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21 July 2016
489647/MURA/ALLK/1607034

SRK Consulting (South Africa) (Pty) Ltd.
PO Box 21842
Port Elizabeth
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Attention: Ms. K Nel and Mr. L Strydom

Dear Ms. Nel and Mr. Strydom

Viewshed Analysis: Proposed Walmer 132 kV Powerline, Port Elizabeth, South Africa

SRK Consulting (South Africa) (Pty) Ltd. (SRK) has been appointed by the Nelson Mandela Bay Municipality (NMBM) to undertake an Environmental Authorisation Process for the proposed construction of a double circuit 132 kV powerline between the existing Lorraine and 17th Avenue substations in Port Elizabeth, South Africa. The majority of the proposed powerline is above ground (approximately 2.4 km) with a short section (approximately 0.4 km) underground.

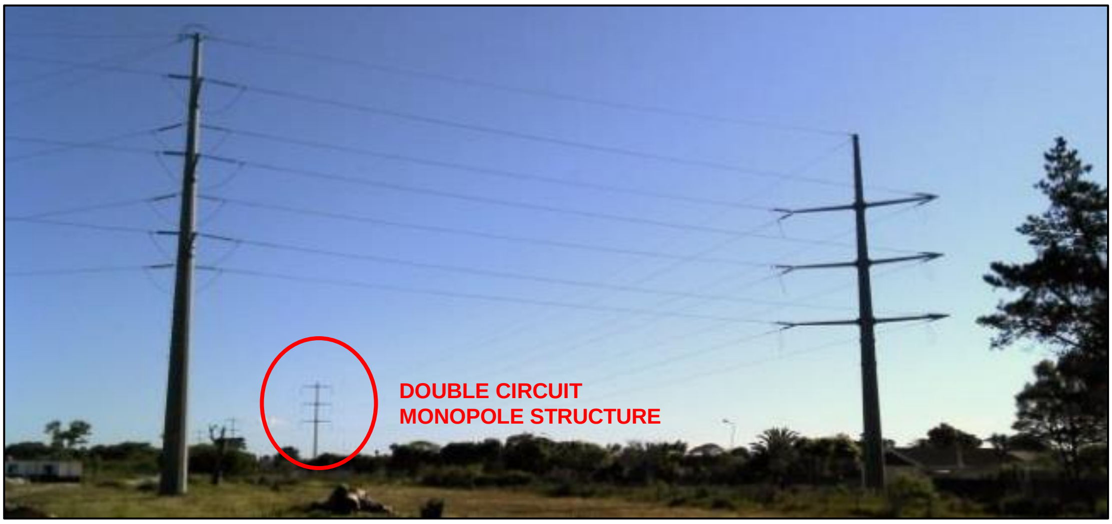
During the course of the Public Participation Process (PPP), comments were received from Stakeholders of the project. Some of these comments expressed concern over the potential visual impact the proposed powerline may have ion the surrounding landscape. SRK has been requested to undertake and desktop Visual Analysis, relating to the potential visual impact the proposed powerline may have.

This letter serves to present the methodology and findings of the viewshed analysis with regards to the potential visibility that may be associated with the placement of the powerline.

1. Description of the proposed powerline

The proposed 132 kV powerline will be routed over a length of approximately 2.8 kilometres (km) from the existing 132 kV Lorraine substation to William Moffet Drive, thereafter the proposed powerline will be installed underground, under William Moffet Drive to the existing 17th Avenue substation (please refer to Figure A1). The proposed route alignment will traverse a number of privately owned properties as well as NMBM owned land.

The proposed powerline is expected to be a dual circuit with dual circuit 132 kV monopole self-supporting steel structures with a servitude width of 25 meters (m). The maximum span lengths are limited by line alignment but could be between 140 m and 180 m. Soil conditions will govern the type of tower to be used, however the ‘Petechane’ tower type is being considered. If this is the case, the servitude will be reduced to 16 m. Figure 1 below indicates a typical 132 kV double circuit monopole self-supporting powerline.



srk consulting	WALMER 132 kV POWERLINE TYPICAL 132 kV DOUBLE CIRCUIT MONOPOLE POWERLINE	Project No. 489647

Figure 1: Typical 132 kV double circuit monopole Powerline

2. Assumptions and Limitations

The following assumptions and limitations are relevant to this analysis:

- A desktop assessment was undertaken, which did not included a site visit.
- The municipal 1 m contour dataset was used in the analysis. The viewshed[1] therefore illustrates the area from which the proposed powerline is likely to be visible. It does not take local undulations, existing vegetation and man-made structures into account. This means that the proposed development may not be visible from everywhere within the viewshed, as the development may be obscured by other existing infrastructure, vegetation or small/localised variations in the topography.
- A Viewshed Analysis, by nature, is not a purely objective or a quantitative process, but is dependent on the subjectivity of the judgments made. Where subjective judgments are required, appropriate criteria and motivations have been clearly stated.

3. Visual Analysis

Various factors are used when considering the potential visual impact a proposed object may have on the receiving environment. For this analysis, the following factors are considered, and discussed in the sections that follow:

- Visual Exposure of the proposed powerline in terms of the viewshed;
- Visibility and viewing distance; and
- Visual Absorption Capacity (VAC).

3.1 Visual Exposure

Visual exposure is determined by an objects "zone of visual influence" or how visible an object may be in the landscape. The visual exposure of an object can be broken down into two elements:

- Firstly, how exposed is the object to the surrounding area? This can be determined by the topography in which the object is; and
- Secondly, how exposed are viewers to the object? This can be determined through topography and landuse in which the viewer is situated.

1 A viewshed is an analysis technique, whereby the visual influence of a given structure is predicted in the landscape

The topography of an area can limit or expose the visibility of an object. In order to assess how topography influences the visual exposure of a feature, a predictive model known as a “viewshed” is used. A viewshed model uses topography datasets to predict where in the landscape a given feature may be visible. This model assumes that the surface is smooth (not taking into account existing vegetation and man-made objects).

Figure A2 indicates the desktop viewshed that was undertaken, a height of 19 m was used in modelling proposed tower positions at 140 m intervals, illustrating a worst case scenario.

It is important to note that due to the viewshed not accounting for existing features such as man-made structures, and vegetation, that various areas indicated as visible in Figure A2 may potentially be shielded from views of the proposed powerline from various locations due to existing vegetation and man-made structures.

3.2 Viewing Distance and Visibility

The distance of a viewer from the proposed project area is an important determinant of the magnitude of the visual impact. This is due to the visual impact of an object diminishing / attenuating as the distance between the viewer and the object increases. This is a measurement of how visual impact is modified by distance. The effect of scale of the proposed development, topography, vegetation and weather, changes with distance, and in turn changes the degree of visual effect.

Hull and Bishop, 1988 identify the inverse relationship between viewing distance and visual impact, this relationship can be described as an exponential decrease in impact as the distance from the proposed infrastructure increased.

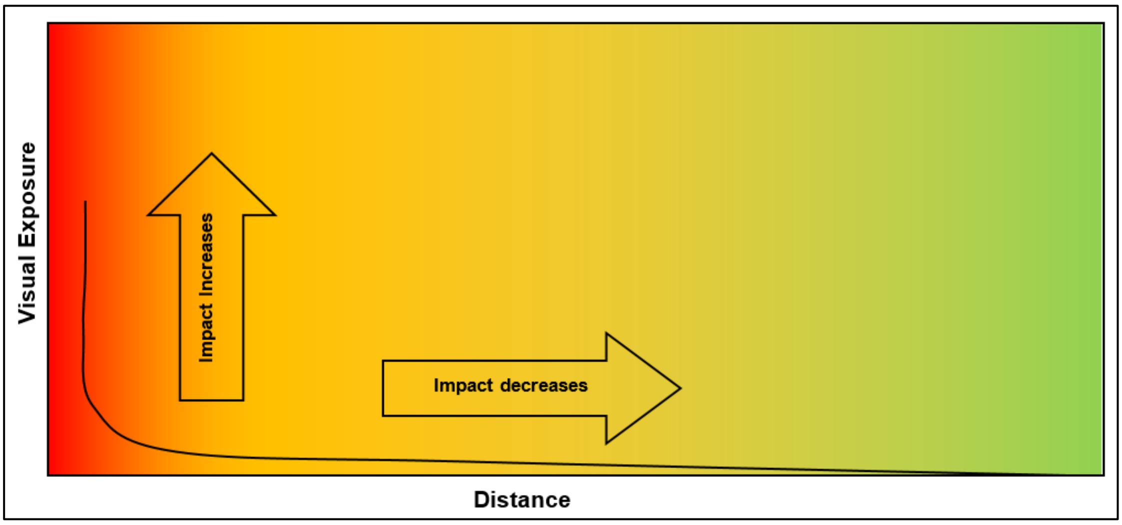
Viewsheds do not take into account the distance from the proposed infrastructure a viewer may be in determining the visibility of the proposed feature. A method, known as the Fuzzy Viewshed, attempts to take into account the distance a viewer is from the proposed site. Equation 1 (Ogburn, 2006) defines the equation used to determine the possible impact of a feature in the landscape, where:

μ = fuzzy viewshed
dvp->ij= distance of object from the viewpoint
b1 = maximum distance from viewpoint of clear visibility
b2 = distance from viewpoint at which visibility drops to 50%

For this instance, the definition of where a feature may become 50% less visible was 1 km.

$$1 \ for \ d_{vp\rightarrow ij} \leq b_1$$
$$and$$
$$\mu(x_{ij}) = \frac{1}{\left(1+2\left(\frac{d_{vp\rightarrow ij}-b_1}{b_2}\right)^2\right)} \ for \ d_{vp\rightarrow ij} > b_1$$

.... Equation 1



Depiction of how impact decreases with an increase in distance from a site (after Hull and Bishop, 1988)

3.3 Visual Absorption Capacity

The VAC is the potential for the area to conceal / mitigate the impact of the proposed development through natural or man-made features in the landscape. Factors contributing to the VAC include:

- Topography and vegetation that is able to provide screening and increase the visual absorption capacity of a landscape.
- The degree of urbanisation compared to open space. A highly urbanised landscape is better able to absorb the visual impacts of similar developments.
- An interrelated landscape comprising a unified environment.
- The scale and density of surrounding developments.

Visual absorption within the wider area of influence will further be provided by:

- Residential suburbs which may reduce the visibility of the site to people residing in the centre or towards the back of the residential area.
- The existing road infrastructure further than 2 km away.
- Powerlines, railway lines etc.

The VAC is considered to be high when the environment can hide the development and as such, the colour of a facility can also determine its VAC. The VAC will be low in areas where the topography is flat and natural features such as trees, koppies and mountains are absent.

The area in which the proposed development will occur is relatively flat. However due to the existence of man-made structures and vegetation within the surrounding area, some views towards the proposed powerline may potentially be impeded.

The overall potential visual impacts of the proposed powerline is not expected to indicate notable differences between the powerline alignment Options 1 and 2

Yours faithfully,

SRK Consulting (South Africa) (Pty) Ltd

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Mr. MJ Morris (Pr.Eng)
Partner

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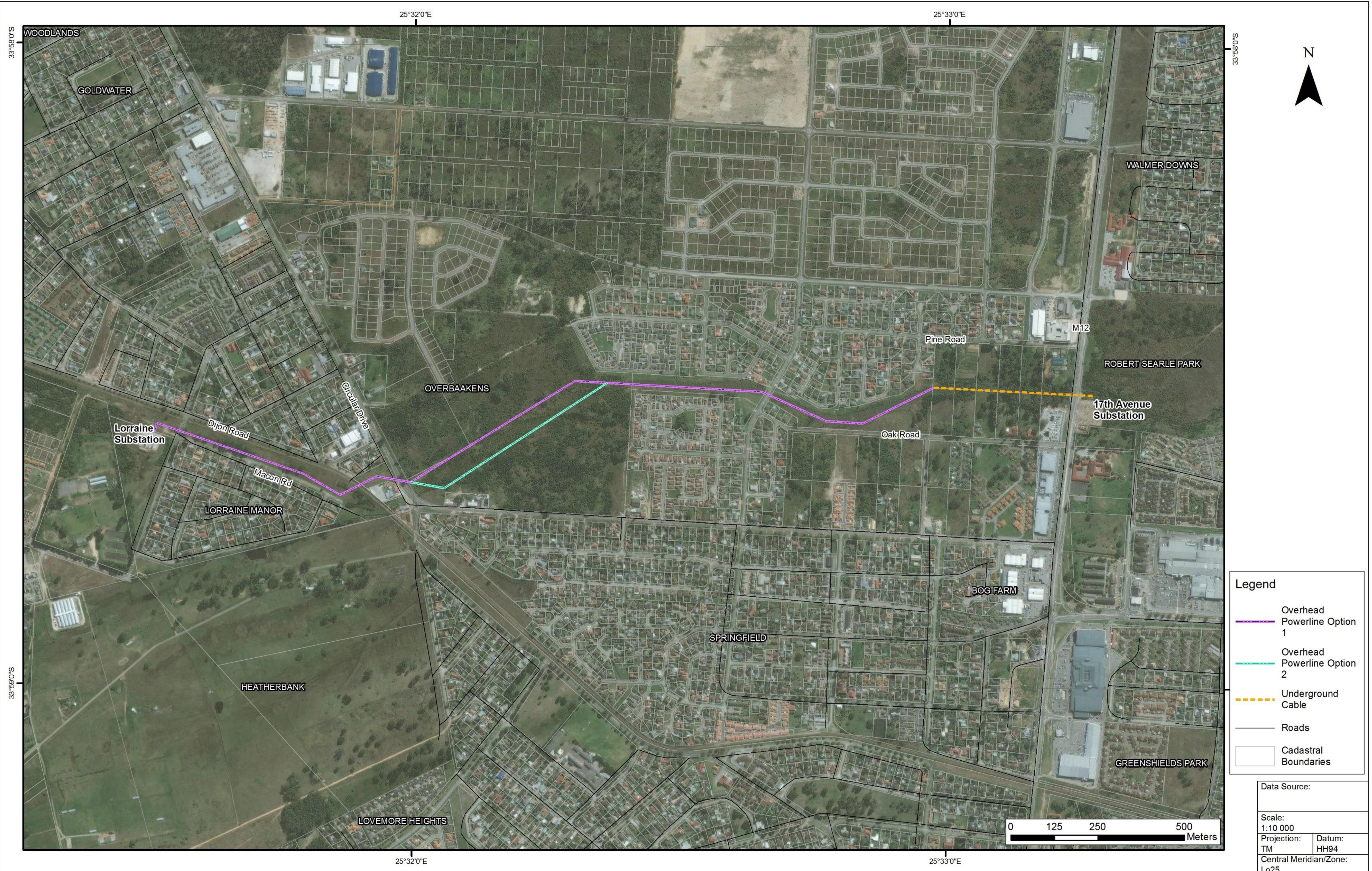
Annexure A: Figures



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Date: 15/07/2016	Compiled by: MURA
Project No: 489647	Fig No: A1

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VISUAL ANALYSIS: WALMER 132 kV POWERLINE

SITE LOCALITY

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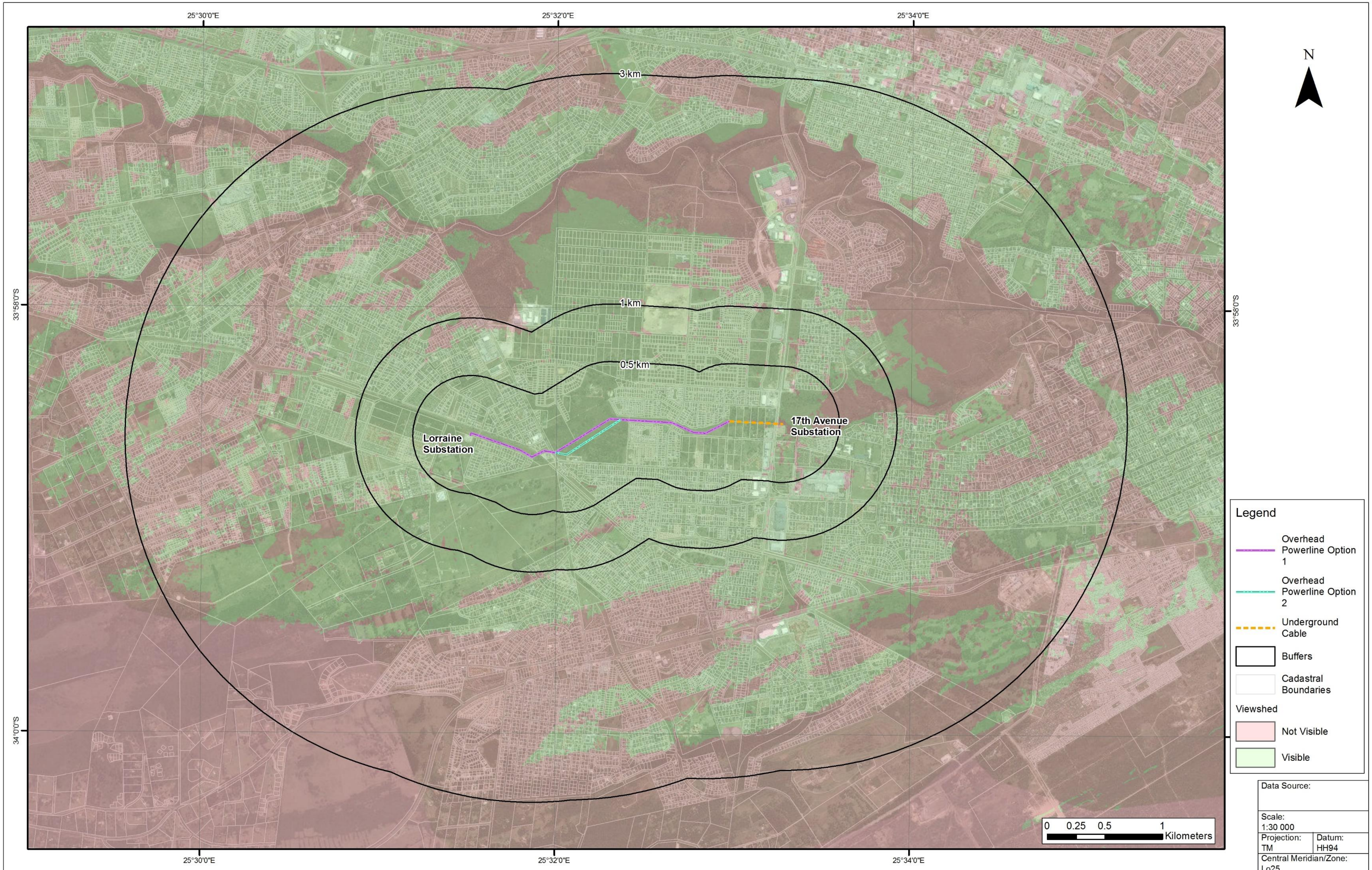

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Date: 15/07/2016	Compiled by: MURA
Project No: 489647	Fig No: A2

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VISUAL ANALYSIS: WALMER 132 kV POWERLINE

VIEWSHED

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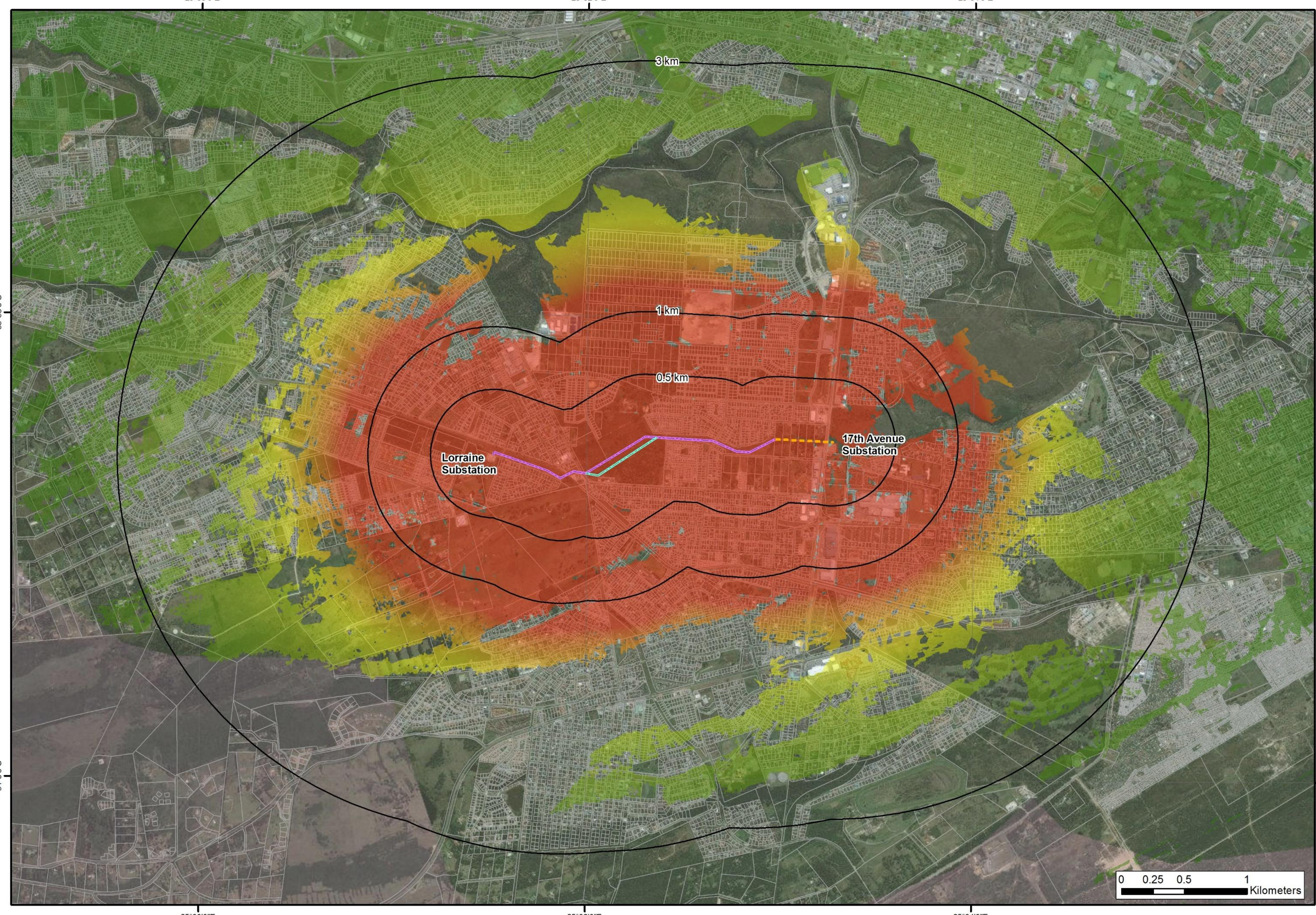

Legend

- Overhead Powerline Option 1
- Overhead Powerline Option 2
- Underground Cable
- Buffers
- Cadastral Boundaries

Fuzzy Viewshed

- High Visibility
- Moderate Visibility
- Low Visibility

Data Source:	
Scale: 1:30 000	
Projection: TM	Datum: HH94
Central Meridian/Zone: Lo25	
Date: 15/07/2016	Compiled by: MURA
Project No: 489647	Fig No: A3

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VISUAL ANALYSIS: WALMER 132 kV POWERLINE

FUZZY VIEWSHED

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