

**COMBINED CYCLE GAS TURBINE (CCGT)
POWER PLANT IN THE AMERSFOORT
AREA, MPUMALANGA**

VISUAL IMPACT ASSESSMENT - INPUT FOR SCOPING REPORT

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- January 2008 -

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**COMBINED CYCLE GAS TURBINE (CCGT) POWER PLANT IN THE
AMERSFOORT AREA, MPUMALANGA
VISUAL IMPACT ASSESSMENT**

1. INTRODUCTION AND BACKGROUND

The visual impact assessment (VIA) for the proposed combined cycle gas turbine (CCGT) power plant in the Amersfoort area in Mpumalanga has been undertaken by Lourens du Plessis and Dawie van Vuuren from MetroGIS (Pty) Ltd. in their capacity as visual assessment and Geographic Information Systems specialists. Both have been involved in the application of Geographical Information Systems (GIS) in Environmental Planning and Management for more than 12 years. They have extensive practical knowledge in spatial analysis, environmental modeling and digital mapping, and apply this knowledge in various scientific fields and disciplines.

The VIA has been undertaken in accordance with the "Guidelines for Involving Visual and Aesthetic Specialists in EIA Processes" (Provincial Government of the Western Cape: Department of Environmental Affairs and Development Planning) and utilise the principles and recommendations stated therein to successfully undertake visual impact assessments. Additional experience and knowledge acquired from long term involvement in VIA studies, as well as continued research in this field, has also been applied.

Bohlweki Environmental (Pty) Ltd. appointed MetroGIS (Pty) Ltd. as an independent specialist consultant for the visual impact assessment. Neither the author, nor MetroGIS will benefit from the outcome of the project decision-making.

The proposed Majuba CCGT power plant is situated approximately 13km south-west of Amersfoort and west of the N11 national road between Amersfoort and Volksrust. The exact location of the plant has not been determined yet. A number of alternative locations are being considered, as indicated on the map in Figure 1. These are grouped into three sites, two of which are in close proximity of the existing Majuba Power Station (Site 1 & 3), and the third (Site 2) being closer to the N11 National Route.

The environmental setting is typical grassland with vast open space. High ground to the south occurs as isolated koppies with an elevation of between 60m and 80m above the proposed sites.



Four river courses transect the study area in a northerly direction, contributing to a smooth undulating topography.

The Majuba Power Station is the most prominent feature in the area, providing a distinct visual character to the environment. The use of land in the area is mainly agriculture with farmsteads occurring in a dispersed pattern. The township areas of Amersfoort and eZamokuhle, as well as the agricultural holdings Daggakraal and Vlakplaats, provide for a concentration of potential sensitive viewers.

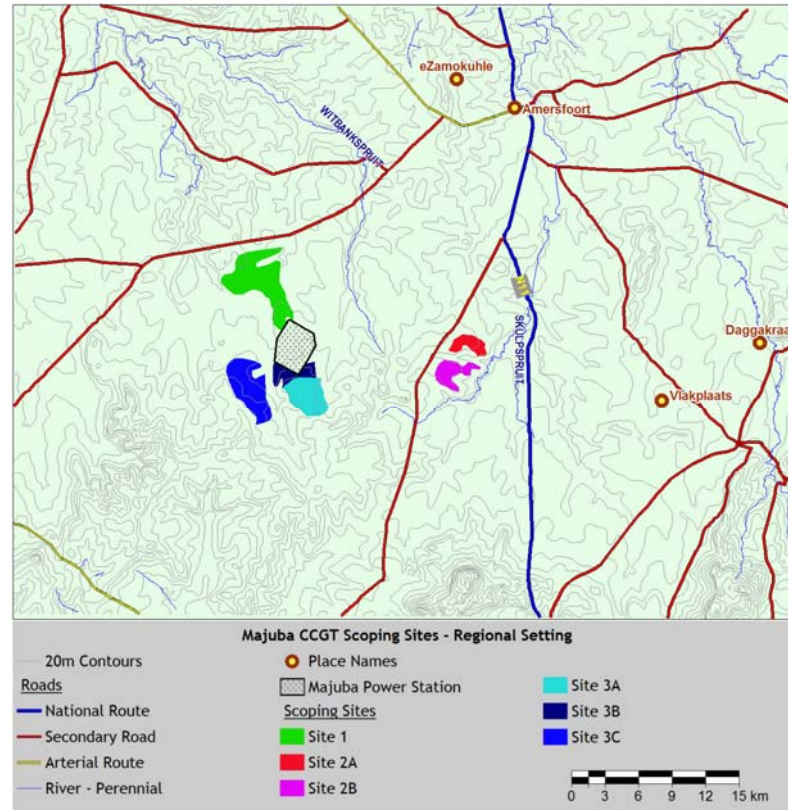


Figure 1: Proposed Majuba CCGT power plant – alternative scoping sites in regional perspective.

The proposed CCGT power station, as a visual concern, primarily entails the positioning of highly visible structures in an area characterised by vast open space. The approximate measurements of one CCGT unit are 75m x 25m x 25m and the smoke stack is 60m above ground level. The broad dimensions of a CCGT plant are eminent from the photograph in Figure 2.

The positioning of six of these units in close proximity of each other is likely to create significant visual impacts. Additional infrastructure associated with the power plant

will also add to the compounding effect of visual impact. Considering a location in close proximity of the existing power station would therefore be a key factor from a visual impact point of view.

In this scoping report the most important issues with regard to visual impact are highlighted. A comparison of the alternative sites will serve to identify and propose a particular site of preference.



Figure 2: Ballylumford CCGT power plant 52km north of Belfast City, Ireland.
(Source: <http://www.premier-power.co.uk/power-generation/ccgt-plant/>)

2. ISSUES RELATED TO THE VISUAL IMPACT ASSESSMENT

Due to the large footprint and vertical dimensions of the proposed CCGT plant, and the predominantly flat topography of the region, it becomes apparent that the facility would be well exposed. The issues relating to visual impact are the following:

- Visibility
- Proximity
- Exposure

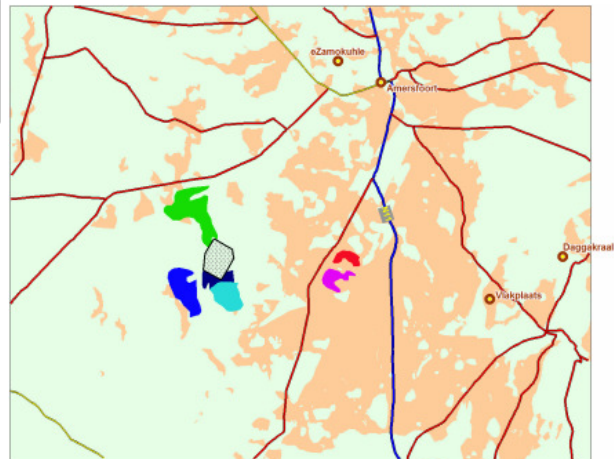
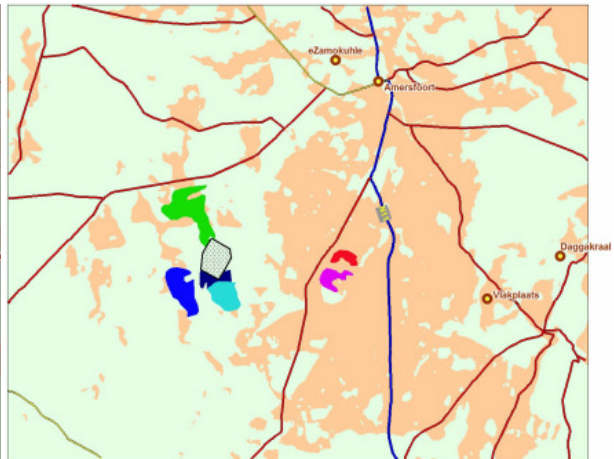
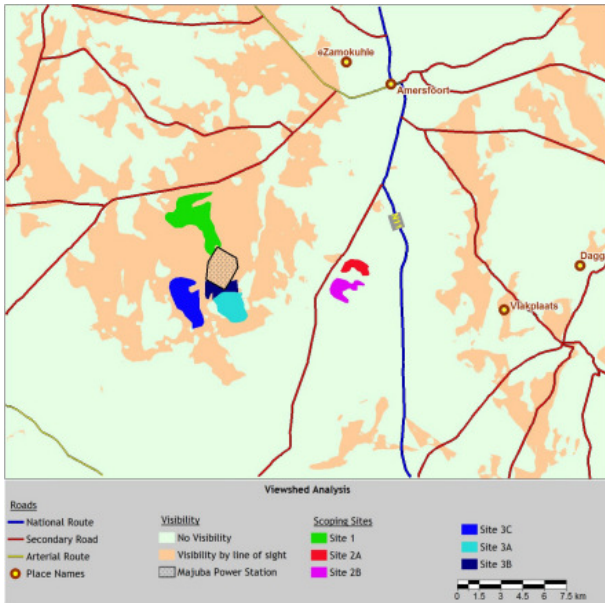
These issues are briefly discussed as follows:

2.1 Visibility

An initial viewshed analysis of the facility, based on a 20m contour interval digital terrain model of the study area, indicates the visibility of the CCGT plant at full capacity (i.e. six turbine units). The object offset for the facility was taken at a maximum 60m above ground level (i.e. the height of the CCGT smoke stacks).

Figure 3: Potential Visibility Site 1.

Figure 4: Potential Visibility Site 2A(top) and Site 2B (bottom)

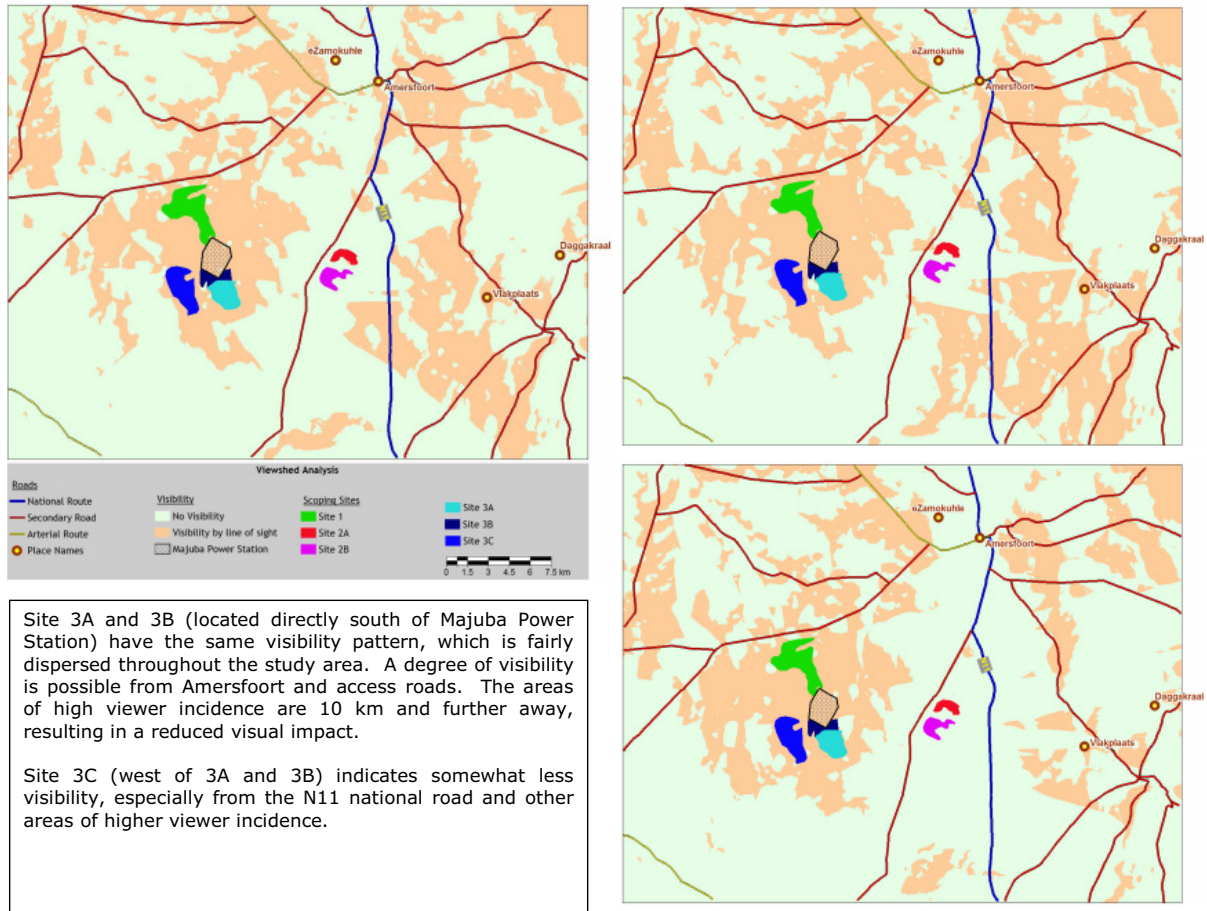


Site 1 is located north of Majuba Power Station. Site 2 is located further east and close to the N11 national road.

The spatial pattern for Site 2 shows a large extent of visibility along the main roads going up to Amersfoort. The close proximity of this site to the roads must be noted. Visibility from Amersfoort is also possible.

Site 1 clearly indicates a lesser degree of visibility, especially with regard to the areas where sensitive viewers might be concentrated, i.e. the residential areas around Amersfoort, as well as Daggakraal, Vlakplaats and the N11 road.

Figure 5: Potential Visibility Site 3A(left), Site 3B (top right) and Site 3C (bottom right).



2.2 Proximity

Proximity to areas of high viewer incidence is an issue that needs to be considered. Potential sensitive viewers are normally concentrated on roads and areas of residence and workplace. The N11 national road and the places of Amersfoort, eZamokhule, Daggakraal and Vlakplaats represent areas of high viewer incidence. Of all the alternatives, Site 2 is located the closest to these areas and it is expected that visual impacts for this location will be greater than for the other alternative sites. In addition sensitive viewers might also be present at farmsteads and on other roads in the area. These will be analysed in more detail in the EIA report.

2.3 Exposure

As mentioned above, the mere extent of the proposed CCGT will render a high degree of exposure to viewers from all directions. The location of the facility in relation to the existing Majuba Power Station will therefore play an important role in the level of visual impacts. It is generally accepted that a location close to the power station will allow for greater visual absorption, by virtue of the following aspects:

- The visual impact of power generation facilities is focussed on one location;
- The buildings and high-rise structures of these facilities may shield visibility of each other, depending on the direction of exposure.

The effect of exposure from an isolated location is illustrated in the photographic simulation of a CCGT plant in Figure 6 below (compare the bottom and top photographs).



Figure 6: Visual exposure of a CCGT plant in isolation from existing structures (on the right of the photographs). Proposed Pembroke CCGT, United Kingdom.

Source: http://www.pembrokepowerstation.co.uk/docs/Photomontage/Milford_Haven_View.asp

An initial scanning level assessment of the above issues did not reveal any fatal flaws to be associated with the proposed CCGT plant. These issues should however still be investigated in greater detail in order to scientifically motivate and/or identify any other mitigating/aggravating circumstances. The potential cumulative visual impact of the existing power station and the proposed project should also be addressed as a site-specific issue. Whereas the positioning of the CCGT facility within the alternative sites has not been determined yet, it is assumed that the closest possible location to the existing Majuba Power Station will be favourable from a visual point of view.

As part of the EAI document the following visual components will be integrated into a single visual impact matrix and spatially represented to arrive at more conclusive results:

- Visual distance/observer proximity to the facility (apply the principle of reduced impact over distance in a buffer analysis)
- Viewer incidence/viewer perception (identify areas with high viewer incidence and negative viewer perception)
- Landscape character/land use character (identify conflict areas in terms of existing and proposed land use)
- Visually sensitive features (scenic features or attractions)
- General visual quality of the affected area
- Visual absorption capacity of the natural vegetation
- The effect of existing man-made structures on the visual exposure
- Potential visual impact of lighting (after hours operations and security)
- Potential mitigation measures

3. CCGT POWER PLANT ALTERNATIVE LOCATIONS

Subsequent to the pre-screening report, the possible location for the proposed CCGT plant has been reduced to six sites within three geographical areas. The main concerns which might influence the location from a visual point of view relate to the distance from potential sensitive viewers and the containment of visual exposure. Concerns with regard to technical aspects include the use of existing infrastructure, such as the existing HV-yard at Majuba Power Station and the Underground Coal Gasification Plant north-east of the power station.

Site 1:

This site includes a large geographical area which might host two possible locations for the CCGT plant, i.e. a northern part and a southern part within the site. The northern part is close to a major road with a possible high incidence of viewers. This part might also entail the construction and duplication of infrastructure such as the HV-yard, which will enlarge the overall exposure of the plant.

The southern part of the site lies adjacent to the existing Majuba Power Station. This location might facilitate the use of the existing HV-yard which in turn will reduce the overall exposure of the plant.

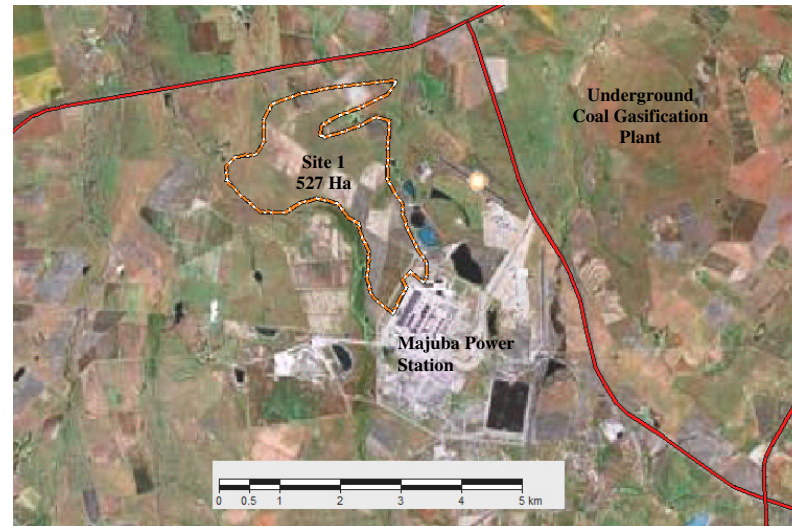


Figure 7: Location of Site 1 north of Majuba Power Station

Site 2

This site consists of two smaller areas. Site 2A is located 1.5km south of an old mine with most of the surface infrastructure still intact. The distance is however too far for these to have any significant value in terms of visual absorption capacity.

With its location between, and close to two major roads, this site renders the highest exposure to traffic of all the alternatives. The site is also the closest to Daggakraal and Vlakplaats agricultural holdings, with a high concentration of possible sensitive viewers.

Site 2 is regarded as a green fields site. Since almost none of the infrastructure at the existing Majuba Power Station can be utilized, the development of this site will result in a full duplication of a power generation facility, 5km apart from each other. This duplication is likely to increase all possible visual impacts.

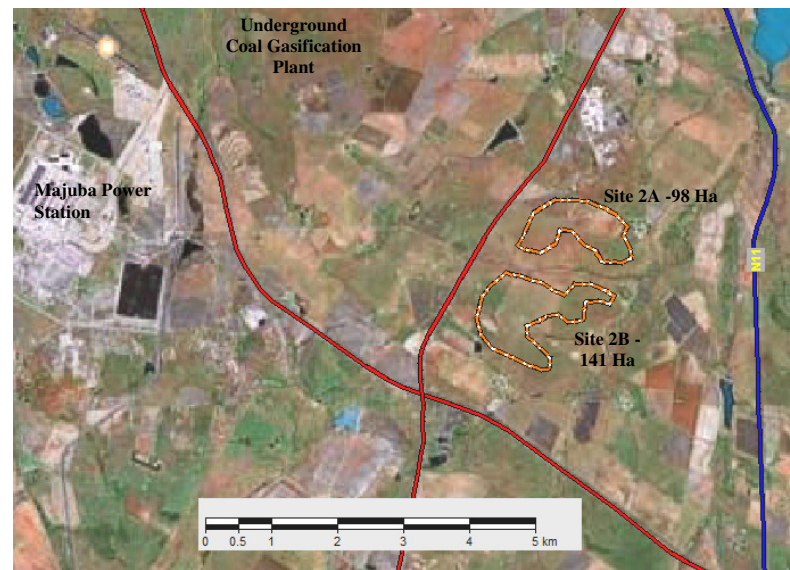


Figure 8: Location of Site 2 east of Majuba Power Station

Site 3

Site 3B can be regarded as a brown fields site due to its proximity to the existing Majuba Power Station and related infrastructure. As in the case of the southern part of Site 1, this site offers potential for the integration of visual intrusions, thereby compromising the visual impact of the CCGT power plant. Site 3A may offer the same possibilities, although it is slightly further from the power station.

Site 3C is a green fields site and offers less visual absorption capacity than the other two sites. This site is however the furthest away from places of high viewer incidence. Depending on the positioning of the facility on this site, the Majuba Power Station might shield the CCGT to a certain degree. A more detailed viewshed analysis might assist in determining the optimum location from a visual perspective.

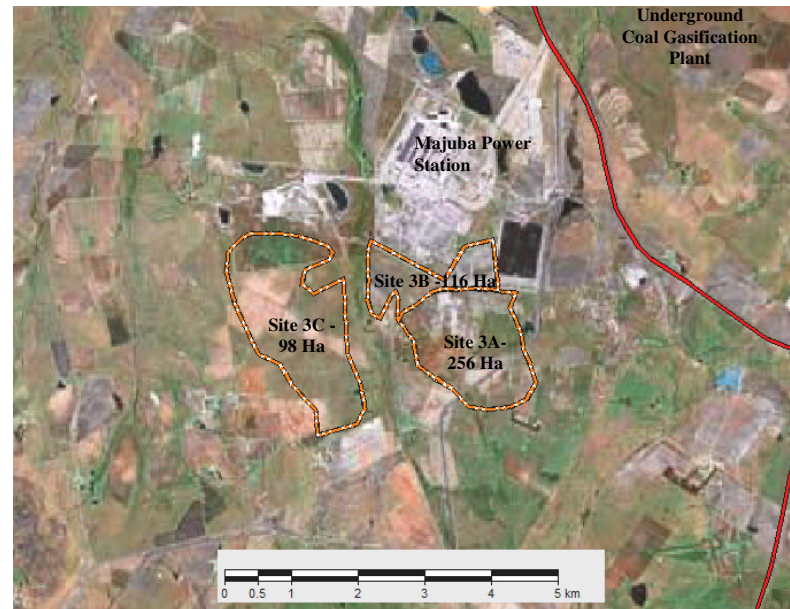


Figure 9: Location of Site 3 south of Majuba Power Station

In order to identify the most suitable site from a visual impact point of view, the above findings are quantified and presented in a table which compares the various sites on the following criteria.

- The potential area of visual exposure within the study area;
- The proximity and exposure to major roads, especially the N11 national road;
- The exposure to places of high viewer incidence;
- The potential consolidation of power plant infrastructure and the consequent absorption of visual intrusions.

A 3-point scale from 0 – 2 is used to assign values representing low, medium and high. Since the lowest value is interpreted as the best result, the high values for visual absorption capacity are given as negatives.

Table 1: Comparative table of the proposed CCGT power plant alternatives.

Alternative Site	Visible area (sqkm)	Vis Rating	Proximity to major roads	Proximity to sensitive viewer locations	Visual absorption capacity	Total value
1	269.53	1	1	0	-2	0
2A	353.08	2	2	2	0	6
2B	311.19	2	2	2	0	6
3A	318.65	2	1	0	-1	2
3B	361.98	2	1	0	-2	1
3C	261.21	1	0	0	-1	0

The preferred alternatives, based on the above criteria are Site 1 and Site 3C, both scoring the lowest point of '0'. Site 3B can also be included with an equal low score of '1'. The location of the CCGT power plant in any of these areas are likely to have the smallest overall visual impact, mainly due to visual absorption capacity and distance from roads and other places where sensitive viewers might be located. The positioning of the facility within Site 1 must however be in the southern part, immediately next to the Majuba Power Station, to conform with the above criteria for the ideal location.

Site 2 can be ruled out in totality, based on the high extent of visibility and its proximity to major roads and sensitive viewer locations, and also the fact that the duplication of power generation facilities is not a preferred option from a visual impact point of view.

4. CONCLUSION

The proposed CCGT plant is an extensive facility with large horizontal and vertical dimensions. The environment is open grassland with agriculture being the main economic activity in the area. Possible sensitive receptors are present on farmsteads in close vicinity and on agricultural holdings to the east of the alternative sites. These viewers are mostly familiarized with the rural character of the area.

Whereas the existing Majuba Power Station has already been established as a visual entity, the introduction of the CCGT as a new facility in the area must be planned with care. Therefore a location close the power station is ideal to reduce the visual impacts that will be difficult to mitigate otherwise.

The sites that are preferable from a visual impact perspective are Site 1, Site 3B and Site 3C. During the EIA phase more detailed analyses will be done to identify the most suitable positioning of the CCGT plant within the final choice of site, upon which the final visual impact assessment will be undertaken.

5. REFERENCES

Chief Director of Surveys and Mapping, varying dates. *1:50 000 Topo-cadastral Maps*

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MetroGIS (Pty) Ltd, 2007. *Atlantis Open Cycle Gas Turbine (OCGT) Plant - Proposed CCGT Capacity Increase Visual Impact Assessment*