ash dump as close to the power station as practically possible as to reduce the footprint envelope of the different project components. A grouped arrangement will result in a concentrated disturbance footprint and the potential exist for the individual elements to screen each other from sensitive viewpoints. The practicality of the re-arrangement would have to be determined and measured against other specialist inputs;
- Screen planting should be introduced along perimeter roads passing the site, around the coal stockyard and the ash dump to screen views of the proposed project components. As a general good practice, screen planting should preferably be indigenous. It is acknowledged that very view indigenous trees can survive the severe Highveld conditions without supplementary watering. The option to introduce non-invasive exotic trees that are more resistant to the conditions and which can also reach a greater height, i.e. increase screening capacity should be considered. The use of exotic trees will not interfere with the regional landscape character. The patchwork of dense tree stands among the grassy plains is a common sight and exotic trees are often planted around farmsteads and along roads. The use of exotic trees should however comply with the conditions in the Environmental Management Program (EMP);
- Strategically introduce screen planting around buildings and along the perimeter fence in order to reduce light trespass and glare on adjacent properties and motorists. Additionally, “full cut-off” luminaries should be installed to limit the amount of light trespass and spillage so as to control light output and restrict glare (Figure 13) (Shaflik, 1997);
- To increase the effectiveness of screen planting, screening berms can be constructed and vegetated;
- When vertical structures or surfaces are lit such as building facades or signs, install a down light luminaire. If the only alternative is to up-light the element, the correct luminaire must be fitted to avoid light spillage (Figure 14); and
- Avoid over-illumination of outdoor spaces. As a general rule, low pressure sodium lights are regarded as highly energy efficient and suitable for security lighting.

Figure 13: Luminaire fixtures (Shaflik, 1997)

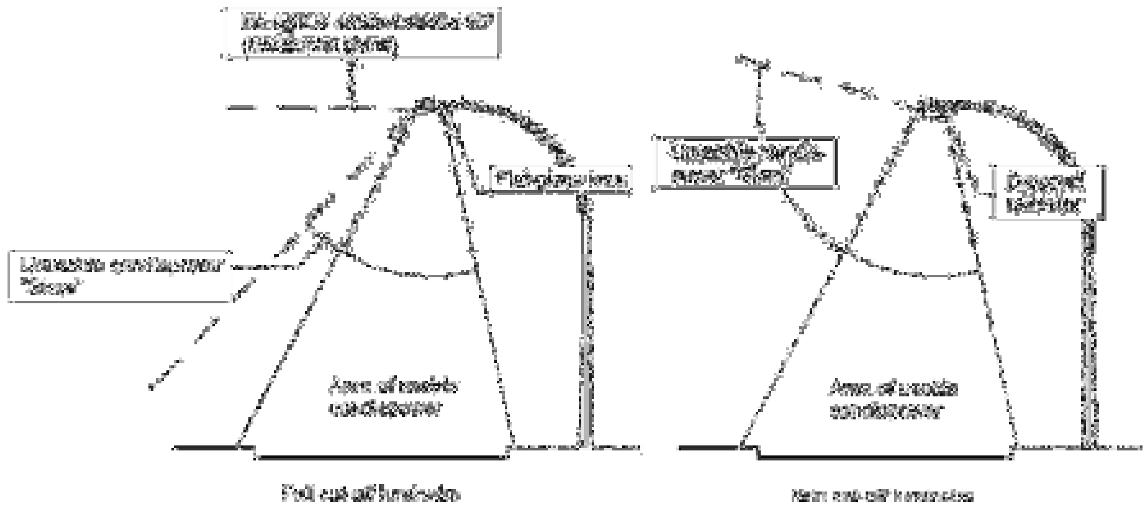
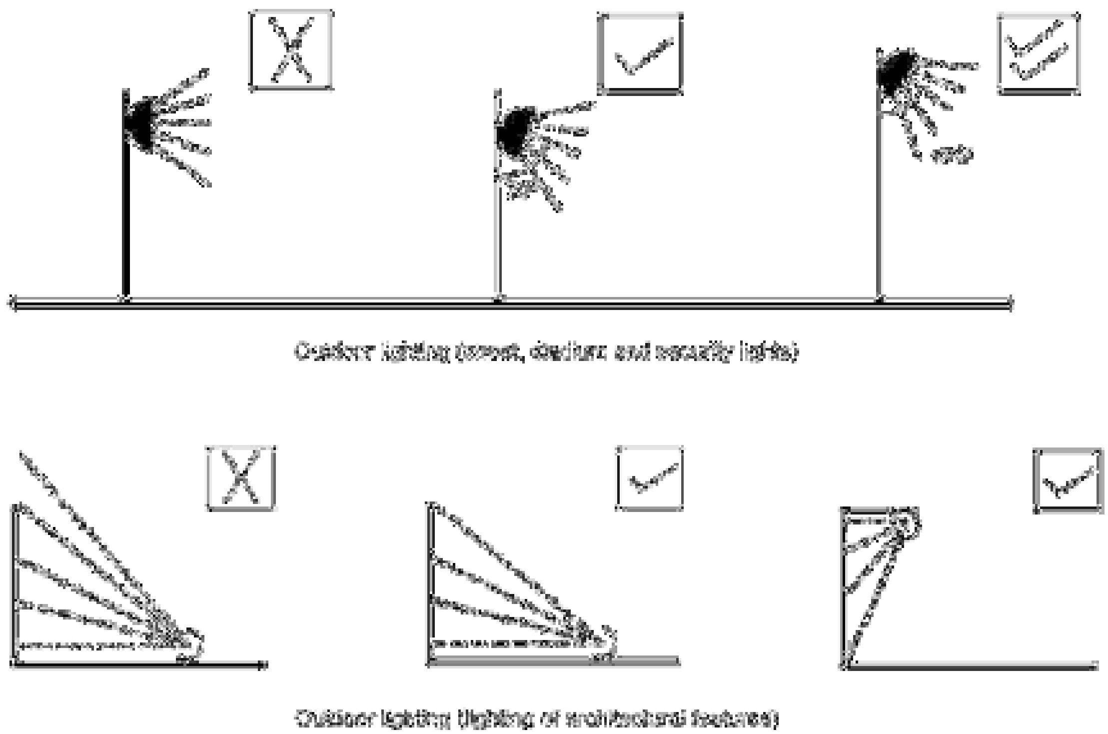


Figure 14: Directing outdoor luminaries (ILE, 2005)



6.1.2. CONSTRUCTION PHASE

- Locate construction camps and stockyards out of the visual field of highly sensitive visual receptors such as farm communities. Choose sites that are close to an existing clump of trees. Utilise the existing screening capacity of the site and improve it by enclosing the construction site and stockyards with a dark green or khaki brown shade cloth as an additional screen;
- Retain the existing vegetation cover of the site through selective clearing. Where practical, protect existing vegetation clumps during the construction phase in order to facilitate screening during construction and operational phases;
- Keep the construction sites and camps neat, clean and organised in order to portray a general tidy appearance;

- Remove rubble and other building rubbish off site as soon as possible or place it in a container in order to keep the construction site free from additional unsightly elements;
- If construction is necessary during night time, light sources should be directed away from residents and roads as to prevent glare; and
- Pave roads where relative high volumes of traffic are expected to minimise dust generation and potential unsightly discoloration of vegetation along roads. Alternatively, other dust suppression techniques should be implemented especially on windy days.

6.1.3. OPERATIONAL PHASE

- Refrain from permanently illuminating outdoor spaces where light is only required intermittently. Lighting can be switched on and off manually or through an automatic time switch, synchronised with the times light is required;
- Keep a small active face and progressively rehabilitate the ash dump as to avoid long periods of exposed ash which creates unsightly views;
- Manipulate the conventional ash dump form and profile to resemble natural landform profiles in order to blend with the overall topographic setting. The interface between the ash dump and the natural landscape is the connection point between two distinctly different slope angles and an abrupt, contrasting edge should be avoided. A natural S-shaped slope profile provides a sensitive solution. A convex curve from the crest converts to a concave curve that flattens out into the landscape. This gradual conversion between different slope angles completely reduces the conspicuous contrast in slope angles (Figure 15);
- The ash dump's final slope configuration should avoid sharp angles and straight lines. The slope typically consists of benches and rises. The edges that will be created as a result of these changes in slope should be rounded to create an even light distribution over the edge and avoid distinct, straight shadow lines (Figure 16);

Figure 15: Manipulation of ash dump profile

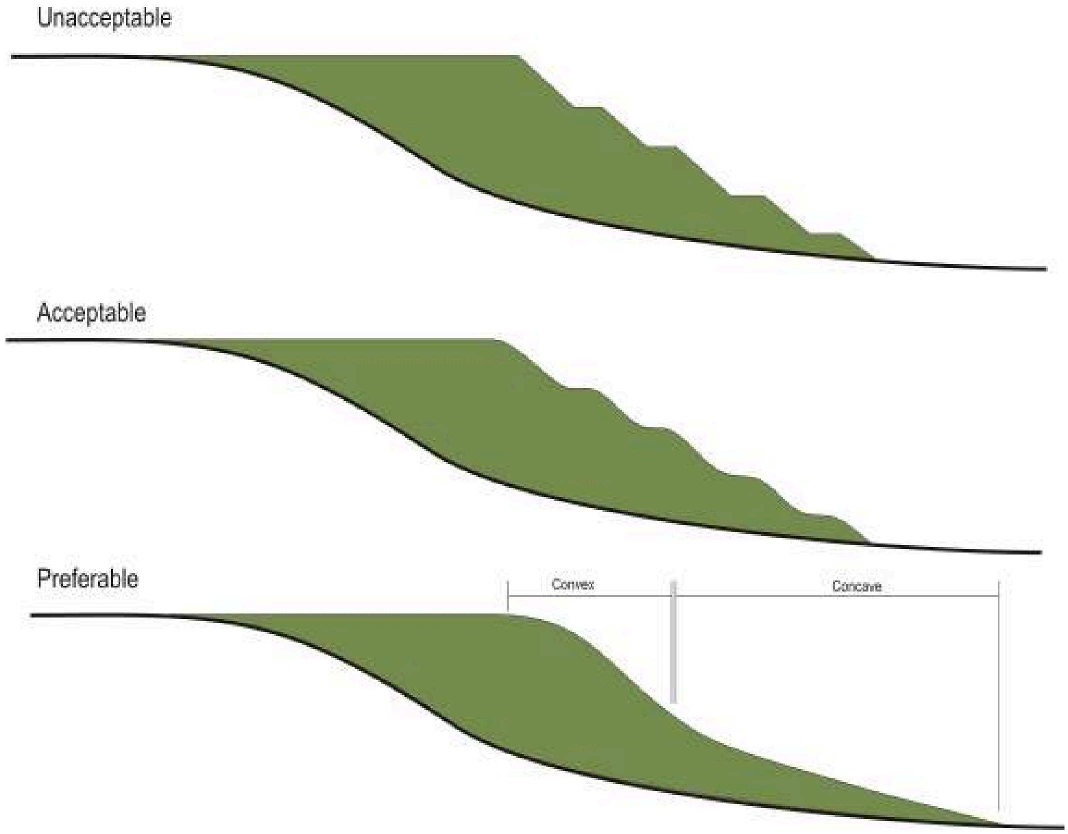
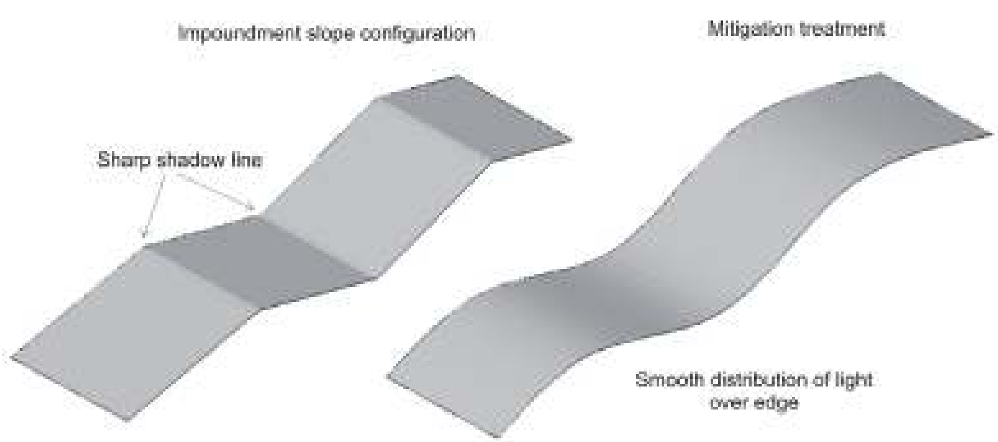


Figure 16: Shadow distribution over different edge conditions



- Rehabilitation of the ash dump should aim to establish a diverse and self-sustaining surface cover that is visually and ecologically representative of naturally occurring vegetation species. Visual synergy can be created by simulating vegetation patterns on the ash dump that resemble vegetation patterns found on local occurring rocky outcrops or in drainage channels. This requires strategic groupings of associative endemic trees and shrubs on the side slopes that will create the perception of, for example a drainage corridor;
- Compile a plant palette consisting of a combination of indigenous vegetation species that occur locally. In order to establish a diverse range of species on the ash dump the plant palette should include various grass, shrub and tree species; and
- Maintain a high level of landscaping around the power station as to portray a neat appearance.

7. CONCLUSION

Preferred site for the proposed power station

The differences in landscape and visual impacts between Sites X and Y are marginal. The visibility analyses (Figure 9 & Figure 10) indicate a similar ZVI with slight differences. The differences pertain to more pronounced intensities of visibility on different areas in the study area. The visibility for Site X (Figure 9) indicates high visibility intensity over a smaller area within 10 km as opposed to Site Y (Figure 10), which indicates high visibility intensity over a greater area.

Farm residents within 10 km from the sites will experience major visual intrusion during both the construction and operational stages, due to their proximity to and the relative large visual magnitude of the proposed power station and its associated components. Visual receptors outside the 10 km threshold are expected to experience less severe visual intrusion due to the reduced visual magnitude resulting from the greater viewing distances.

The impact on the landscape character compared between the two proposed sites, is in essence the same. Site X is closer to the coal resource which will require a shorter conveyor system. The impact on the landscape character will be less due to the shorter route and the limited surface disturbance. Site X is marginally closer to the highly disturbed mining areas on the eastern side of the study area. The landscape nearer to the Bronkhorstspruit Dam (Site Y) is less disturbed, although highly cultivated.

The preferred site is Site X, as it is the furthest away from the Bronkhorstspruit Dam which is considered to have high recreational potential and a higher visual quality. In addition, the cumulative visibility analysis of Site X indicates high visibility intensity over a smaller area within 10 km as opposed to Site Y.

Alternative power station configurations and technologies

The potential alternatives described in Section 3.2 will not significantly aggravate or mitigate the anticipated landscape and visual impacts. The severity of the anticipated impacts will remain essentially the same, but marginal increases and decreases are to be expected.

The preferred combination of alternative configurations will be the construction of the proposed power station on Site X, with clad boilers, along with a direct dry cooling system. The absence of FGD technology will cause the least impacts from a visual stand point, but considering the reduction in air pollution, FGD technology will be the preferred alternative from a health perception.

GLOSSARY OF TERMS

Glare	Glare is the uncomfortable brightness of a light source when viewed against a dark background (ILE, 2005).
Horizon contour	A line that encircles a development site and that follows ridgelines where the sky forms the backdrop and no landform is visible as a background. This is essentially the skyline that when followed through the full 360-degree arc as viewed from a representative point on the site defines the visual envelope of the development. This defines the boundary outside which the development would not be visible.
Landscape amenity	Landscape amenities are those perceivable landscapes and/or landscape elements that greatly contribute to the prevailing landscape character and/or visual quality and –value of the study area. The notable features such as hills or mountains or distinctive vegetation cover such as forests and fields of colour that can be identified in the landscape and described. It also includes recognised views and viewpoints, vistas, areas of scenic beauty and areas that are protected in part for their visual value.
Landscape characterisation/ character	This covers the gathering of information during the desktop study and field survey work relating to the existing elements, features, and extent of the landscape (character). It includes the analysis and evaluation of the above and the supporting illustration and documentary evidence.
Landscape condition	Refers to the state of the landscape of the area making up the site and that of the study area in general. Factors affecting the condition of the landscape can include the level maintenance and management of individual landscape elements such as buildings, woodlands etc and the degree of disturbance of landscape elements by non-characteristics elements such as invasive tree species in grassland or car wrecks in a field.
Landscape impact	Changes to the physical landscape resulting from the development that include; the removal of existing landscape elements and features, the addition of new elements associated with the development and altering of existing landscape elements or features in such as way as to have a detrimental affect on the value of the landscape.
Landscape receptor	Landscape receptors are those defined visual recourses or landscape components that contribute to the prevailing landscape character and that will be affected by the proposed project.
Landscape receptor sensitivity	Landscape receptor sensitivity is a measure of the magnitude of change the visual resource can accommodate without loosing its inherent character. A landscape receptor with a high sensitivity would be one that is valued for its aesthetic attractiveness and/or have ecological, cultural or social importance.
Light trespass	Light trespass can be described as the effects of light or illuminance that strays from its intended purpose (Shaflik, 1997)
Night glow	Night glow (sky glow) is the brightening of the night sky above towns, cities and countryside (ILE, 2005).

Sense of place That distinctive quality that makes a particular place memorable to the visitor, which can be interpreted in terms of the visual character of the landscape. A more emotive sense of place is that of local identity and attachment for a place "*which begins as undifferentiated space* [and] *becomes place as we get to know it better and endow it with value*" (Tuan 1977)[1].

Viewer exposure The extent to which viewers are exposed to views of the landscape in which the proposed development will be located. Viewer exposure considers the visibility of the site, the viewing conditions, the viewing distance, the number of viewers affected the activity of the viewers (tourists or workers) and the duration of the views.

Viewer sensitivity The assessment of the receptivity of viewer groups to the visible landscape elements and visual character and their perception of visual quality and value. The sensitivity of viewer groups depends on their activity and awareness within the affected landscape, their preferences, preconceptions and their opinions.

Visual absorption capacity (VAC) Visual Absorption Capacity (VAC) signifies the ability of the landscape to accept additional human intervention without serious loss of character and visual quality or value. VAC is founded on the characteristics of the physical environment such as vegetative screening, diversity of colours and patterns and topographic variability. It also relates to the type of project in terms of its vertical and horizontal scale, colours and patterns. A high VAC rating implies a high ability to absorb visual impacts while a low VAC implies a low ability to absorb or conceal visual impacts.

Visual acuity "Visual acuity refers to the clarity or clearness of one's vision, a measure of how well a person sees. The word "acuity" comes from the Latin *acuitas*, which means sharpness."

(http://www.tedmontgomery.com/the_eye/acuity.html [Accessed 17 Sep. 06])

Visual character Visual character is based on human perception and addresses the viewer's response to the landscape elements and the relationship between these elements that can be interpreted in terms of aesthetic characteristics such as pattern, scale, diversity, continuity and dominance.

Visual contour The outer perimeter of the visual envelope determined from the site of the development. The two dimensional representation on plan of the horizon contour.

Visual contrast The degree to which the physical characteristics of the proposed development differ from that of the visual character of the visual resource. The characteristics affected typically include:

- Volumetric aspects such as size, form, outline and perceived density;
- Characteristics associated with balance and proportion such scale, diversity, dominance, continuity;
- Surface characteristics such as colour, texture, reflectivity; and
- Luminescence or lighting.

Visual envelope The approximate extent within which the development can be seen. The extent is often limited to a distance from the development within which views of the development are expected to be of concern.

[1] Cited in Climate Change and Our 'Sense of Place', http://www.ucsusa.org/greatlakes/glimpactplace.html

Visual impact	Changes to the visual character of available views resulting from the development that include: obstruction of existing views; removal of screening elements thereby exposing viewers to unsightly views; the introduction of new elements into the viewshed experienced by visual receptors and intrusion of foreign elements into the viewshed of landscape features thereby detracting from the visual amenity of the area.
Visual impact assessment	A specialist study to determine the visual effects of a proposed development on the surrounding environment. The primary goal of this specialist study is to identify potential risk sources resulting from the project that may impact on the visual environment of the study area, and to assess their significance. These impacts include landscape impacts and visual impacts.
Visual intrusion	Visual intrusion occurs when the viewer becomes aware, usually with negative associations, to a new element, or the removal of a familiar feature in a familiar view. The likelihood that a viewer will become aware of change is dependent on the compatibility of the element added, or the importance of the feature removed. This awareness is directly related to the perceived visual contrast between the existing and new scene, or between the new element and the existing landscape. In order to understand visual intrusion, the existing quality of views of the site must be compared to the views that will be experienced during the project phases.
Visual magnitude	Product of the vertical and horizontal angles of an object to describe quantitatively the visual dimension of an object. (Iverson, 1985). The visual magnitude is best described in terms of visual arcs with a one minute arc usually considered as being the minimum resolution detectable by the human eye (equivalent to observing a 29mm ball at a distance of one hundred metres).
Visual quality	An assessment of the aesthetic excellence of the visual resources of an area. This should not be confused with the value of these resources where an area of low visual quality may still be accorded a high value. Typical indicators used to assess visual quality are vividness, intactness and unity. For more descriptive assessments of visual quality attributes such as variety, coherence, uniqueness, harmony, and pattern can be referred to.
Visual receptors	Includes viewer groups such as the local community, residents, workers, the broader public and visitors to the area, as well as public or community areas from which the development is visible.
Visual resource	Visual resource is an encompassing term relating to the visible landscape and its recognisable elements which, through their co-existence, result in a particular landscape and visual character
Zone of visual influence	The extent of the area from which the most elevated structures of the proposed development could be seen and may be considered to be of interest (see visual envelope).

APPENDIX 1

Table 14: Visual receptor sensitivity

VISUAL RECEPTOR SENSITIVITY	DEFINITION (BASED ON THE GLVIA 2ND ED PP90-91)
Exceptional	Views from major tourist or recreational attractions or viewpoints promoted for or related to appreciation of the landscape, or from important landscape features.
High	Users of all outdoor recreational facilities including public and local roads or tourist routes whose attention or interest may be focussed on the landscape; Communities where the development results in changes in the landscape setting or valued views enjoyed by the community; Residents with views affected by the development.
Moderate	People engaged in outdoor sport or recreation (other than appreciation of the landscape);
Low	People at their place of work or focussed on other work or activity; Views from urbanised areas, commercial buildings or industrial zones; People travelling through or passing the affected landscape on transport routes.
Negligible (Uncommon)	Views from heavily industrialised or blighted areas

APPENDIX 2

As part of a level four VIA, visual simulations were prepared to provide a realistic impression of the proposed power station on the alternative sites. The client requested the following simulations:

- Views with and without mitigation;
- Views under worst (least visible) and best (most visible) weather conditions;
- Views during night time; and
- Views under varying operating scenarios.

The simulations were done for both the direct and indirect dry cooling power stations to indicate the difference in visual impact. It clearly indicates that the direct dry cooling technology yield a much smaller power station due to the absence of the cooling towers. There is also a major difference in operational stages. The water vapour plums create a highly visible feature in the landscape and the negative public perception with regards to health aspects, are increased. It is strongly recommended that the proposed power station should make use of the direct dry cooling technology due to the reduced visual intrusion that is created by it.

Figure 17: View points

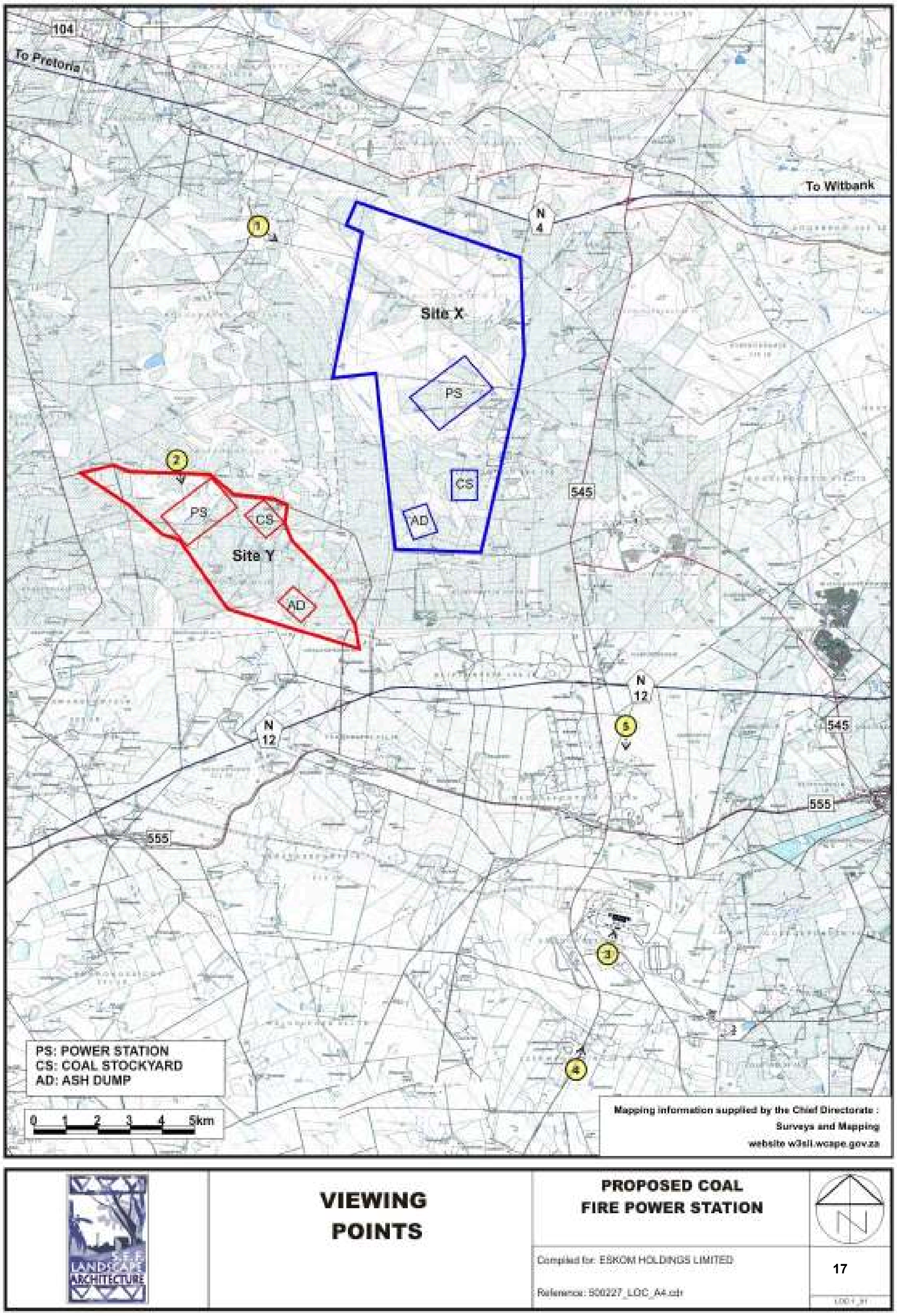


Figure 18: Proposed Site X

PROPOSED SITE FOR THE POWER STATION
VIEW POINT 1

S.E.F. LANDSCAPE ARCHITECTURE	VISUAL SIMULATION SITE X (AT 8km)	PROPOSED COAL FIRED POWER STATION	
		Compiled for: ESKOM HOLDINGS LIMITED Reference: 500227_LOC_A4.cdr	Figure 18

Figure 19: Visual simulation 1 (Site X)

WITHOUT FGD TECHNOLOGY
(DIRECT COOLING SYSTEM)

WITHOUT FGD TECHNOLOGY - PLANTING ALONG PERIMETER ROAD
(DIRECT COOLING SYSTEM)

VISUAL SIMULATION SITE X (AT 8km)	**PROPOSED COAL FIRED POWER STATION**	
	Compiled for: ESKOM HOLDINGS LIMITED Reference: 500227_LOC_A4.cdr	Figure 19

Figure 20: Visual simulation 2 (Site X)

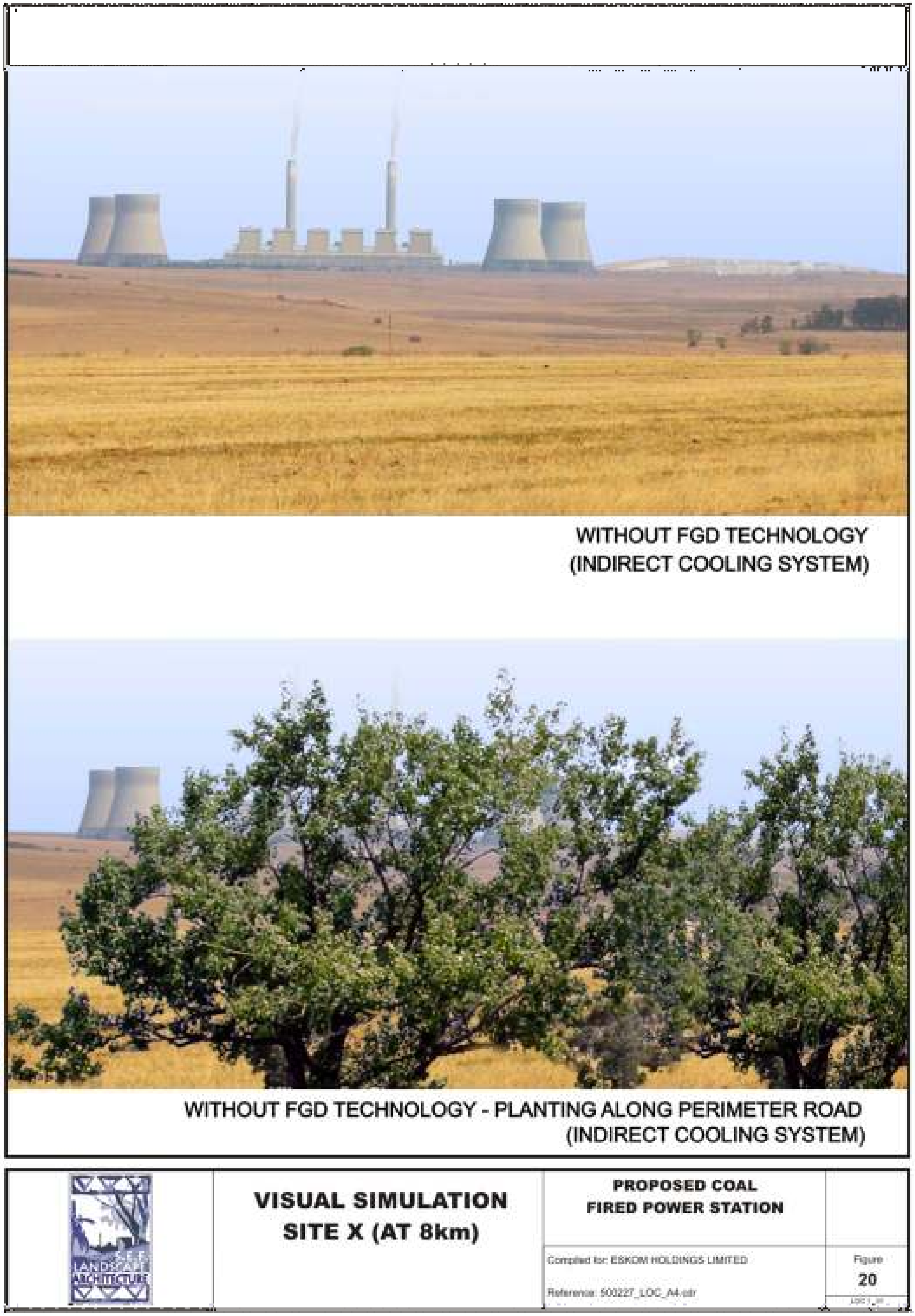


Figure 21: Visual simulation 3 (Site X)

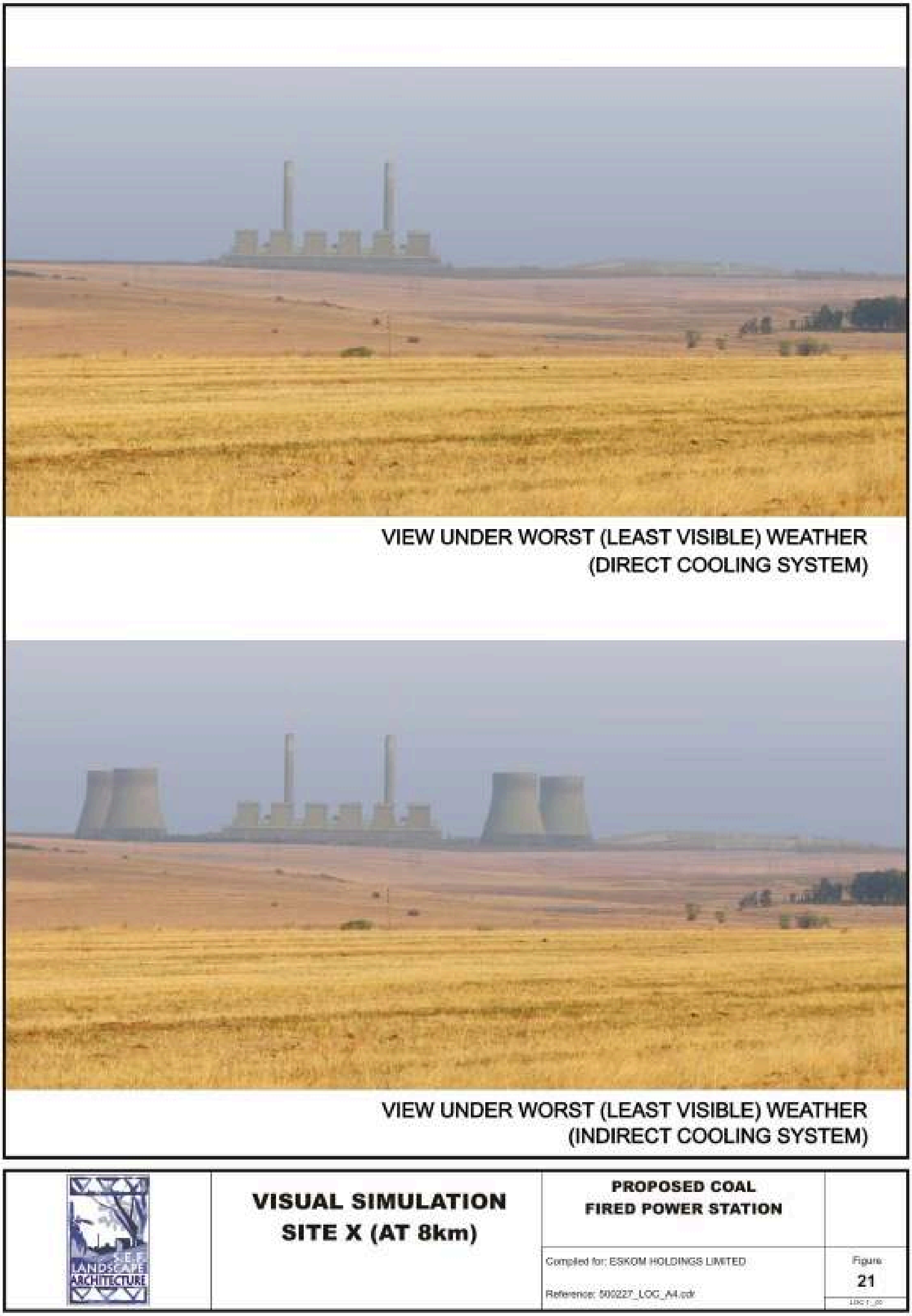


Figure 22: Visual simulation 4 (Site X)

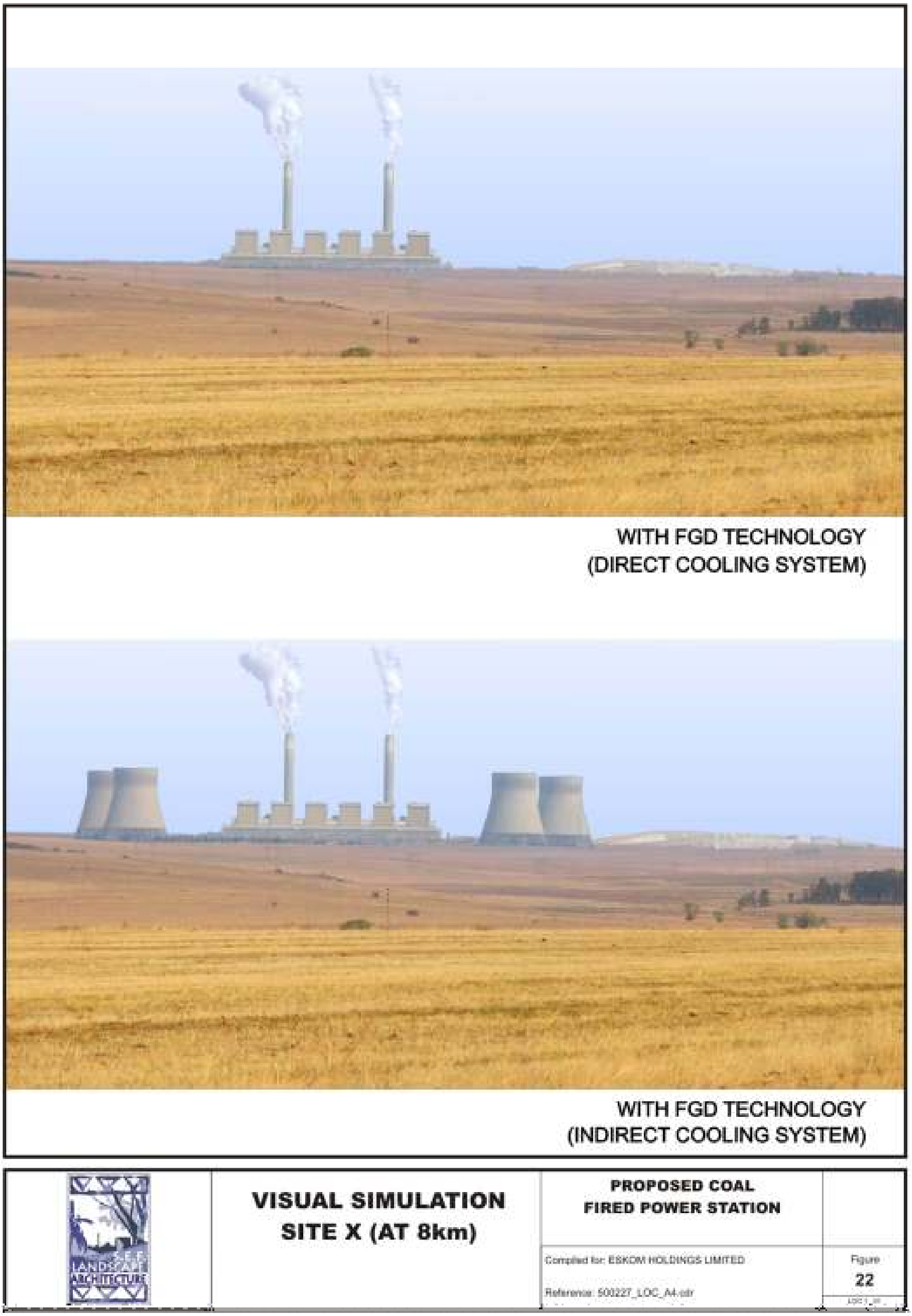
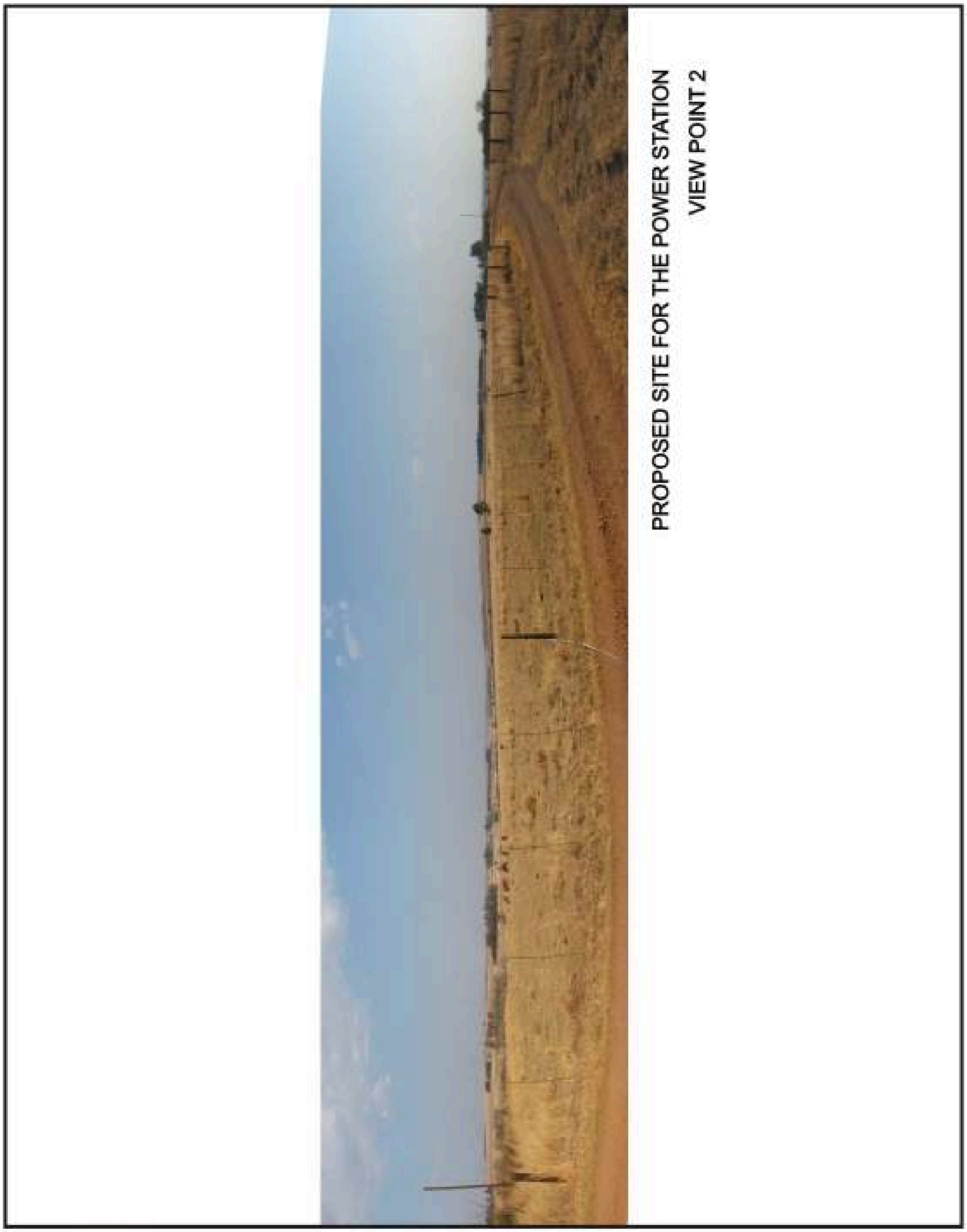


Figure 23: Proposed Site Y



S.E.F. LANDSCAPE ARCHITECTURE	**VISUAL SIMULATION SITE Y (AT 0.5 km)**	**PROPOSED COAL FIRED POWER STATION**	
		Compiled for: ESKOM HOLDINGS LIMITED Reference: 500227_LOC_A4.cdr	Figure **23**

Figure 24: Visual simulation 1 (Site Y)

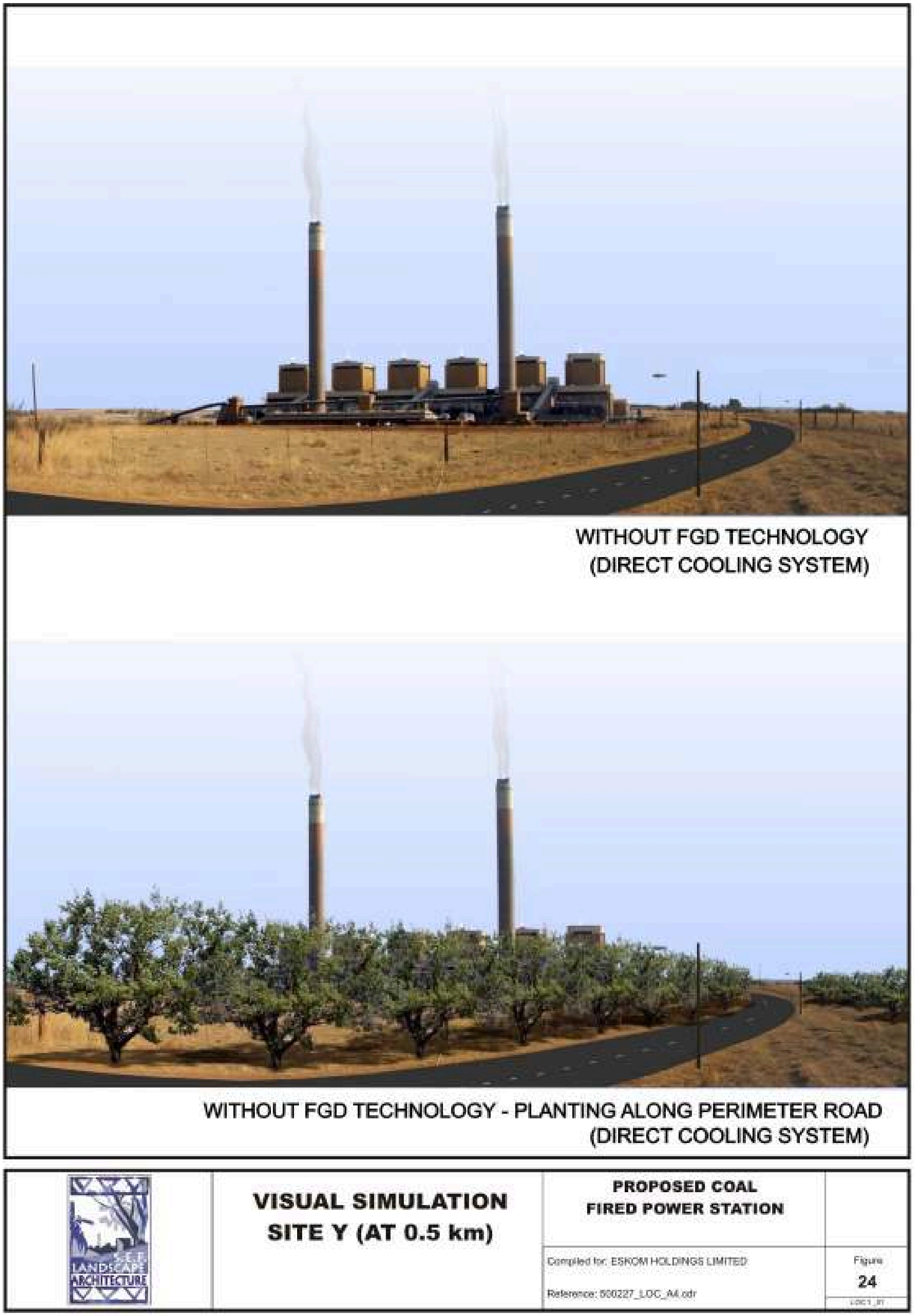


Figure 25: Visual simulation 2 (Site Y)

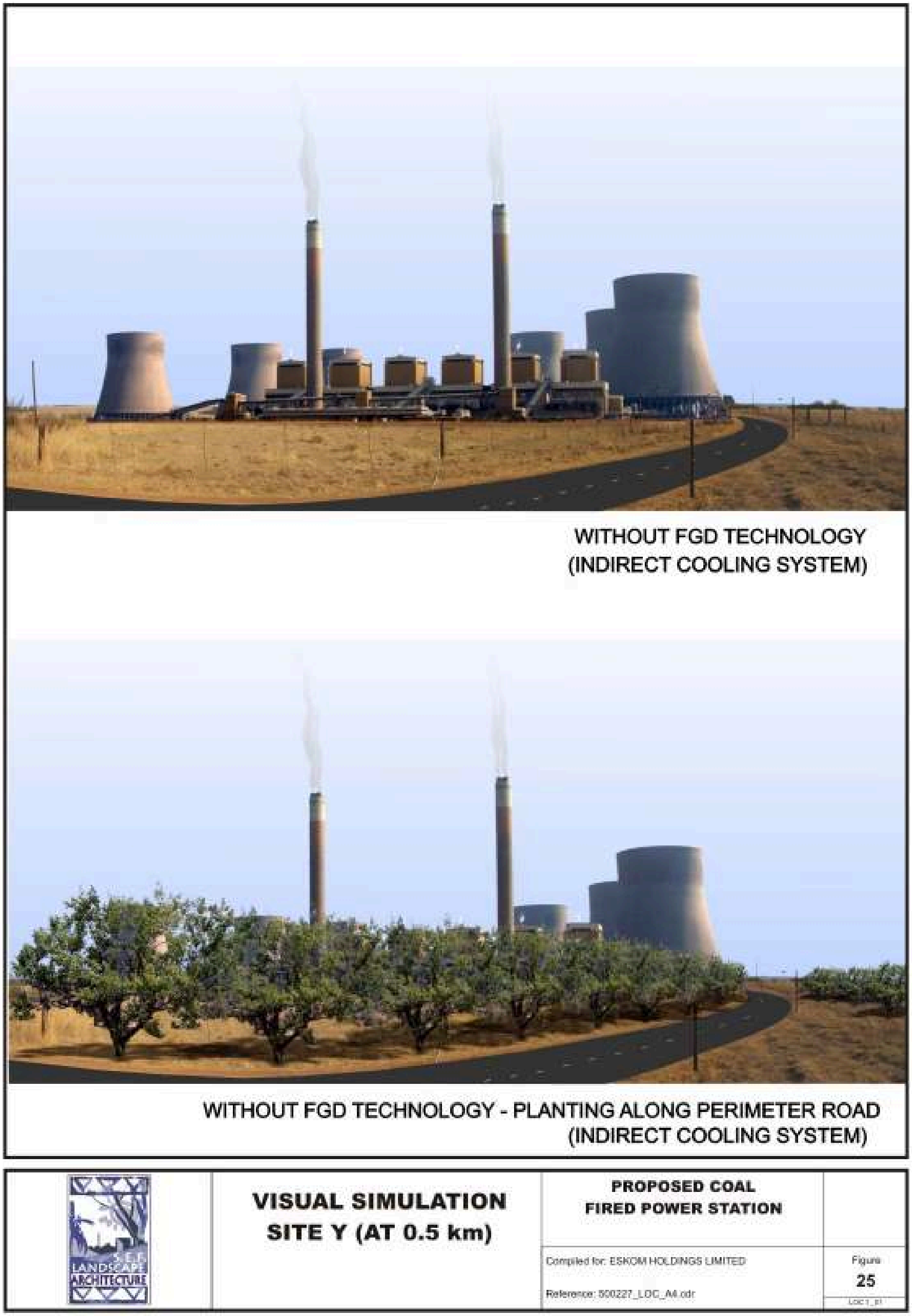


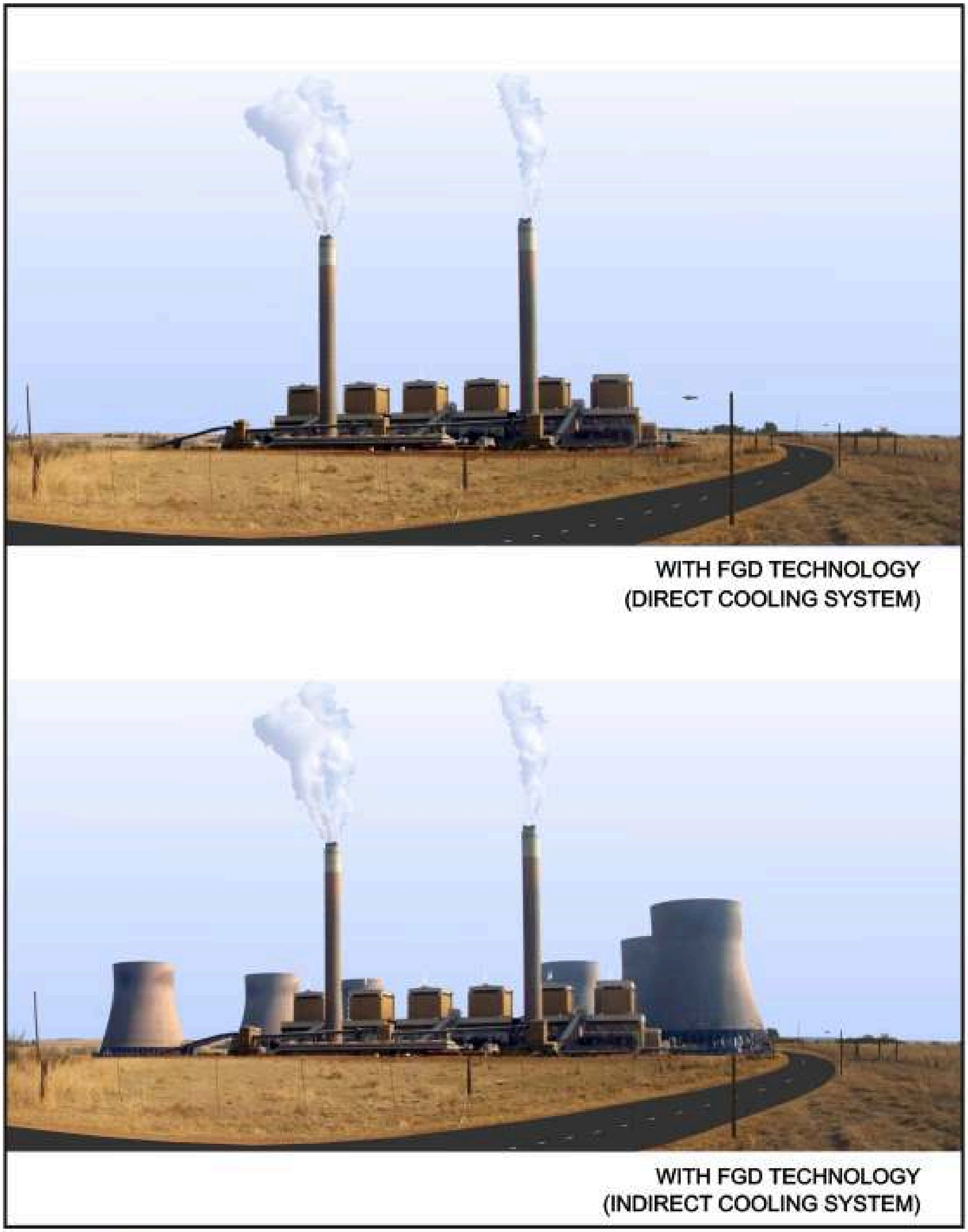
Figure 26: Visual simulation 3 (Site Y)

VIEW UNDER WORST (LEAST VISIBLE) WEATHER
(DIRECT COOLING SYSTEM)

VIEW UNDER WORST (LEAST VISIBLE) WEATHER
(INDIRECT COOLING SYSTEM)

S.E.F. LANDSCAPE ARCHITECTURE	**VISUAL SIMULATION SITE Y (AT 0.5 km)**	**PROPOSED COAL FIRED POWER STATION**	
		Compiled for: ESKOM HOLDINGS LIMITED Reference: 500227_LOC_A4.cdr	Figure **26**

Figure 27: Visual simulation 4 (Site Y)



S.E.F. LANDSCAPE ARCHITECTURE	**VISUAL SIMULATION SITE Y (AT 0.5 km)**	**PROPOSED COAL FIRED POWER STATION**	
		Compiled for: ESKOM HOLDINGS LIMITED	Figure 27
		Reference: 500227_LOC_A4.cdr	

Figure 28: Views during night time at 1.7 km

VIEW OF POWER STATION AT DUSK FROM 1.7 KM

VIEW OF POWER STATION AT NIGHT FROM 1.7 KM

S.E.F. LANDSCAPE ARCHITECTURE	**VIEWS DURING NIGHT TIME- VIEW POINT 3**	**PROPOSED COAL FIRED POWER STATION**	
		Compiled for: ESKOM HOLDINGS LIMITED Reference: 500227_LOC_A4.cdr	Figure **28**

Figure 29: Views during night time at 5 km

VIEW OF POWER STATION AT NIGHT FROM 5 KM

VIEW OF POWER STATION DURING DAY TIME FROM 5KM

SEF LANDSCAPE ARCHITECTURE	VIEWS DURING NIGHT TIME- VIEW POINT 4	PROPOSED COAL FIRED POWER STATION	
		Compiled for: ESKOM HOLDINGS LIMITED Reference: 500227_LOC_A4.cdr	Figure 29

Figure 30: Views during night time at 6.3 km

VIEW OF POWER STATION AT NIGHT FROM 6.3 KM

VIEW OF POWER STATION DURING DAY TIME FROM 6.3 KM

SEF LANDSCAPE ARCHITECTURE	**VIEWS DURING NIGHT TIME- VIEW POINT 5**	**PROPOSED COAL FIRED POWER STATION**	
		Compiled for: ESKOM HOLDINGS LIMITED Reference: 500227_LOC_A4.cdr	Figure **30**

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