APPENDIX K:

VISUAL IMPACT ASSESSMENT METHODOLOGY

VISUAL IMPACT ASSESSMENT METHODOLOGY

1. Viewshed calculations

'Viewsheds' indicate positions within a study area from which a development feature is visible. They are useful for analysing the visual impact of point features, such as towers, and linear features such as roads or power lines. A single viewshed is calculated from a digital elevation model (DEM) for a point feature and it will provide an indication of positions within the study area from which the point feature is visible.

Linear features are more complex. The approach followed in this report, is to calculate viewsheds at intervals (i.e. points) along the line, and then to combine these to provide a graduated scale of potential visual impact. The interval will depend on the input feature data - if point co-ordinates along the linear feature are provided (for instance, the tower positions of a power line), these can be used, otherwise points are calculated at regular intervals along the feature. The graduated scale reflects the number of points along the feature which are visible from any specific location within the study area. This approach is applicable to features such as power lines where the towers are usually more visible than the lines, and so provide a series of points for which viewsheds can be calculated. In this study an interval of 1km was used and the towers were taken to be 36 m high (as for the Cross-Rope Suspension tower type in Clara, 2001).

The graded or classified viewshed is a raster image where every pixel value indicates the number of points (towers) along the feature (power line) which are visible from the geographic position of the pixel. In order to make quantitative inferences it is necessary to convert the viewshed raster or image into a vector object, and this is done by contouring the image. In a visual impact assessment there are often several proposed alternative paths or locations for a feature, and by using a vector object it is possible to produce quantitative answers to the following types of queries:

- Which proposed location will have a higher impact on nature reserves in the study area?
- Which proposed location will have a higher visual impact in terms of area?
- Which proposed location will have a higher impact on residential areas?
- Which farms will be most affected, visually, by the proposed feature for different locations?

These are standard queries which a geographic information system can process when the viewsheds are in a vector format. Most of them can be answered by deriving areas of intersection between viewshed polygons and other feature polygons (farms, nature reserves or residential areas, buffer zones).

In the contouring process isolines are created indicating a constant value of the underlying spatial data. Along that line the variable under investigation is constant. In the case of a graded viewshed this variable is the number of towers visible from points in the study area. Contours created from a graded viewshed will indicate lines along which a constant number of towers are visible. A contour line of value 5 will indicate geographic locations within the study area from which five towers are visible.

The number of towers used in this study is arbitrary - but consistent for all the related impact surveys. In this study a tower is positioned at 1km intervals along each of the corridors. Provided the same spacing is used for the towers for each corridor the results will be comparable. The resultant maps can then only be described in terms of a qualitative - rather than a quantitative scale. For this reason the term 'potential visual impact' is used.

In order to reduce the contour data to manageable proportions and create a visually acceptable product, algorithms are used to smooth the contours which are interpolated from the raster data. This reduces detail to provide a map that can be readily interpreted.

Areas on the visual impact maps that are not coloured (or white) indicate areas of very low impact or no impact at all. In places this will show that even where towers are present the impact map may still show white - this indicates that only a few towers (less than for thenext level of impact but more than zero) are visible from these points rather than indicating no towers are visible at all. For example, an area intersected by the southern corridor west of the Magaliesberg shows no colour. Here, the Magaliesberg ridge obscures all points to the east of the ridge and only the first few towers of the development are visible on the western side which puts it into the 'none/very low' potential visual impact category

The Ikaros substation was modeled as a line (unclosed polygon) of points (36m high) for which a simple viewshed calculation was done. The resultant viewshed shows whether this line is visible from a viewpoint in the study area or not (i.e. a binary raster only, not a graded/classified raster).

2. Visual impact maps

Visual impact maps take into consideration further variables such as distance from the feature, vegetation, urban development and other factors that can influence the impact. The visual impact maps for the project extends the visibility maps to include a weighting value for distance from the power line, as well as a weighting value for distance of the powerline from urban developments. It is assumed for this report that proximity of the line to urban developments will increase the visual impact, and this produces a bias towards members of the public who live in urban areas near the line (as opposed to tourism developers, or farmers who may view the proximity of the line to urban developments as a mitigating factor to the visual impact).

The visual impact maps were produced by creating 'buffer zones' at 10 km, 5 km, 1 km and 500 m around proposed power line corridors, and then adding a constant value to pixels in the graded viewsheds which falls within a “buffer zone”. By doing this for each “buffer zone” the effect is to increase impact values with increasing proximity to the power line. “Buffer zones” of 500 m were created around urban areas (Rustenburg and townships in the area) and a constant weighting value was added to pixels of the graded viewsheds within these “buffer zones”. This created an emphasis on urban areas for the maps. The resultant weighted viewsheds were then contoured and visual impact maps were produced. These visual impact maps provide a means to assess the potential visual impact the power line will have by incorporating distance from the line, as well as distance of urban areas from the line.

A visual impact map for the Ikaros substation also incorporated distance from the substation by using “buffer zones” around the substation and adding a weighting value to pixels in the substation viewshed according to how far the pixel lies from the substation.

3. Considerations and limitations

Viewsheds are only an indication of potential visual impact. Their effectiveness is constrained by the accuracy and resolution of available digital topographic data which controls the scale and resolution of the DEM or contour base data.

Other factors which may have an influence on visual impact, such as vegetation or man made features, are not included in the calculations. These factors may be investigated during field visits to the study area, or analysed in combination with the viewshed if data is available. They include:

- Natural features such as vegetation or ridges may obscure the feature. It is also possible that the vegetation backdrop may be such that it camouflages the feature and reduces its visibility.
- Existing man made features such as high buildings may obscure the feature. An already developed area would also have a poor ‘view quality’ value and would therefore not be as severely impacted by further development. For instance, existing power lines will lessen the impact of new lines.

- Distance - the feature may be so far away from the viewpoint as to be invisible to the human eye. The viewshed will still indicate that the feature is visible. It is possible to create "buffer zones" around the feature to indicate a reduction in impact related to distance.

4. Visual Impact Criteria

According to Hankinson (1999), impacts can be categorised according to the following criteria:

- visual intrusiveness of the development
- degree of view obstruction, character
- character, quality or value of the existing view or viewpoint
- scale of the development relative to local elements
- timescale (impacts may change over time).

4.1. Visual intrusiveness of the development

The study used the number of towers (points) which would be visible from an area as a measure of the visual intrusiveness of the development. This approach was deemed to be most suitable for the following reasons:

- some part of the development would be visible from most parts of the study area
- the degree of the impact would be variable, but could be 'quantified' in terms of the number of towers visible
- topography in much of the study area is low lying and views are extensive allowing for sighting of many features, except where obscured by ridges
- the low vegetation cover does not obscure the features.

4.2. Degree of View Obstruction

The frame structure of the towers presents a low degree of view obstruction, and allows for blending with background colour/pattern.

4.3. Character, quality or value of the existing view or viewpoint

The study area is heavily impacted by existing developments and infrastructure such as mining operations, urban settlements, roads, railroads, and existing power lines and substations. The urban settlements are expanding and other mining developments are expected (Clara 2001). Vegetation is generally sparse Savanna in the area to the east and north of the Magaliesberg (Clara, 2001) and will probably provide little camouflage for the development.

4.4. Scale of the development relative to local elements

The height of the towers and length of the feature in this particular topographical setting makes the potential visual impact of the development significant. However, the scale will be influenced greatly by the position of the viewer relative to the development feature.

4.5. Timescale

The timescale, in this case, plays a minor role as the feature itself will not change once constructed, nor will natural features of the landscape change sufficiently to diminish the impact over time. However, the construction time may be relevant, and also, since this is a region of active development (new mines, urban expansion), impact may be reduced in future