September 2009

VISUAL SPECIALIST REPORT

SPECIALIST STUDY

PROPOSED KUSILE RAILWAY: VISUAL IMPACT SPECIALIST STUDIES

Proponent: **Eskom Holdings Limited**

Prepared by: **Zitholele Consulting**

FINAL VISUAL IMPACT REPORT

Project 12202

PURPOSE OF THIS DOCUMENT

The growing demand for electricity is placing increasing pressure on Eskom's existing power generation and transmission capacity. Eskom is committed to implementing a Sustainable Energy Strategy that complements the policies and strategies of National Government. Eskom aims to improve the reliability of electricity supply to the country, and in particular to provide for the growth in electricity demand in the Gauteng and Mpumalanga provinces. For this reason, Eskom obtained environmental authorisation to construct the new Kusile Power Station between Bronkhorstspruit and Witbank in 2007. Construction of this power station has already commenced.

The new Kusile Power Station requires the delivery of a sorbent to the plant as a reagent in the power generation process. At present it is anticipated that this delivery will be best suited to rail transport. A proposed project to construct a new railway line from the existing Bronkhorstspruit – Emahlahleni railway line to the Kusile Power Station was therefore commissioned.

Eskom's Generation Division appointed Zitholele Consulting (Pty) Ltd, an independent company, to conduct an EIA to evaluate the potential environmental and social impacts of the proposed project.

As part of the environmental process Eskom requested specialist assessments to be undertaken in order to inform the Impact Assessment Phase. This report details the findings the visual impact specialist assessment.

Zitholele Consulting have undertaken the aforementioned studies. The purpose of this document is therefore to present the findings from these assessments and to provide impact assessments and mitigation measures for each of the project phases.

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1.1 PROJECT BACKGROUND

The growing demand for electricity is placing increasing pressure on Eskom's existing power generation and transmission capacity. Eskom is committed to implementing a Sustainable Energy Strategy that complements the policies and strategies of National Government. Eskom aims to improve the reliability of electricity supply to the country, and in particular to provide for the growth in electricity demand in the Gauteng and Mpumalanga provinces. For this reason, Eskom obtained environmental authorisation to construct the new Kusile Power Station between Bronkhorstspruit and Witbank in 2007. Construction of this power station commenced in 2008.

The new Kusile Power Station requires the delivery of sorbent (Limestone most likely) to the plant as a reagent in the power generation process. At present it is anticipated that this delivery will be best suited to rail transport. This project proposes to construct a new railway line from the existing Bronkhorstspruit – Witbank railway line to the Kusile Power Station. At present three route alternatives are being investigated, varying in length from 12 – 18 km, namely (Figure 1-1):

<u>Alternative 1: Kusile – Wilge River interchange shortcut</u>

The Alternative 1 route alignment, which starts at the existing Pretoria-Witbank railway line (A), heads in a south westerly direction and crosses the N4 highway (F). Thereafter the route follows the course of the Wilge River (FB). This route then heads in a south easterly direction and crosses an unnamed tributary of the Wilge River continuing for six kilometres into the Kusile Power Station (BCDE). This route is approximately 12 km in length.

<u>Alternative 2: Kusile - Wilge River interchange</u>

The second alternative follows the same initial alignment as Alternative 1 (AF), but after crossing the N4 highway the alignment continues in a south westerly direction for approximately 4.5 kilometres. Thereafter the route crosses over the Klipfonteinspruit and turns in a south easterly direction for approximately two kilometres. The route then turns south south east for 2.5 kilometres, turns eastward and crosses the Klipfonteinspruit a second time and then turns to run in a northerly direction for three kilometres before meeting up with alternative 1 approximately 3 kilometres from the Kusile Power Station (BGDE). This route is estimated at 18 km in length.

<u>Alternative 3: Kusile – Wilge River interchange shortcut 2</u>

The Alternative 3 route alignment follows the same initial alignment as Alternative 1 (AF) but it crosses the N4 highway 500 metres eastward of the Alternative 1 and 2 crossing (avoiding the farmstead complexes) (FCDE). The alternative rejoins alternative 1 for approximately seven kilometres before entering the Kusile Power Station. This route is very similar to Alternative 1, with some minor deviations 12.2 km.

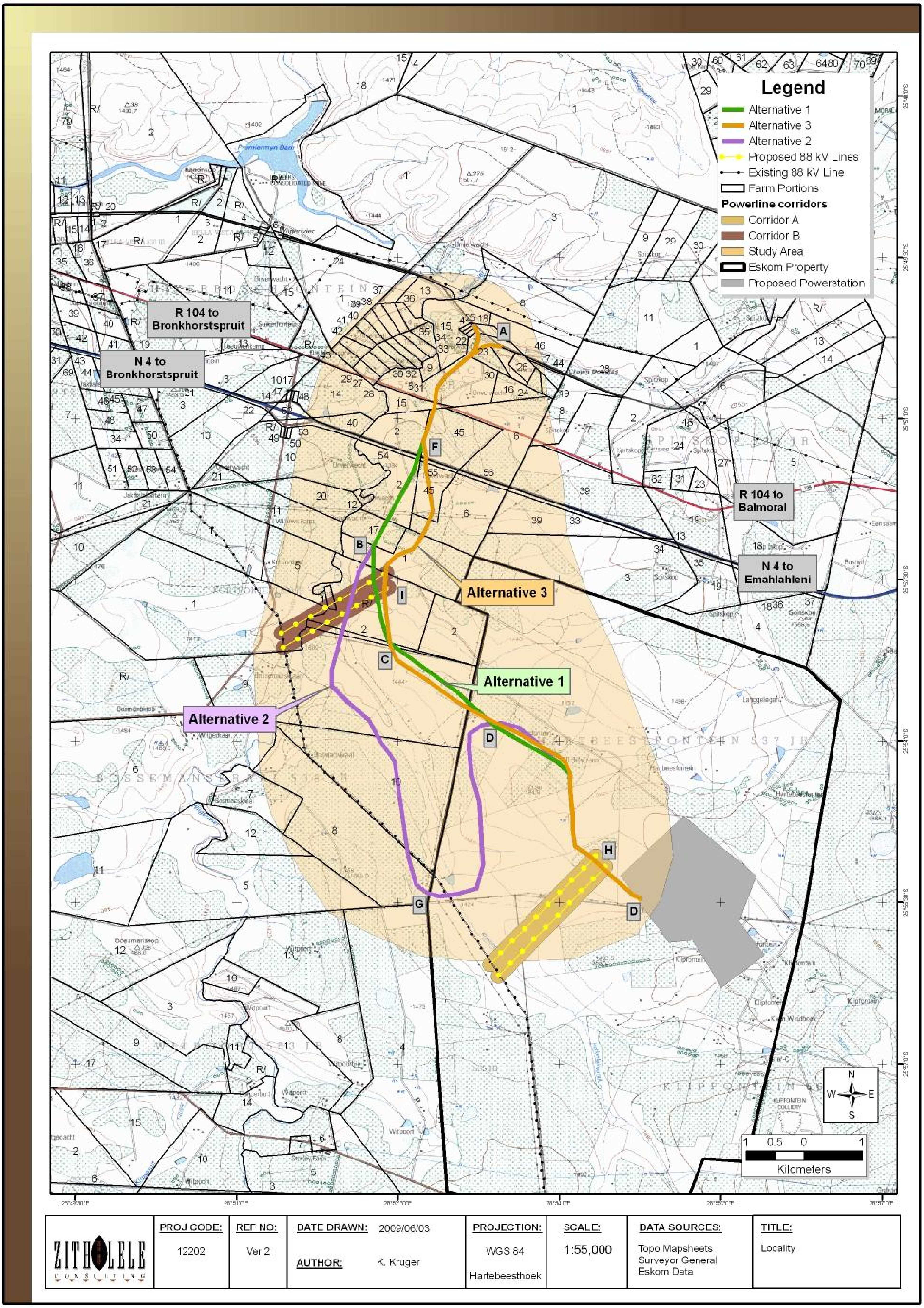


Figure 1-1: Proposed route alternatives for the railway line.

Power Line Alternatives

In order to power the railway line, two 88 kV power lines will be connected to two substations adjacent to the proposed railway line. This line will feed from the existing 88 kV power lines in the area and the potential placements are shown as Corridors A and B that link into the railway lines at points H and I in the Figure above. Each of the corridors requires one power line which will connect to one substation, depending on the route selected.

1.2 STUDY SCOPE

Eskom's Generation Division has appointed Zitholele Consulting (Pty) Ltd, an independent company, to conduct an EIA to evaluate the potential environmental and social impacts of the proposed project. As part of the environmental impact assessment for the aforementioned project it is required that certain biophysical specialist investigations are undertaken. Zitholele Consulting was appointed to undertake the following biophysical specialist studies:

- Wetlands and Surface Water;
- Topography and Visual Impact;
- Soils;
- Agricultural Potential; and
- Terrestrial Ecology.

This report details the findings of the visual impact assessment.

1.3 STUDY APPROACH

Zitholele Consulting undertook the aforementioned specialist studies during several site visits conducted from the 23rd – 30th March, the 6th – 9th July and 1st – 4th September 2009. The wide spread of site visits during the year were undertaken to obtain a maximum cover of the seasonal variations. The study area encompasses the area within a 500 m radius of the proposed railway line alternatives. Transects were walked on either side of the proposed railway line alternatives in which site characteristics were sampled.

1.4 PROJECT PERSONNEL

The following project personnel were involved in the compilation of this report.

<u>Konrad Kruger, BSc Hons (Geog)</u>

Mr. Konrad Kruger graduated from the University of Pretoria with a BSc Honours in Geography in 2003. He has been involved in a variety of environmental projects in the last three years and has become specialised in undertaking specialist studies, mapping and environmental consulting. He has undertaken GIS mapping for mining, residential as well as industrial developments. He is also an experienced land ecologist and will provide expertise for this project in terms of soil surveys, land capability assessments and mapping. He is currently in the process of acquiring his MSc in Geography (Landscape Ecology) from the University of Pretoria.

1.5 ASSUMPTIONS AND LIMITATIONS

The following assumptions were made during the assessment:

- The information regarding the routes provided by Eskom is accurate;
- Ecological and wetland assessments have to be undertaken during the summer months; and
- A corridor width of 500 m was used for each alternative route.

2 BIOPHYSICAL RECEIVING ENVIRONMENT

This section details the receiving environment at the project location. For the context of this report the regional environment refers to a 30 km radius around the study area.

Although the aim of this report is to detail the vegetation, wetlands and, soil and land capability component of the receiving environment; certain additional factors have been included, as they provide perspective to the soil and vegetation study. These include geology, topography, climate, surface water and land use.

2.1 TOPOGRAPHY

2.1.1 Data Collection

The topography data was obtained from the Surveyor General's 1:50 000 toposheet data for the region, namely 2528DD. Contours were combined from the topographical mapsheets to form a combined contours layer. Using the Arcview GIS software the contour information was used to develop a digital elevation model of the region as shown in Figure 2-1 below.

2.1.2 Regional Description

The topography of the region is gently undulating to moderately undulating landscape of the Highveld plateau. Some small scattered wetlands and pans occur in the area, rocky outcrops and ridges also form part of significant landscape features in the area. Altitude ranges between 1 360 – 1 600 metres above mean sea level (mamsl). Figure 2-1 provides an illustration of the topography of the site, while Figure 2-2 shows the ridges found on site. With regards to ridges, all the routes avoid the ridges found on site, but it should be noted that in various places the routes do come in close proximity to ridges.

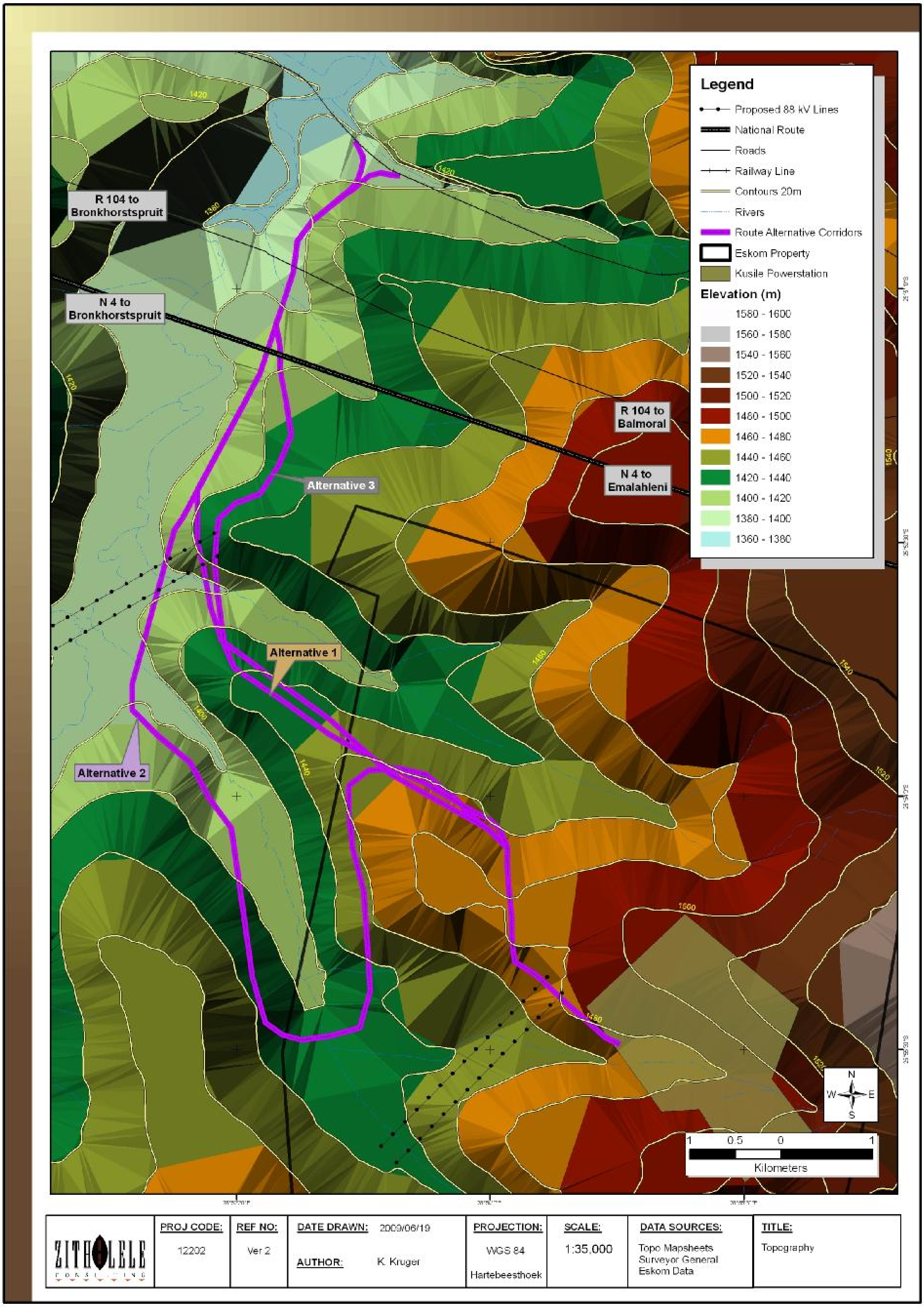
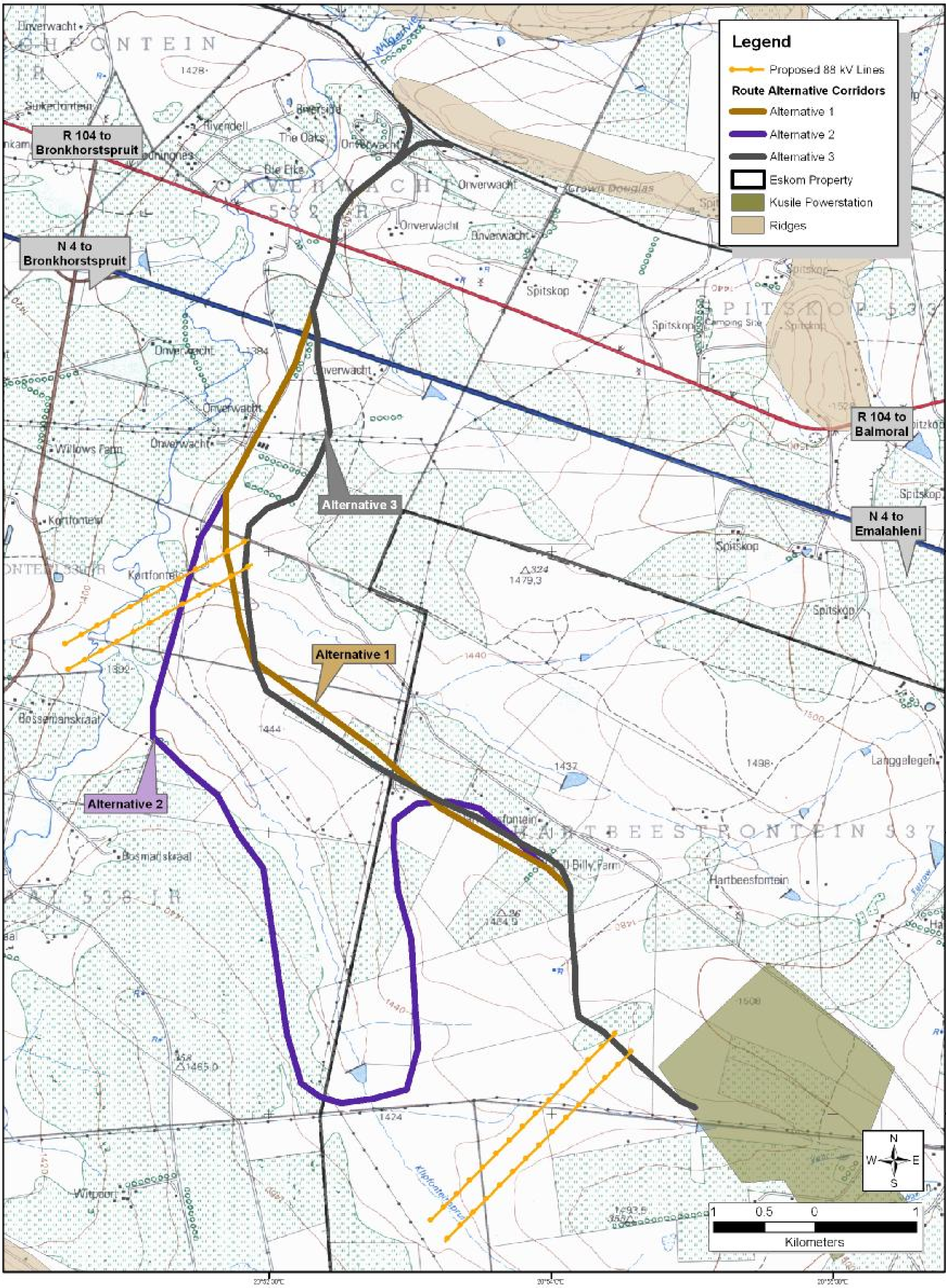


Figure 2-1: Topography of the site



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12202	Ver 2	AUTHOR: K. Kruger	WGS 84 Hartebeesthoek	1:35,000	Topo Mapsheets Surveyor General Eskom Data	Ridges

Figure 2-2: Ridges found on site

2.2 VISUAL IMPACT ASSESSMENT

2.2.1 Introduction

The site and surrounding area may be characterised as agricultural land utilised mainly for the grazing of cattle. The topography of the region and study site is gently undulating to moderately undulating landscape of the Highveld plateau.

The proposed railway lines are located in the area immediately west of the Kusile Power Station with the power station construction site and other infrastructures like existing power lines and roads featuring prominently in the landscape.

2.2.2 Methodology

The methodology adopted for the visual assessment includes the following tasks:

- Examine the baseline information (contours, building dimensions, vegetation, inter alia);
- Determine the area from which the proposed railway may be visible (viewshed);
- Identify the locations from which views of the proposed railway may be visible (observation sites), which include buildings and roads;
- Analyse the observation sites to determine the potential level of visual impact that may result from the proposed railway; and
- Identify measures available to mitigate the potential impacts.

Each component of the assessment process is explained in detail in the following sections of the Report.

The Viewshed

The viewshed represents the area from which the proposed site would potentially be visible. The extent of the viewshed is influenced primarily by the combination of topography and vegetation, which determine the extent to which the site would be visible from surrounding areas.

The viewshed was determined by Zitholele through the following steps and presumptions:

- The likely viewshed was determined by desktop study (ArcGIS) using contour plans (20 m interval); and
- An offset of 2 m (maximum) for the observer and an offset of 30 m (maximum) for the proposed power lines were utilized during the spatial analysis.

Visibility Assessment

Site visibility is an assessment of the extent to which the proposed railway would potentially be visible from surrounding areas. It takes account of the context of the view, the relative number of viewers, duration of view and view distance.

The underlying rationale for this assessment is that if the proposed railway (and associated infrastructure) is not visible from surrounding areas then the development will not produce a visual impact. On the other hand if one or more power lines are highly visible to a large number of people in surrounding areas then the potential visual impact is likely to be high.

Based on a combination of all these factors an overall rating of visibility was applied to each observation point. For the purpose of this report, categories of visibility have been defined as high (H), moderate (M) or low (L).

Assessment Criteria

For the purpose of this report, the quantitative criteria listed in Table 2-1 have been determined and used in the Visibility Assessment. The criteria are defined in more detail in the subsection following.

Table 2-1: Visual Impact Assessment Criteria

CRITERIA	DEFINITIONS
Category of Viewer	
Static	Farms, homesteads or industries
Dynamic	Travelling along road
View Elevation	
Above	Higher elevation then proposed railway.
Level	Level with railway view
Below	Lower elevation then railway viewed
View Distance	
Long	> 5 km
Medium	1 – 5 km
Short	200 m – 1 000 m
Very Short	< 200 m
Period of View	
Long Term	> 120 minutes
Medium Time	1 – 120 minutes
Short Term	< 1 minute

Category Viewer

The visibility of the proposed railway will vary between static and dynamic view types. In the case of static views, such as views from a farmhouse or homestead, the visual relationship between the proposed railway and the landscape will not change. The cone of vision is relatively wide and the viewer tends to scan back and forth across the landscape.

In contrast views from a moving vehicle are dynamic as the visual relationship between the proposed railway / associated infrastructure is constantly changing as well as the visual relationship between the proposed railway and the landscape in which they it is seen. The view cone for motorists, particularly drivers, is generally narrower than for static views.

View Elevation

The elevation of the viewer relative to the object observed, which in this case is the proposed railway (and associated infrastructure), significantly influences the visibility of the object by changing the background and therefore the visual contrast. In situations where the viewer is at a higher elevation than the building/structure it will be seen against a background of landscape. The level of visual contrast between the proposed railway and the background will determine the level of visibility. A white/bright coloured structure seen against a background of dark/pale coloured tree-covered slopes will be highly visible compared to a background of light coloured slopes covered by yellow/brown dry vegetation.

In situations where the viewer is located at a lower elevation than the proposed railway it will mostly be viewed against the sky. The degree of visual contrast between a white coloured structure will depend on the colour of the sky. Dark grey clouds will create a significantly greater level of contrast than for a background of white clouds.

View Distance

The influence of distance on visibility results from two factors:

- With increasing distance the proportion of the view cone occupied by a visible structure will decline; and
- Atmospheric effects due to dust and moisture in the air reduce the visual contrast between the structure and the background against which they are viewed.

Period of View

The visibility of structures will increase with the period over which they are seen. The longer the period of view the higher the level of visibility. However, it is presumed that over an extended period the level of visibility declines as people become accustomed to the new element in the landscape.

Long term views of the proposed railway will generally be associated with rest camps located within the viewshed. Short term and moderate term views will generally relate to tourist moving through the viewshed mostly by vehicle.

Site Visibility

The procedure followed by Zitholele to assess Site Visibility involved:

- Generate a viewshed analysis of the area utilizing ArcGIS 9.
- Determine the various categories of observation points (e.g. Static, Dynamic).

Impact Assessment Methodology

Visual impact is defined as the significance and/or severity of changes to visual quality of the area resulting from a development or change in land use that may occur in the landscape.

Significance or severity is a measure of the response of viewers to the changes that occur. It represents the interaction between humans and the landscape changes that they observe. The response to visible changes in the landscape may vary significantly between individuals.

Perception results from the combination of the extent to which the proposed railway is visible (level of visibility) and the response of individuals to what they see. A major influence on the perception of people/tourist in relation to the proposed railway will be the visual character and quality of the landscape in which it would be located. Natural landscape areas such as national parks, mountain areas or undeveloped sections of coast are valued for their high visual quality. The introduction of buildings and associated infrastructure may be seen as a negative impact on these areas of high visual quality. In the case of rest camps many people perceive them in a positive manner because they represent tourism/conservation infrastructure usually elegantly designed, non-conspicuous and contributing the local and national economy.

The potential visual impact of the proposed railway will primarily result from changes to the visual character of the area within the viewshed. The nature of these changes will depend on the level of the visual contrast between buildings/structures and the existing landscape within which they would be viewed.

The degree of contrast between the proposed railway and the surrounding landscape will result from one or more of the following visual characteristics:

- Colour;
- Shape or form;
- Scale;
- Texture; and
- Reflectivity.

2.2.3 Visual Character

Landscape Character

The site and the surrounding area can be described as an agricultural landscape with intermittent mining and power generation activities. The proposed railway will be located on a slope starting at the Klipfonteinspruit valley bottom and moving up the slope towards the Kusile Power Station. Elevations along the slope range from 1420 mamsl and 1520 mamsl. All railway route alternatives are located on this slope with very little screening from topography or vegetation. Please refer to Figure 2-1 for the topography of the site.

There are no major rivers in the area, but the non perennial Klipfonteinspruit and an unnamed tributary to the spruit are found on site. Alternative 1 crosses the Klipfonteinspruit and the tributary, while Alternative 2 is aligned along the tributary and crosses the Klipfonteinspruit. For an illustration of the surface water features please refer to **Error! Reference source not found.**.

The landscape surrounding the proposed railway can be described as open grassland with numerous cultivated fields. In addition a large section of the site is currently being developed for the Kusile Power Station. The natural vegetation does not provide any screening for the proposed railway. There are also several existing power lines on site. Figure 2-3 below provides a view of the existing Bronkhorstspruit – Witbank railway lines looking east along the railway line.

The study area is dominated by agricultural smallholdings and small farms with the main farming activities being either livestock or maize farming. The N4 highway and the R 104 regional roads cross through the site and the railway line will cross over/under these roads. In addition to the main roads, several smaller gravel farm roads also occur in the area along with several 400 kV power lines.

Viewshed

It should be noted that the viewsheds for each of the alternatives, which are plotted on Figure 2-4, Figure 2-5 and Figure 2-6, are an approximation that may vary in some locations. Potential views to the proposed railway are likely to be blocked in some localised situations by buildings, vegetation or local landform features at specific locations within the viewshed. Similarly, glimpses of the proposed railway may be available from some isolated high-elevation locations outside the plotted viewshed. The figures illustrate the visibility of each of the alternatives. The coloured areas indicate areas that are visible with the red areas having very high visibility and the green having lower visibility. It should be noted that the variations in visual impact between the alternatives are relatively small, considering the alignment of all three alternatives together in the northern part of the route, which is also the most populated.

Figure 2-3: View of the existing railway line to the north of the study area.

Notable features of the viewshed are summarised by the following points:

- The viewshed extends approximately 9 km to the north of the proposed railway;
- In a easterly direction the viewshed is generally limited by a ridgelines approximately 5 km from the site;
- To the west the viewshed extends approximately 14 km with isolated views on high outcrops; and
- Potential views from the south are blocked by the flowing ridges located south from the proposed site, and the viewshed extends about 6 km.

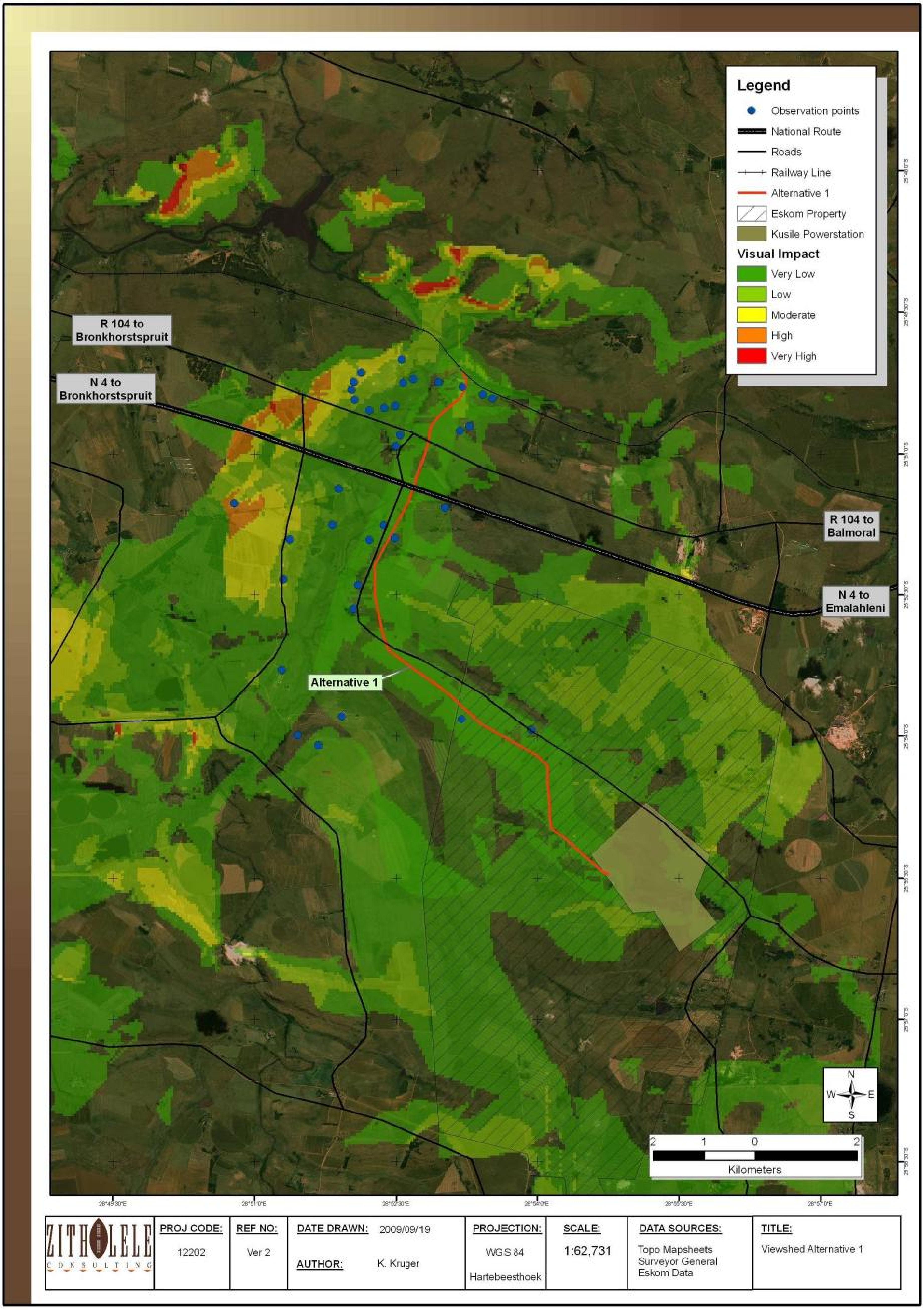


Figure 2-4: Visual Impact from the Alternative 1 alignment.

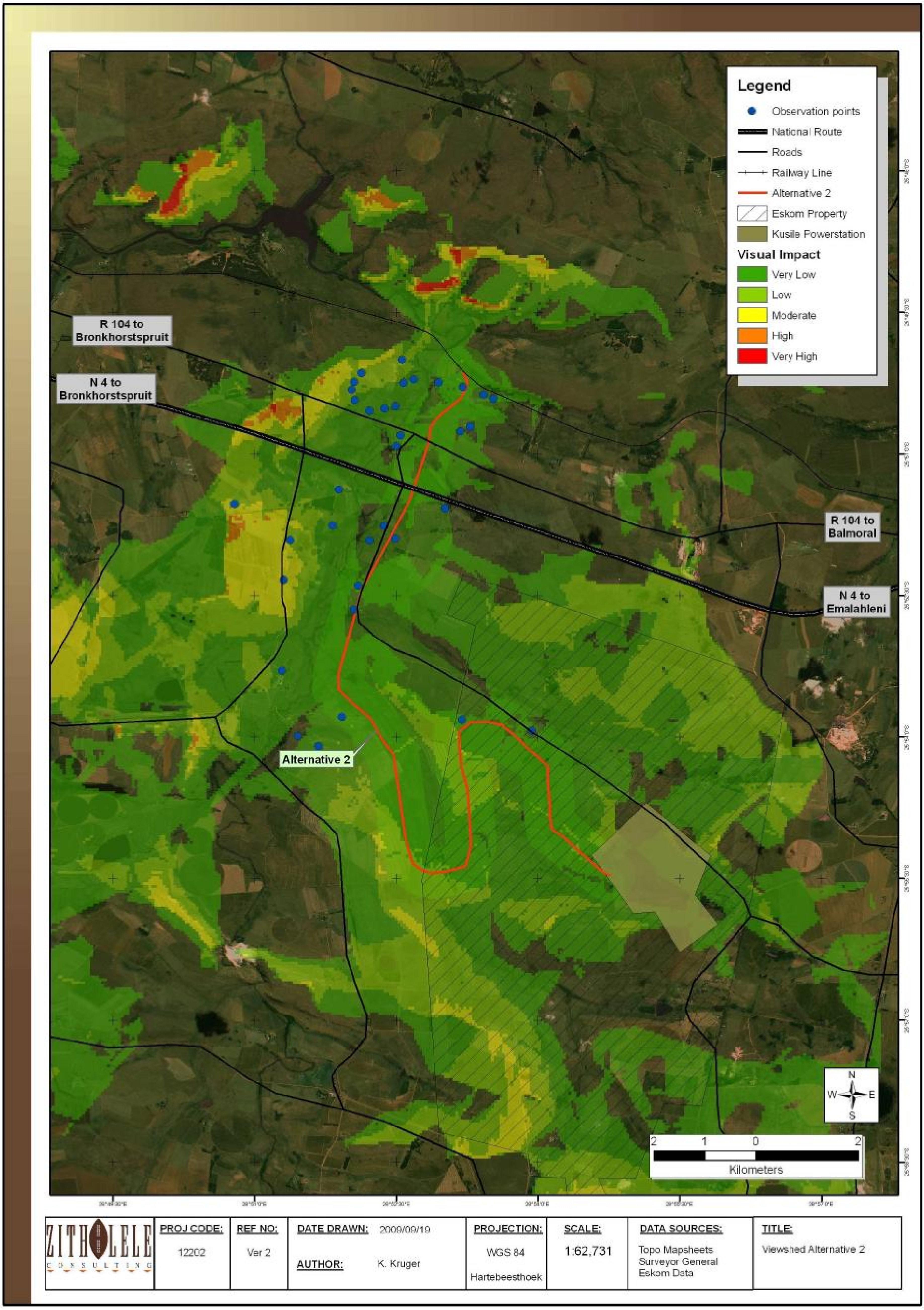
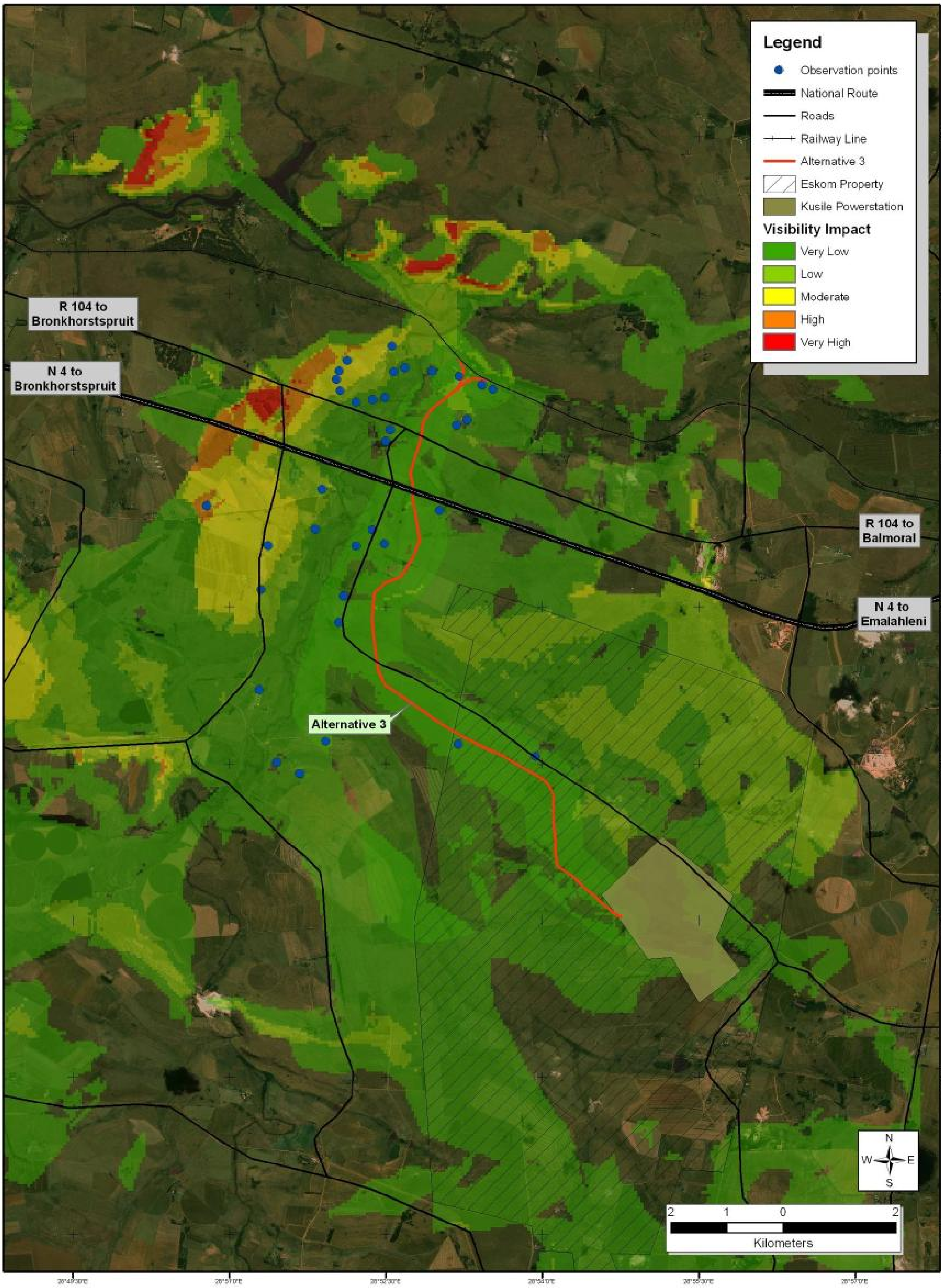


Figure 2-5: Visual Impact from the Alternative 2 alignment



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12202	Ver 2	AUTHOR: K. Kruger	WGS 84 Hartebeesthoek	1:62,731	Topo Mapsheets Surveyor General Eskom Data	Viewshed Alternative 3

Figure 2-6: Visual Impact from the Alternative 3 alignment

3 IMPACT ASSESSMENT METHODOLOGY

The impacts will be ranked according to the methodology described below. Where possible, mitigation measures will be provided to manage impacts. In order to ensure uniformity, a standard impact assessment methodology was utilised so that a wide rage of impacts can be compared with each other. The impact assessment methodology makes provision for the assessment of impacts against the following criteria:

- Significance;
- Spatial scale;
- Temporal scale;
- Probability; and
- Degree of certainty.

A combined quantitative and qualitative methodology was used to describe impacts for each of the aforementioned assessment criteria. A summary of each of the qualitative descriptors along with the equivalent quantitative rating scale for each of the aforementioned criteria is given in Table 3-1.

Table 3-1: Quantitative rating and equivalent descriptors for the impact assessment criteria

Rating	Significance	Extent Scale	Temporal Scale
1	VERY LOW	*Isolated sites / proposed site*	Incidental
2	LOW	*Study area*	Short-term
3	MODERATE	*Local*	Medium-term
4	HIGH	*Regional / Provincial*	Long-term
5	VERY HIGH	*Global / National*	Permanent

A more detailed description of each of the assessment criteria is given in the following sections.

3.1 SIGNIFICANCE ASSESSMENT

Significance rating (importance) of the associated impacts embraces the notion of extent and magnitude, but does not always clearly define these since their importance in the rating scale is very relative. For example, the magnitude (i.e. the size) of area affected by atmospheric pollution may be extremely large (1 000 km^2) but the significance of this effect is dependent on the concentration or level of pollution. If the concentration is great, the significance of the impact would be HIGH or VERY HIGH, but if it is diluted it would be VERY LOW or LOW. Similarly, if 60 ha of a grassland type are destroyed the impact would be VERY HIGH if only 100 ha of that grassland type were known. The impact would be VERY LOW if the grassland type was common. A more detailed description of the impact significance rating scale is given in Table 3-2 below.

Table 3-2 : Description of the significance rating scale

Rating		Description
5	Very high	Of the highest order possible within the bounds of impacts which could occur. In the case of adverse impacts: there is no possible mitigation and/or remedial activity which could offset the impact. In the case of beneficial impacts, there is no real alternative to achieving this benefit.
4	High	Impact is of substantial order within the bounds of impacts, which could occur. In the case of adverse impacts: mitigation and/or remedial activity is feasible but difficult, expensive, time-consuming or some combination of these. In the case of beneficial impacts, other means of achieving this benefit are feasible but they are more difficult, expensive, time-consuming or some combination of these.
3	Moderate	Impact is real but not substantial in relation to other impacts, which might take effect within the bounds of those which could occur. In the case of adverse impacts: mitigation and/or remedial activity are both feasible and fairly easily possible. In the case of beneficial impacts: other means of achieving this benefit are about equal in time, cost, effort, etc.
2	Low	Impact is of a low order and therefore likely to have little real effect. In the case of adverse impacts: mitigation and/or remedial activity is either easily achieved or little will be required, or both. In the case of beneficial impacts, alternative means for achieving this benefit are likely to be easier, cheaper, more effective, less time consuming, or some combination of these.
1	Very low	Impact is negligible within the bounds of impacts which could occur. In the case of adverse impacts, almost no mitigation and/or remedial activity are needed, and any minor steps which might be needed are easy, cheap, and simple. In the case of beneficial impacts, alternative means are almost all likely to be better, in one or a number of ways, than this means of achieving the benefit. Three additional categories must also be used where relevant. They are in addition to the category represented on the scale, and if used, will replace the scale.
0	No impact	There is no impact at all - not even a very low impact on a party or system.

3.2 SPATIAL SCALE

The spatial scale refers to the extent of the impact i.e. will the impact be felt at the local, regional, or global scale. The spatial assessment scale is described in more detail in Table 3-3.

Table 3-3 : Description of the significance rating scale

Rating		Description
5	Global/National	The maximum extent of any impact.
4	Regional/Provincial	The spatial scale is moderate within the bounds of impacts possible, and will be felt at a regional scale (District Municipality to Provincial Level).
3	Local	The impact will affect an area up to 5 km from the proposed study area.
2	Study Area	The impact will affect an area not exceeding the study area.
1	Isolated Sites / proposed site	The impact will affect an area no bigger than the power line alignments.

3.3 DURATION SCALE

In order to accurately describe the impact it is necessary to understand the duration and persistence of an impact in the environment. The temporal scale is rated according to criteria set out in Table 3-4.

Table 3-4: Description of the temporal rating scale

Rating		Description
1	Incidental	The impact will be limited to isolated incidences that are expected to occur very sporadically.
2	Short-term	The environmental impact identified will operate for the duration of the construction phase or a period of less than 5 years, whichever is the greater.
3	Medium term	The environmental impact identified will operate for the duration of life of plant.
4	Long term	The environmental impact identified will operate beyond the life of operation.
5	Permanent	The environmental impact will be permanent.

3.4 DEGREE OF PROBABILITY

Probability or likelihood of an impact occurring will be described as shown in Table 3-5 below.

Table 3-5 : Description of the degree of probability of an impact occurring

Rating	Description
1	Practically impossible
2	Unlikely
3	Could happen
4	Very Likely
5	It's going to happen / has occurred

3.5 DEGREE OF CERTAINTY

As with all studies it is not possible to be 100% certain of all facts, and for this reason a standard "degree of certainty" scale is used as discussed in Table 3-6. The level of detail for specialist studies is determined according to the degree of certainty required for decision-making. The impacts are discussed in terms of affected parties or environmental components.

Table 3-6 : Description of the degree of certainty rating scale

Rating	Description
Definite	More than 90% sure of a particular fact.
Probable	Between 70 and 90% sure of a particular fact, or of the likelihood of that impact occurring.
Possible	Between 40 and 70% sure of a particular fact or of the likelihood of an impact occurring.
Unsure	Less than 40% sure of a particular fact or the likelihood of an impact occurring.
Can't know	The consultant believes an assessment is not possible even with additional research.
Don't know	The consultant cannot, or is unwilling, to make an assessment given available information.

3.6 QUANTITATIVE DESCRIPTION OF IMPACTS

To allow for impacts to be described in a quantitative manner in addition to the qualitative description given above, a rating scale of between 1 and 5 was used for each of the assessment criteria. Thus the total value of the impact is described as the function of significance, spatial and temporal scale as described below:

$$\textbf{\textit{Impact Risk}} = \frac{\text{SIGNIFICANCE} + \textit{Spatial} + \text{Temporal}}{3} \times \frac{\text{Probability}}{5}$$

An example of how this rating scale is applied is shown below:

Table 3-7 : Example of Rating Scale

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
	LOW	*Local*	Medium-term	*Could Happen*	
Impact to air	**2**	***3***	**3**	**3**	**1.6**

Note: The significance, spatial and temporal scales are added to give a total of 8, that is divided by 3 to give a criteria rating of 2,67. The probability (3) is divided by 5 to give a probability rating of 0,6. The criteria rating of 2,67 is then multiplied by the probability rating (0,6) to give the final rating of 1,6.

The impact risk is classified according to five classes as described in the table below.

Table 3-8 : Impact Risk Classes

Rating	Impact Class	Description
0.1 – 1.0	**1**	**Very Low**
1.1 – 2.0	**2**	**Low**
2.1 – 3.0	**3**	**Moderate**
3.1 – 4.0	**4**	**High**
4.1 – 5.0	**5**	**Very High**

Therefore with reference to the example used for air quality above, an impact rating of 1.6 will fall in the Impact Class 2, which will be considered to be a low impact.

3.7 CUMULATIVE IMPACTS

It is a requirement that the impact assessments take cognisance of cumulative impacts. In fulfilment of this requirement the impact assessment will take cognisance of any existing impact sustained by the operations, any mitigation measures already in place, any additional impact to environment through continued and proposed future activities, and the residual impact after mitigation measures.

It is important to note that cumulative impacts at the national or provincial level will not be considered in this assessment, as the total quantification of external companies on resources is not possible at the project level due to the lack of information and research documenting the effects of existing activities. Such cumulative impacts that may occur across industry boundaries can also only be effectively addressed at Provincial and National Government levels.

Using the criteria as described above an example of how the cumulative impact assessment will be done is shown below:

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Initial / Existing Impact (I-IA)	**2**	**2**	**2**	<u>*1*</u>	0.4
Additional Impact (A-IA)	**1**	***2***	<u>**1**</u>	<u>*1*</u>	0.3
Cumulative Impact (C-IA)	**3**	***4***	<u>**2**</u>	<u>*1*</u>	0.6
Residual Impact after mitigation (R-IA)	**2**	***1***	<u>**2**</u>	<u>*1*</u>	0.3

As indicated in the example above the Additional Impact Assessment (A-IA) is the amount that the impact assessment for each criterion will increase. Thus if the initial impact will not increase, as shown for temporal scale in the example above the A-IA will be 0, however, where the impact will increase by two orders of magnitude from 2 to 4 as in the spatial scale the A-IA is 2. The Cumulative Impact Assessment (C-IA) is thus the sum of the Initial Impact Assessment (I-IA) and the A-IA for each of the assessment criteria.

In both cases the I-IA and A-IA are assessed without taking into account any form of mitigation measures. As such the C-IA is also a worst case scenario assessment where no mitigation measures have been implemented. Thus a Residual Impact Assessment (R-IA) is also made which takes into account the C-IA with mitigation measures. The latter is the most probable case scenario, and for the purpose of this report is considered to be the final state Impact Assessment.

3.8 NOTATION OF IMPACTS

In order to make the report easier to read the following notation format is used to highlight the various components of the assessment:

- Significance or magnitude- IN CAPITALS
- Temporal Scale – <u>in underline</u>
- Probability – <u>*in italics and underlined*</u>.
- Degree of certainty - **in bold**
- Spatial Extent Scale – *in italics*

4 IMPACT ASSESSMENT

The Impact Assessment will highlight and describe the impact to the environment following the abovementioned methodology and will assess the following components:

- Topography, and
- Visual Assessment.

The impact assessment was undertaken for the construction, operational and decommissioning phases of the project. The impact of each line/route alternative was also assessed separately, however, where the impact was not significantly different, only one impact assessment was undertaken. The railway line will constitute a single railway line with a single overhead line and an access road (Figure 4-1). According to the design team at Kwezi V3 the impact footprint for such a railway line would be approximitaly 50 m depending on the cut/fill required.

Figure 4-1: Example of what the railway line would look like

4.1 TOPOGRAPHY

The main impact to topography will come from the cut/fill operations during the construction phase. In order to keep the railway line at a steady angle, the line will be constructed by either cutting or filling the underlying substrate. The various impacts to topography are described below and summarised in Table 4-1.

4.1.1 Initial Impact

Currently the topography of the study area is relatively undisturbed with isolated areas of impact. Current impacts include the construction site of the Kusile Power Station, where major terracing and fill operations are underway. Other impacts include borrow pits and quarrying operations in the sandstone in the area.

Figure 4-2: Current construction activities on site

4.1.2 Additional Impact

The additional impact will be the impact of the railway line on topography excluding any mitigation measures. During the construction phase this will involve the clearing of rock for cut operations, filling of areas and the erecting of the railway line including the placing of the ballast on the terrain. This impact is rated as **Moderate**. The impact to topography during the operational phase should be negligible while the impact during the closure phase should be similar to the construction phase impact. The three alternatives suggested have similar impacts to topography, especially in the northern sections of the railway line, but in the southern section Alternative 2 has a couple more stream crossings. These inevitable require more cut and fill operations adjacent to the streams in order to elevate the railway line over the water. On this basis, Alternative 1 or 3 should rather be considered.

4.1.3 Cumulative Impact

The construction cumulative impact of the railway line in combination with the activities already present on site will be a MODERATE negative impact over the *study area* that will remain for the long term. This impact *will definitely* occur. This results in a rating of **Moderate**.

During the operational phase there will be negligible impacts to topography as all the impacts occurred during the construction phase. During the decommissioning and closure, the impacts will be the same as assessed for the construction phase, but the end result would be a positive impact.

4.1.4 Mitigation Measures

The following mitigation measures are proposed to mitigate the impact on topography.

- Use blasting as a last resource, preferably never to clear rock for the railway line;
- Ensure that all structures, whether cut or fill, are erosion resistant and built to the relevant SABS codes;
- Limit the cut and fill operations to the preferred alternative alignment servitude; and
- Ensure that adequate storm water control measures are in place to prevent erosion.

4.1.5 Residual Impact

The mitigation measures proposed above won't reduce the impact rating to topography, but in implementing these measures it will ensure that the impact remains a moderate impact.

Table 4-1: Impact Rating Matrix for Topography

Construction phase					
Impact Type	**Significance**	**Spatial**	**Temporal**	**Probability**	**Rating**
Initial	Low	Isolated sites	Long Term	Has occurred	**3 - Moderate**
Additional	High	Proposed site	Long Term	Very likely	**2.4 – Moderate**
Cumulative	Moderate	Study area	Long Term	Will definitely occur	**3 - Moderate**
Residual	Moderate	Study area	Long Term	Has occurred	**3 - Moderate**
Operational Phase					
Impact Type	**Significance**	**Spatial**	**Temporal**	**Probability**	**Rating**
Additional	None	None	None	None	None
Cumulative	None	None	None	None	None
Residual	None	None	None	None	None
Closure and Rehabilitation Phase					
Impact Type	**Significance**	**Spatial**	**Temporal**	**Probability**	**Rating**
Residual	Moderate	Study area	Long Term	Has occurred	**3 - Moderate**

4.2 VISUAL IMPACT ASSESSMENT

The visual simulations prepared by Zitholele illustrate the extent to which the railway will be visible from key observation points (static and dynamic views). The vertical form/dimensions of the buildings/structures would be hidden by their location among existing buildings and within a well vegetated area. The visual contrast is increased by the “shape” and scale of the buildings/structures, which generally will not be viewed along the skyline.

4.2.1 Static Views

The proposed railway would potentially be visible from the surrounding farmland and the high-lying areas to the north of Bronkhorstspruit. The potential number of viewers from this area should be low as the farmlands are quite sparsely populated but the views would vary greatly depending on site specific conditions like the orientation of the homes as well as the location of other buildings, fences, vegetation and localized landforms. All these elements have the potential to block views from the buildings to the proposed railway.

4.2.2 Dynamic Views

The railway and power lines will be visible to a moderate number of viewers, mainly those travelling along the N4 highway and some travellers along the R 104. Views from the N4 extend approximately 8 km and represent a view period of approximately 36 seconds travelling at 120 km/h. The level of visibility would be low due to the view distance of more than 5 km and the resulting atmospheric effects that reduce the contrast between the power lines and the surrounding landscape. The effects are similar for the R 545. Please refer to Table 4-2 for a summary of the dynamic impacts. This assessment is similar for both route alternatives.

The proposed railway would also be visible from several farm roads which are located around the proposed site. The viewing distance varies between 1 and 11 km for these roads and if the viewing distance is less than 2 km, the potential visual impact would be considered as moderate.

Table 4-2: Dynamic Impact Table

Road Name	Speed limit (km/h)	Length of Road (km)	Approximate Period of View (min)	View Distance
N 4	**120**	**8**	**4**	**0 – 8 km**
R 104	**100**	**7**	**4.2**	**0 – 7 km**

4.2.3 Conclusion

Table 4-3 lists the observation points together with the category of viewer, context of view, relative numbers of viewers and approximate distance of observation point to the proposed site. The location of these observation points are shown in Figure 2-4 and Figure 2-5.

Table 4-3: Visual Impact Matrix

Potential Observation Point	Category of Potential Receptor	Context of View	Approximate View Distance	Period of View	Visibility Rating
Surrounding Farmland	Static	Level	0 – 11 km	Long Term	Medium
Bronkhorstspruit highlands	Static	Level Above	> 5 km	Long Term	Medium
Gravel Roads	Dynamic	Above & below	0 – 11 km	Medium	Low
Tar Roads	Dynamic	Level - Above	5 – 11 km	Short	Low

The visual impact of the railway line in a landscape characterised by power lines, roads and farmlands will have an impact, but not as high as in an unimpacted area. All three alternatives have very similar visual impacts and none of the alternatives can be suggested as a preferred alternative on visual grounds.

5 CONCLUSION

In conclusion the proponent proposes to construct and operate a railway line in order to connect the Kusile Power Station to the existing Bronkhorstspruit – Emahlahleni railway line in order to deliver Limestone to the Power Station.

Zitholele Consulting was appointed to investigate the biophysical aspects and Stakeholder sensitivities of the proposed routes. The aspects investigated include topography, soils, agricultural potential, surface water and wetlands, terrestrial ecology and visual impacts.

It was found that the major areas of concern were the surface water crossings, habitat fragmentation and loss of agricultural land. Most of the elements analysed indicate that the impacts from Alternative 2 will be larger than the other 2 alternatives as shown in Table 5-1 below.

Table 5-1: Summary of impacts per alternative

Impact	Alt 1	Alt 2	Alt 3
Topography	Moderate	Moderate but more cut and fill required	Moderate
Visual	Moderate	Moderate (longer route and therefore more impact)	Moderate

Alternative 2 is 8 km longer than the other two alternatives and also crosses more streams and the associated riparian and wetland habitat. It is therefore suggested that either Alternative 1 or 3 be used for the railway line rather that Alternative 2. On the basis of the criteria evaluated there is no difference between Alternative 1 and 3 and either can be utilised.

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