

Figure 8-39: Wetlands and Riparian Zones including buffer

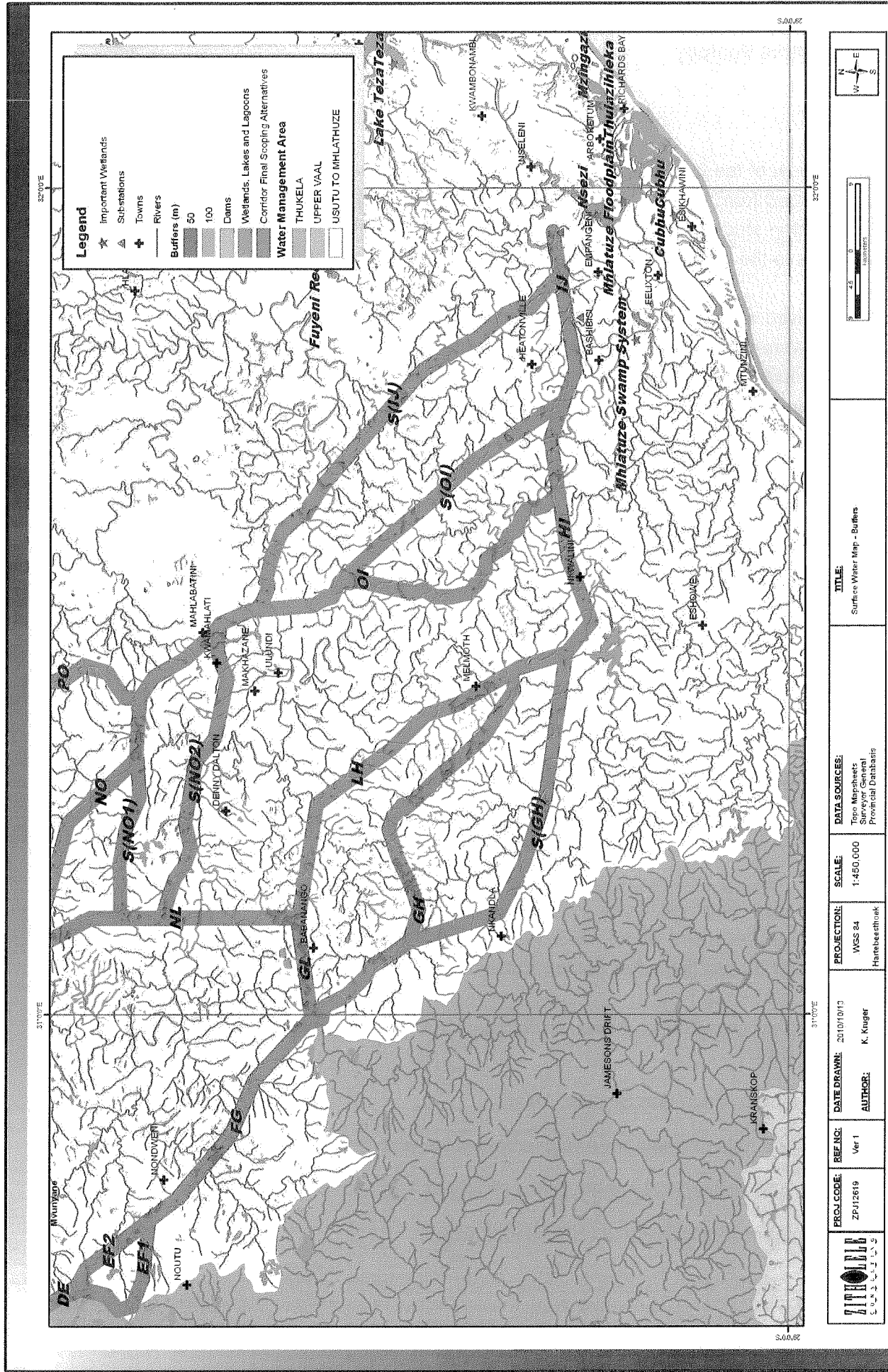


Figure 8-41: Wetlands and Riparian Zones including buffer

8.1.8 Terrestrial Ecology

Data Collection

A literature review of the faunal and floral species that could occur in the area was conducted. C-Plan data provided from the Mpumalanga and KwaZulu Natal provincial departments was used to conduct a desktop study of the area. This data consists of terrestrial components; ratings provide an indication as to the importance of the area with respect to biodiversity.

The study involved extensive fieldwork, a literature review and a desktop study utilizing GIS. Site investigations were conducted from October to February 2011, from spring to summer. The area within the servitude was sampled using transects placed at 500 m intervals. At random points along these transect an area of 20 m x 20 m was surveyed. All species within the 20 m x 20 m quadrant were identified, photographed and their occurrence noted. Sensitive features such as ridges or wetlands were sampled by walking randomly through the area concerned and identifying all species within the area.

The floral data below is taken from *The Vegetation of South Africa, Lesotho and Swaziland* (Mucina and Rutherford 2006). Also, while on site, the following field guides were used:

- Guide to Grasses of Southern Africa (Frits van Oudtshoorn, 1999);
- Field Guide to Trees of Southern Africa (Braam van Wyk and Piet van Wyk, 1997);
- Field Guide to the Wild Flowers of the Highveld (Braam van Wyk and Sasa Malan, 1998);
- Problem Plants of South Africa (Clive Bromilow, 2001); and
- Medicinal Plants of South Africa (Ben-Erik van Wyk, Bosch van Oudtshoorn and Nigel Gericke, 2002)

Species lists were obtained from the SIBIS (*South African National Biodiversity Institute - Accessed through the SIBIS portal, sibus.sanbi.org, 2011-01-25*). In addition the following faunal guides were used on site and while compiling this report:

- Die Natuurlewe van Suider-Afrika, 'n veldgids tot diere en plante van die streek (Vincent Carruthers, 1997);
- Birds of Southern Africa (Ian Sinclair, 1994);
- Smithers' Mammals of Southern Africa, a field guide (Ed. Peter Apps, 2000);
- Sasol Owls and Owling in Southern Africa (Warwick Tarboton & Rudi Erasmus, 1998);
- Bats of Southern Africa (Peter John Taylor, 2000);
- Ecological Assessment Report Of The Three Alternative Transmission Power line Route Corridors For The Proposed 765kv Transmission Power Line From Umfolozi Substation To The New Empangeni Sub-Station (Indiflora Environmental Services, 2007); and

- Ecological Assessment Specialist Report Of The Three Alternative Power line Alignment Corridors For The Proposed 765kv Transmission Line From Majuba Power Station To Umfolozi Sub-Station (Indiflora Environmental Services, 2006).

Regional Description – Flora

The area under investigation straddles the Savanna and Grassland Biomes. Each biome comprises several bioregions which in turn has various vegetation types within the bioregion. The Grassland Biome is represented by Mesic Highveld Grassland, Sub-Escarpment Grassland bioregions. The Savanna Biome is represented by the Lowveld and Sub-Escarpment Savanna bioregions. Each of these bioregions is described below. These descriptions are adapted from Mucina and Rutherford, 2006.

Mesic Highveld Grassland

Mesic Highveld Grassland is found mainly in the eastern, high rainfall regions of the Highveld, extending all the way to the northern escarpment. These are considered to be “sour” grasslands and are dominated by primarily andropogonoid grasses. The different grassland types are distinguished on the basis of geology, elevation, topography and rainfall. Shrublands are found on outcrops of rock within the bioregion, where the surface topography creates habitat in which woody vegetation is favoured above grasses.

As mentioned above the power line corridors were visited for a lengthy period of time and the following vegetation types were identified along the route:

- Amersfoort Highveld Clay Grassland
- Eastern Highveld Grassland;
- Paulpietersburg Moist Grassland; and
- KaNgwane Montane Grassland.

The vegetation types identified on site are indicated in Figure 8-42 below and described in detail below.

Sub-Escarpment Grassland

Sub-Escarpment Grassland is found on the rolling hills and flat plains of the foothills of the Drakensberg and Northern Escarpment. The physical nature of these areas is determined by the rate at which the landscape ascends to the main Escarpment region as well as the degree to which the landscape has been geomorphologically shaped. The result is a diversity of landforms including rolling hills and flat plains.

The following vegetation types from this bioregion were identified along the route:

- Northern Zululand Mistbelt Grassland
- Ithala Quartzite Sourveld
- Northern KwaZulu-Natal Moist Grassland
- KwaZulu Natal Highland Thornveld; and
- Income Sandy Grassland.

Lowveld

The Lowveld bioregion is found in the low-lying frost free areas near the coastline of South Africa. Here there is an abundance of typical savanna trees namely those members of the *Acacia* genus that along with the numerous grasses create the typical patchwork of grassy plains and clumps of trees. The following vegetation types were identified within the bioregion:

- Swaziland Sour Bushveld;
- Northern Zululand Sourveld;
- Zululand Lowveld; and
- Zululand Coastal Thornveld.

Sub-Escarpment Savanna

The Sub-escarpment Savanna is found typically just below the escarpment of South Africa's Drakensberg mountains and the northern escarpment as the name suggests. Here the drop in altitude and lack of frost allows the thorn trees to propagate and the vegetation changes from the grasslands to savanna. The following vegetation types were found along the corridors:

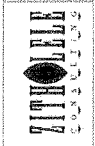
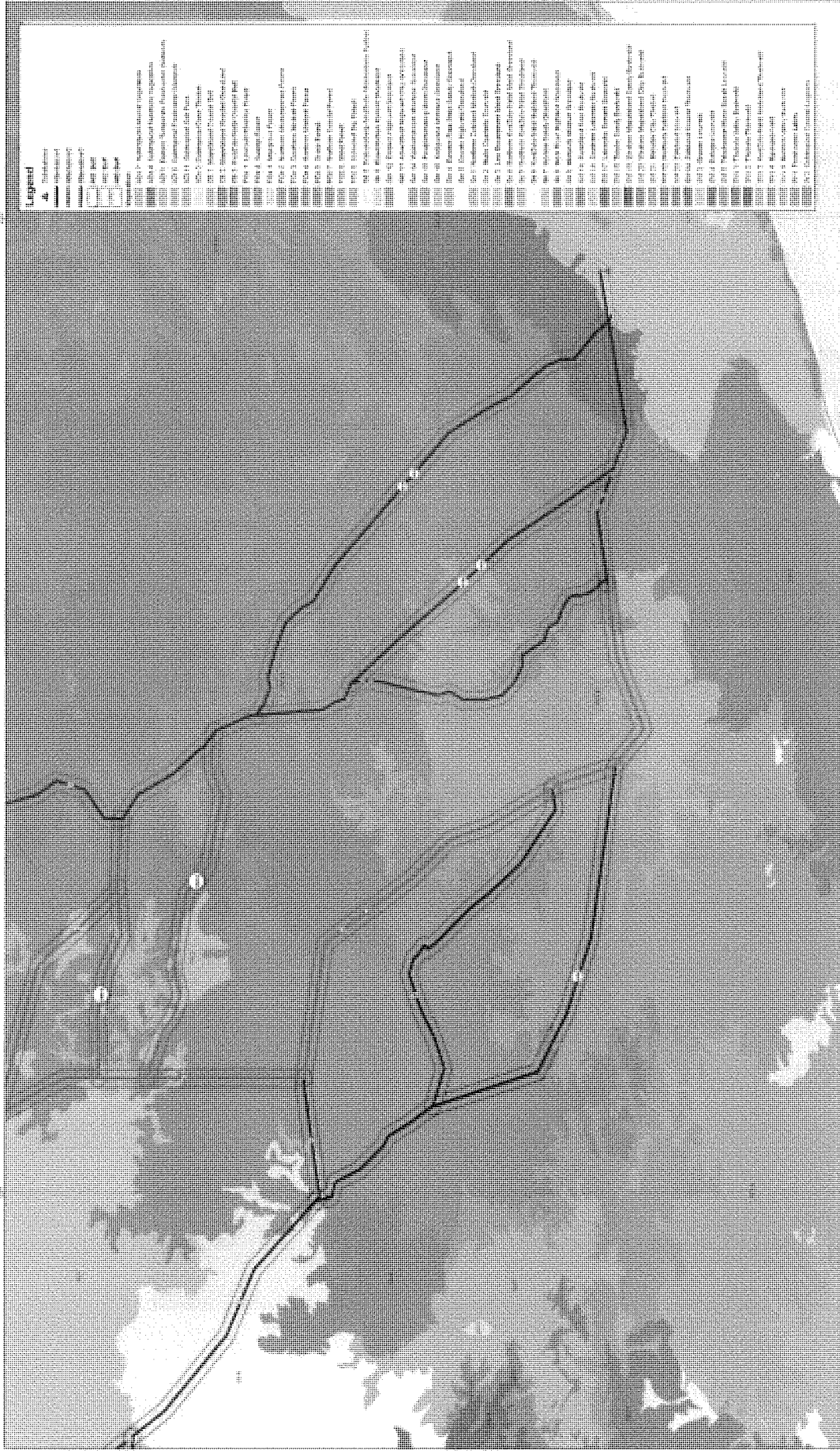
- Ngongoni Veld; and
- Eastern Valley Bushveld.

Inland Azonal Vegetation

The Azonal Vegetation bioregion is characterised by those vegetation units that is associated with inland water features such as riparian and wetland vegetation. Along the proposed route only one vegetation type was identified, namely Easter Temperate Freshwater Wetlands.

Site Description

Each of the vegetation types identified along the corridors are described in more detail below and shown in the maps below.



PROJ CODE:
ZF-12619

REF NO:
Ver 2

DATE DRAWN: 2011/02/10
AUTHOR: K. Kruger

PROJECTION:
WGS 84
Hartebeestnek

SCALE:
1:150,000

DATA SOURCES:
Topo Mapsheets
Surveyor General
Eskom Data

TITLE:
Vegetation Map



Figure 8-44: Vegetation Map the site.

Wetlands

Eastern Temperate Freshwater Wetlands

This vegetation unit is found throughout the Northern Cape, Eastern Cape, Free State, North-West, Gauteng, Mpumalanga and KwaZulu-Natal Provinces as well as in neighbouring Lesotho and Swaziland. It is based around water bodies with stagnant water (lakes, pans, periodically flooded vleis, and edges of calmly flowing rivers) and embedded within the Grassland Biome. These water bodies support zoned systems of aquatic and hygrophillous vegetation of temporary flooded grasslands and ephemeral herblands.

Due to the recent efforts of organisations such as Ramsar, this vegetation unit is now 4.6 % conserved and rated as least threatened. The following alien species are encountered in this type of wetland: *Bidens bidentata*, *Cirsium vulgare*, *Conyza bonariensis*, *Oenothera rosea*, *Physalis viscosa*, *Plantago lanceolata*, *Rumex crispus*, *Sesbania punicea*, *Schkuhria pinnata*, *Stenotaphrum secundatum* (native on South African coast, alien on Highveld), *Trifolium pratense*, *Verbena bonariensis*, *V. brasiliensis*, and *Xanthium strumarium*.

Areas around drainage lines/seepage areas were also added to this unit because of the similar vegetation that may occur in these areas. Seepage areas are seasonally wet areas that occur in sandy areas where water seeps into lowlying drainage lines after rains. These areas are usually covered by hygrophytes such as sedges and reeds. The dominant sedge in the study area is *Juncus rigidus*. Sometimes bulrush (*Typha capensis*) and reeds (*Phragmites australis*) also occurs.

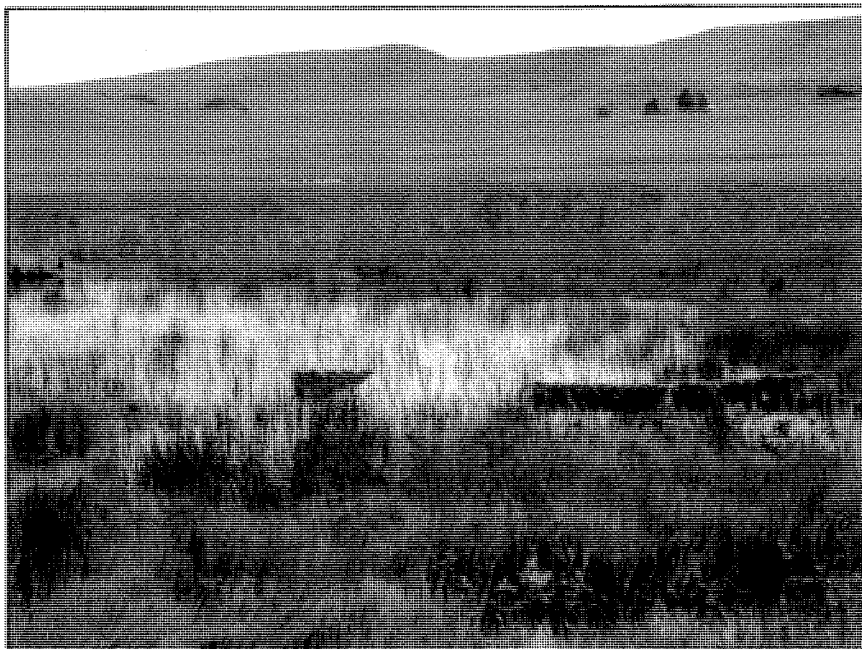


Figure 8-45: A wetland close to Groenvlei

Wetlands are of a more permanent nature and occur in low-lying areas such as tributaries of streams and rivers. Here hydrophytes can be found. Typical plants are the Orange River Lily (*Crinum bulbispermum*), bulrush (*Typha capensis*) and reeds (*Phragmites australis*), sedges of the *Cyperus*, *Fuirena* and *Scirpus* genera also occur. The site had many drainage and seepage lines running into large streams and into dams. Many of the site drainage and seepage lines had associated wetland and riparian flora. This made these areas have a high species diversity in terms of both plants and animals and makes them have a high conservation level.

Eastern Highveld Grassland

The Eastern Highveld Grassland occurs in the Mpumalanga and the Gauteng provinces on the plains between Belfast in the east and the eastern side of Johannesburg in the west extending southwards to Bethal, Ermelo and west of Piet Retief. The landscape is slightly to moderately undulating plains, including some low hills and pan depressions. The vegetation is short dense grassland dominated by the usual Highveld grass composition (*Aristida*, *Digitaria*, *Eragrostis*, *Themeda*, *Tristachya*, etc.) with small scattered rocky outcrops with wiry, sour grasses and some woody species (*Arcacia caffra*, *Celtis Africana*, *Diospyros luciodes subspecies lycioides*, *Parinari capensis*, *Protea caffra*, *P. Welwitschii* and *Rhus magalismontanum*).

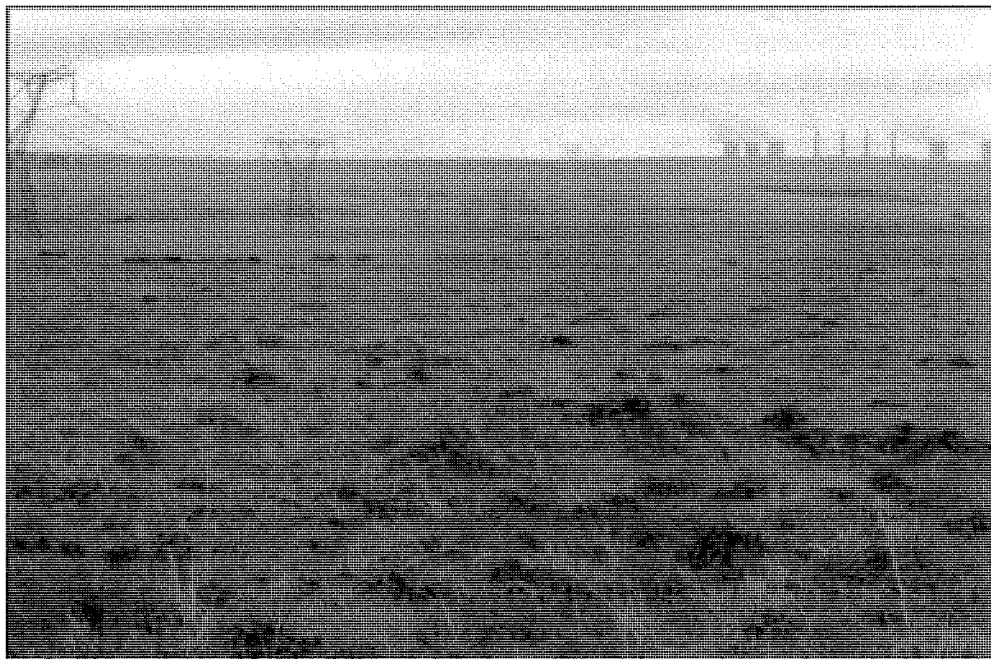


Figure 8-46: Eastern Highveld Grassland found to the south of Camden Power Station.

This vegetation unit is considered endangered with a conservation target of 24%. Only a very small fraction is conserved in statutory reserves (Nooitgedacht dam and Jericho dam Nature Reserves) and in private reserves (Holkransse, Kransbank, Morgenstond). Approximately 44% is transformed primarily by cultivation, plantations, mines, urbanisation and by the building of dams. Cultivation may have had a more extensive impact, indicated by land-cover data. No serious alien invasions are reported, but *Acacia mearnsii* can become dominant in disturbed areas.

Wakkerstroom Montane Grassland



Figure 8-47: Wakkerstroom Montane Grassland en route to Groenvlei.

The Wakkerstroom Montane Grassland occurs in the KwaZulu-Natal and Mpumalanga provinces. It occurs from the escarpment just north of Sheepmoor (north) to southeast of Utrecht, and then from the vicinity of Volksrust in the west to Mandhlangampisi Mountain near Lunebrg in the east

This unit is a less obvious continuation of the escarpment that links the southern and northern Drakensburg escarpments. It straddles this divide and is comprised of low mountains and undulating plains. The vegetation comprises predominantly short montane grasslands on the plateaus and the relatively flat area, with short forest and *Leucosidea* thickets occurring along steep, mainly east facing slopes and drainage areas. *L. Sericea* is the dominant woody pioneer species that invades areas as a result of grazing mismanagement.

This unit is less threatened with a conservation target of 27%, however less than 1% is statutorily protected in the Paardeplaats Nature Reserve. There are 10 South African Natural Heritage Sites in this unit, although very little of it is formally protected. Land use pressures from agriculture are low (5% cultivated) probably owing to the colder climate and shallower soils. The area is also suited to afforestation, with more than 1% under *Acacia mearnsii* and *Eucalyptus* plantations. The black wattle (*Acacia mearnsii*) is an aggressive invader of riparian areas and the erosion potential is very low.

Paulpietersburg Moist Grassland

The Paulpietersburg Moist Grassland is located in both the Mpumalanga and KwaZulu-Natal provinces, mainly in the broad surrounds of Piet Retief, Paulpietersburg, and Vryheid, extending

westwards to east of Wakkerstroom. This unit occurs in the upper most catchments of the Pongola River.

The unit is mainly undulating with moderately steep slopes, but valley basins are wide and flat and mountainous areas occur mostly along the northern and eastern boundary. Tall closed grassland rich in forbs and dominated by *Tristachya leucothrix*, *Themda triandra* and *Hyparrhenia hirta*. Evergreen woody vegetation is characteristic on rocky outcrops.

The unit is seen as vulnerable with a conservation target of 24%. Only a very small portion is statutorily conserved in Witbad, Vryheid Mountain, Paardeplaats and Phongola Bush Nature Reserves. Some private reserves protect small patches (Rooikraal, Mhlongamvula, Kombewaria). About one third is already transformed by plantations or cultivated land. Heavy livestock grazing and altered fire regimes have greatly reduced the area of grasslands of high conservation value. Aliens such as species of *Acacia*, *Eucalyptus* and *Pinus* are a major concern in places. The erosion potential is very low.

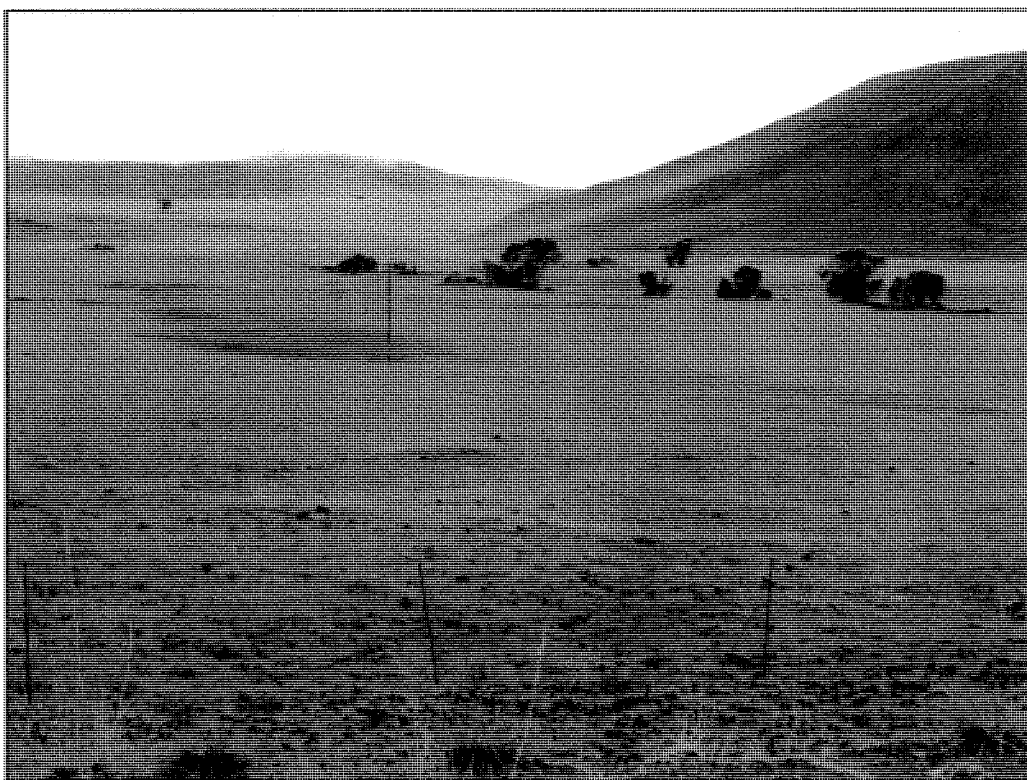


Figure 8-48: PaulPietersburg Moist Grassland

KaNgwane Montane Grassland

The KaNgwane Montane Grassland is situated in Mpumalanga and Swaziland, and marginally into northern KwaZulu-Natal. The unit occurs along the gentle slopes of the Escarpment from the Phongolo Valley in the south, northwards to the Usutu Valley and to the uppermost Lomati Valley near Carolina, including the western grassland areas of Swaziland.



Figure 8-49: Plantations.

The vegetation unit largely comprises of undulating hills and plains that occur on the eastern edge off the escarpment. This unit is transitional between the Highveld and the escarpment and contains elements of both. The vegetation structure comprises of a short closed grassland layer with many forbs, and a few scattered shrubs on the rocky outcrops.

This unit is considered vulnerable with a conservation target of 27%. Only 0.4% is protected within formally proclaimed nature reserves (Malalotja, Nooitgedacht Dam, and Songimvelo). A number of private conservation areas protect small patches of this unit. It is well suited for afforestation and 30% has already been converted to plantations of alien trees. A further 6% is under cultivation.

Amersfoort Highveld Clay Grassland

The Amersfoort Highveld Clay Grassland occurs in the Mpumalanga and KwaZulu-Natal provinces. This vegetation unit extends in a north-south band from just south of Ermelo, down through Amersfoort to the Memel area in the south. The vegetation unit is comprised of undulating grassland plains, with small scattered portions of dolerite outcrops in areas. The vegetation is comprised of a short closed grassland cover, largely dominated by a dense *Themeda triandra* sward, often severely grazed to form a short lawn

The Amersfoort Highveld Clay Grassland is considered vulnerable. The conservation target for this unit is 27% but none is protected. Some 25% of the unit is transformed, predominantly by cultivation (22%). The area is not suited to afforestation. Silver and black wattle (*Acacia* species), and *Salix babylonica* invade drainage areas. The erosion potential is however very low.



Figure 8-50: Amersfoort Clay Grassland with Blue Cranes in the background

Northern Zululand Misbelt Grassland

The Northern Zululand Misbelt Grassland is, as the name suggests, located in KwaZulu-Natal specifically on the crests and slopes of the Ngome Mountain range and the Ngoje Mountain surrounding Louwsburg as well as some smaller mountainous areas of Langkrans, KwaCeze, KwaNtimbankulu and Nhlazatshe. Located on gentle to steep upper slopes of mountains formed by hard dolerite dykes dominated by relatively forb-rich, tall sour *Themeda triandra* grasslands.

This vegetation unit is seen as vulnerable with a 23% conservation target. Only about 3% is statutorily conserved in the Ithala Nature Reserve and in the Ntendeka Wilderness Area of the Ngome State Forest. Some 22% has been transformed for plantations or cultivated land. Threats to the remaining grasslands are heavy selective grazing by livestock and extensive annual burning. Spread of alien *Acacia mearnsii* and Eucalypts species is a serious concern.



Figure 8-51: Northern Zululand Mistbelt Grassland

Income Sandy Grassland

The Income Sandy Grassland is located in the KwaZulu-Natal province in a large triangle between Newcastle, Vryheid and Dundee and a larger polygon in the Wasbank area in northern KwaZulu-Natal. The vegetation unit occurs in very flat extensive areas with generally shallow, poorly drained, sandy soils supporting low, tussock-dominated sourveld forming a mosaic with wooded grasslands (with *Acacia sieberiana* var. *woodii*) and on well-drained sites with the trees *A. Karroo*, *A. Nilotica*, *A. Caffra* and *Diospyros lyciodes*. On disturbed sites *A. Sieberiana* var. *woodii* can form sparse woodlands. *Aristida congesta*, *Cynodon dactylon* and *Microchloa caffra* are common on shallow soils.



Figure 8-52: Income Sandy Grassland to the south of Utrecht.

The vegetation unit is considered vulnerable with a conservation target of 23%. None of this vegetation unit is currently in statutory conservation areas. Approximately 27% has been transformed for cultivation, plantations and by urban sprawl. A small portion of the area has been lost due to the building of dams (Klipfontein and Mvunyane). No serious invasions of aliens have been observed (probably due to the low nutrient status of the soils).

Northern KwaZulu-Natal Shrubland

The Northern KwaZulu-Natal Shrubland is located in the KwaZulu-Natal province with a widely scattered group of patches. The unit is embedded within sub-escarpment grassland units of Northern KwaZulu-Natal Moist Grassland, KwaZulu-Natal Highland Thornveld, and Income Sandy Grassland units, from Ladysmith in the west to Vryheid in the northeast. Large portions of this unit are found in the surrounds of Newcastle.

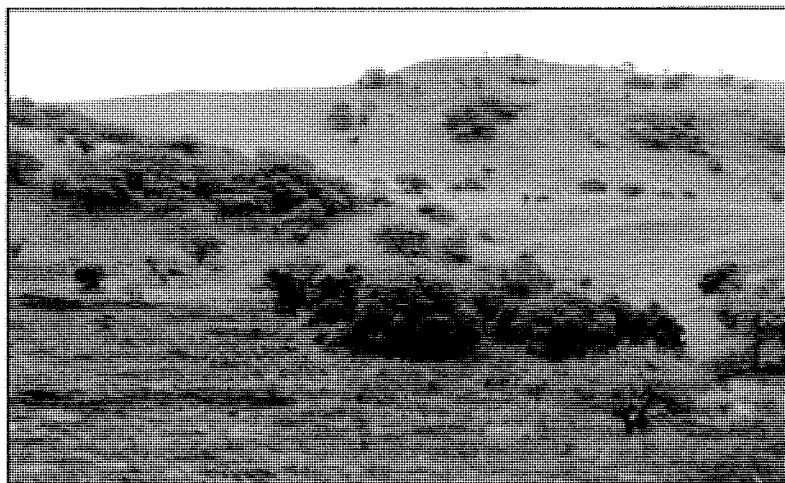


Figure 8-53: Northern KZN Shrubland just to the north of Newcastle

The landscape comprises of small dolerite koppies and steeper slopes of ridges with sparse grass cover and typical occurrence of scattered shrubland pockets (and locally also thickets). *Acacia caffra*, *A. natalitia*, *Clerodendrum glabrum*, *Diospyros lycioides*, *Rhus pyroides*, *R. pentheri*, *Scutia myrtina* etc are the most prominent shrubs and small trees.

This vegetation unit is classified as least threatened with a conservation target of 23%. Currently less than 1% is statutorily conserved in the Spioenkop Nature Reserve and about 3% is transformed by cultivation.

Ithala Quartzite Sourveld

The Ithala Quartzite Sourveld occurs in the Mpumalanga and KwaZulu-Natal provinces. The unit is confined to large quartzite patches that occur from Amsterdam, southwards east of Piet Retief and through Mahamba, to the Paris dam and Ithala Game Reserve, with isolated outcrops near Magudu. This unit is located in low mountain ranges and undulating hills with rocky lowlands. The general pattern is a mosaic of woody shrubs and small trees in rocky areas, interspersed in the grass layer. The vegetation structure varies according to altitude and rockiness, but the basal density of the grass sward is relatively low. This unit occurs in the zone between Grassland and Savanna where the dominant grassland gives way to woodland as elevation decreases. The grasslands are species rich covering a variety of altitudes but sharing common species unique to the dystrophic quartzite geology.

This vegetation unit is considered least threatened and the 27% conservation target has not been reached. A total of 10% of this unit is protected within the Ithala Game Reserve. Land use pressures on this unit are low, probably because of its low nutrient status and rocky nature. Approximately 5 % is under plantations and a further 5% has been transformed into cultivated land.

Savanna Biome

Most Savanna has an herbaceous layer usually dominated by grass species and a discontinuous to sometimes very open tree layer. The following Savanna vegetation units are present in the proposed study area:

- Eastern Valley Bushveld;
- Swaziland Sour Bushveld;
- Zululand Lowveld;
- Northern Zululand Sourveld;
- Ngongoni Veld; and
- Zululand Coastal Thornveld.

Eastern Valley Bushveld

The Eastern Valley Bushveld is characteristic of the KwaZulu-Natal and Eastern Cape provinces, occurring in deeply incised valleys of rivers including the lower reaches of the Thukela, Mvoti, Mgeni, Mlazi, Mkhomazi, Mzimkulu, Mzimkulwana, Mtamvuna, Mtentu, Msikaba, Mzimvubu (and its several tributaries), Mthatha, Mbhashe, Shixini, Qhorha and Great Kei Rivers. This vegetation unit very seldom extends to the coast.

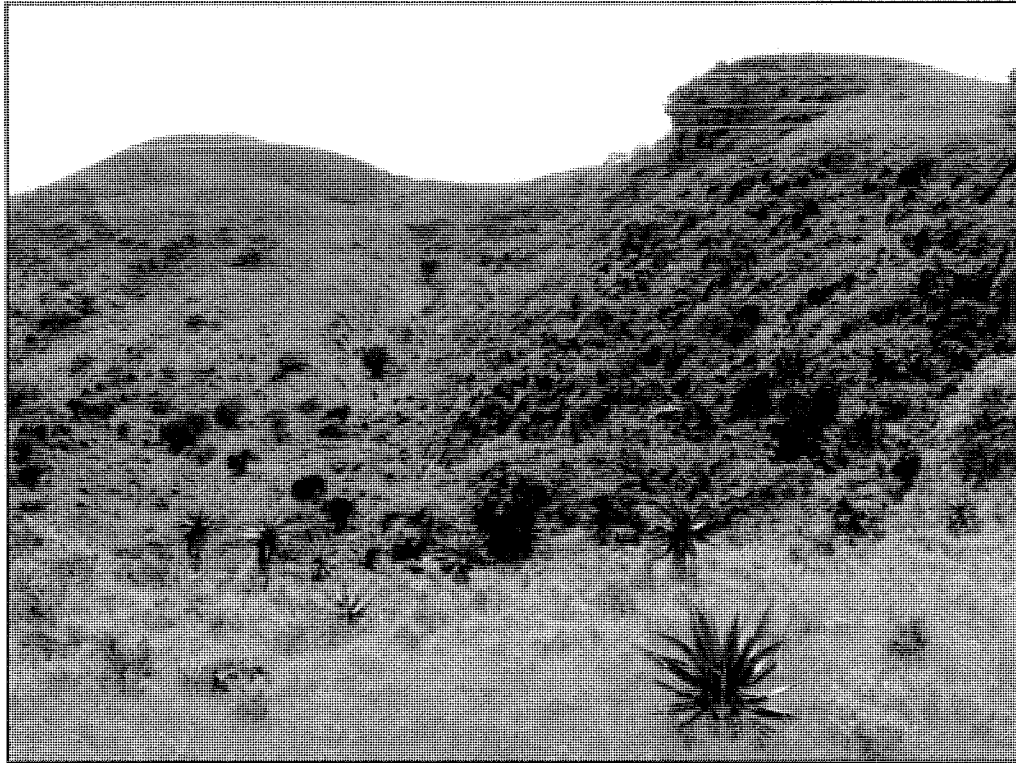


Figure 8-54: Eastern Valley Bushveld with Aloes in the foreground and Euphorbia in the background.

The unit comprises of semi-deciduous savanna woodlands in a mosaic with thickets, often succulent and dominated by species of Euphorbia and Aloe. Most of the river valleys run along a northwest-southwest axis which results in unequal distribution of rainfall on respective north-facing and south-facing slopes since the rain-bearing winds blow from the south. The steep north-facing slopes are sheltered from the rain and also receive greater amounts of insulation adding to xerophilous conditions on these slopes.

This unit is considered least threatened with a conservation target of 24%. Only 0.8% is statutorily conserved, mainly in the Luchaba Wildlife Reserve and small patches are also conserved in the Oribi Gorge Nature Reserve. Approximately 15% has been transformed mainly by cultivation. Alien invasive species are a serious threat with *Chromolaena odorata*, *Lantana camara* and *Caesalpinia decapetala* being most problematic.

Swaziland Sour Bushveld

The Swaziland Sour Bushveld is located in the Mpumalanga province, Swaziland and marginally in KwaZulu-Natal. It occurs from Badplaas, Tjakastad east to the Piggs Peak area in the north, southwards through valleys around Manzini and slopes around the Grand Valley, with some isolated mountain outcrops in the lowveld plains, for example the Nkambeni Hills and the Bulungu Mountains.

The vegetation is characteristic of an open to closed, medium to tall tree layer with a closed well-developed grass layer. The landscape is very hilly with moderate to steep slopes. The unit is considered vulnerable with a conservation target of 19%. Only about 6% is statutorily conserved in mainly the Songimvelo, Ithala and Malalotja Nature Reserves, and a further 0.5% is conserved in the Mlilwane Game Sanctuary in Swaziland. Approximately 21% of this unit has been transformed by cultivation and plantations.



Figure 8-55: Swaziland Sour Bushveld.

Zululand Lowveld

The Zululand Lowveld occurs in the KwaZulu-Natal province, Swaziland and Mpumalanga province with the main extent occurring from around Big Bend south of Mkuze, Hluhluwe, Ulundi to just north of the Ongoye Forest. An isolated patch is found in the Swaziland-Mpumalanga border.

The landscape is extensively flat or only slightly undulating supporting a complex of various bushveld units ranging from dense thickets of *Dichrostachys cineria* and *Acacia* species, through park-like savanna with flat topped *A. tortilis* to tree dominated woodland with broad-leaved open bushveld with *Sclerocarya birrea* subspecies *caffra* and *A. Nigrescens*. Tall grassland types occur with sparsely scattered solitary trees and shrubs from a mosaic with the typical savanna thornveld, bushveld and thicket patches.

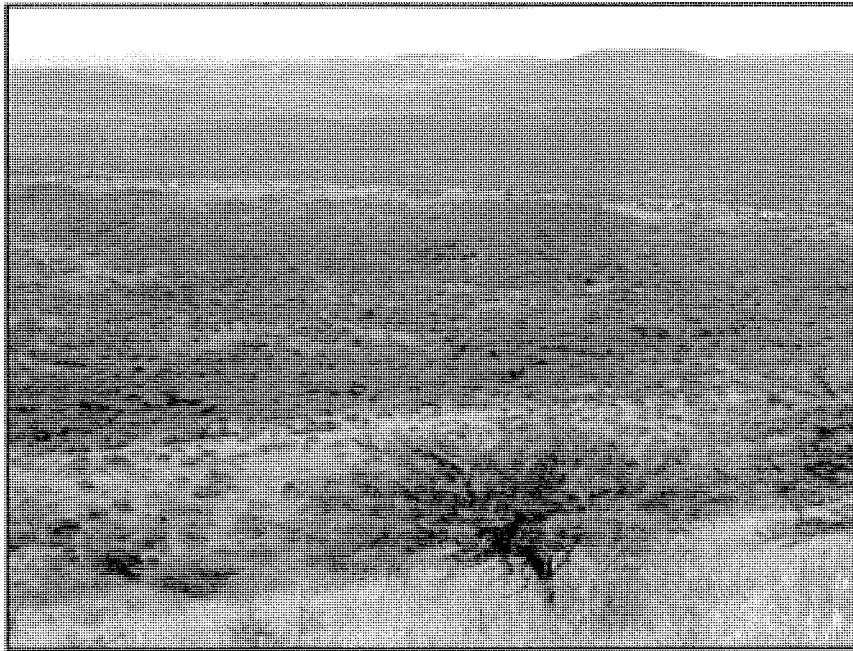


Figure 8-56: Zululand Lowveld

This unit is considered vulnerable with a conservation target of 19%. Approximately 11% is statutorily conserved mainly in the Hluhluwe-iMolozzi Park and Phongolapoort Nature Reserve. Almost 1% is protected in the private Masibekela Wetland. Much of the area between Magudu, Mkuze and Nongoma is managed as private game farms and lodges. Approximately 26% of the area has been transformed, mostly by cultivation.

Northern Zululand Sourveld

The Northern Zululand Sourveld occurs in the KwaZulu-Natal province and in Swaziland, from the Lusthof area in Swaziland southwards with scattered patches in northern Zululand in the surrounds of Hlomohlomo, east of Louwsburg, Nongoma and the vicinity of Ulundi including Nkandla. It occurs in the highest altitudes of the Hluhluwe-iMfolozi Park. The dominant structural vegetation type in this unit is wooded grassland, in places pure sour grasslands occur and rarely dense bushveld thickets. The terrain is low, undulating mountains and sometimes highly dissected.

This unit is considered vulnerable with a 19% conservation target. Only 4% is statutorily conserved, mainly in the Hluhluwe-iMfolozi Park and the Ithala Game Reserve. Approximately 22% of this unit is already transformed, mainly by cultivation and plantations.

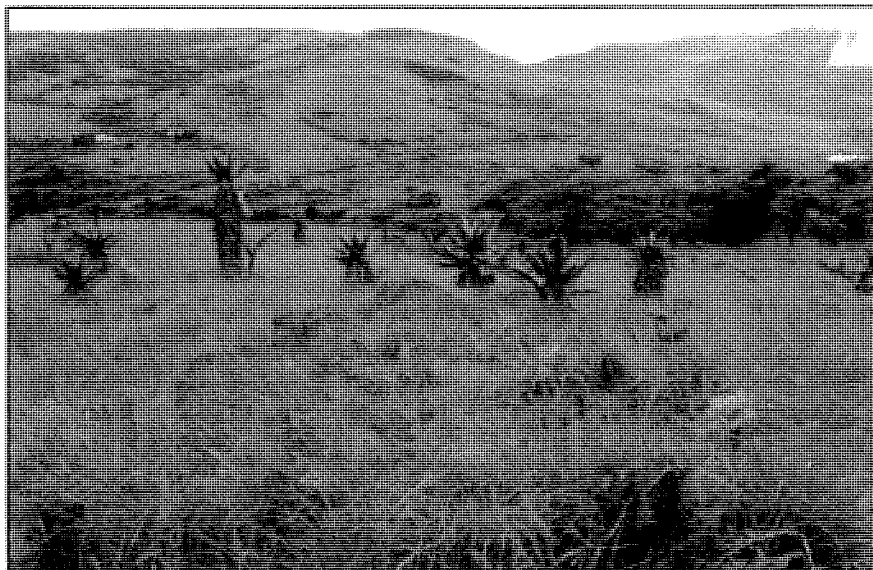


Figure 8-57: Northern Zululand Sourveld.

Ngongoni Veld

The Ngongoni Veld is located in the KwaZulu-Natal and Eastern Cape provinces, from Melmoth in the north to near Libode in the former Transkei (including Eshowe, New Hanover, Camperdown, Eston, Richmond, Dumisa, Harding, Lusikisiki and the Libode area). The vegetation is dense, with tall grassland overwhelmingly dominated by unpalatable, wry Ngongoni grass (*Aristida junciformis*), with this monodominance associated with low species diversity. Wooded (thornveld) areas are found in valleys at lower altitudes, where this vegetation unit grades into KwaZulu-Natal Hinterland Thornveld and Bhisho Thornveld. Termitaria, support bush clumps with *Acacia* species, *Cussonia spicata*, *Ziziphus mucronata*, *Cordia rudis*, *Ehretia rigida* etc.

This unit is considered vulnerable with a 25% conservation target. Only less than 1% of this unit is statutorily conserved in the Ophathe and Vernon Crookes Nature Reserves. Approximately 39% has been transformed for cultivation, plantations and urban development.

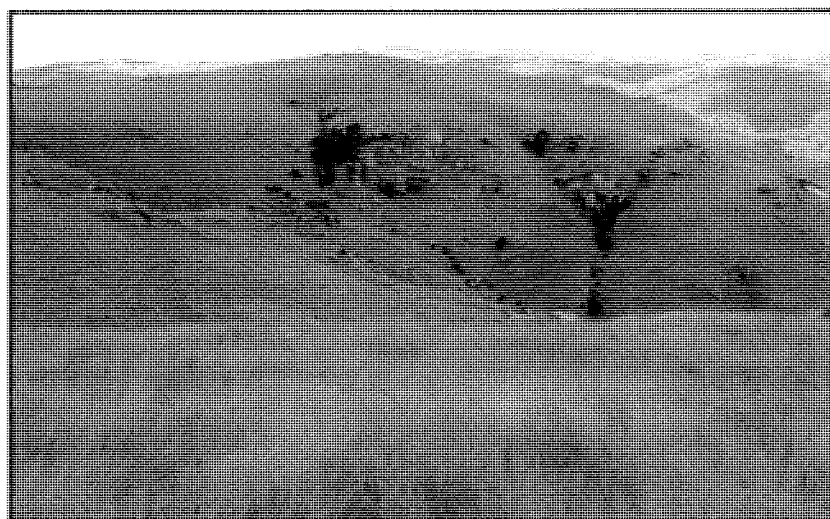


Figure 8-58: Ngongoni Veld to the south of Melmoth

Zululand Coastal Thornveld

The Zululand Coastal Thornveld only occurs in the KwaZulu-Natal province, immediately west of Mtubatuba (in the north) and Empangeni (in the south) bisected by the iMfolozi River, extending westwards for 10-20km. The area is characteristic of gently rolling landscapes supporting wooded grassland dominated by *Themeda triandra*. The bush clumps are a strong feature and are more numerous on deeper soils, with *Phoenix reclinata* and *Gymnosporia senegalensis* usually dominant. These plant communities are species rich relative to the surrounding vegetation units. They grade into dense Acacia woodland on dry slopes and riverine bushland thickets and Lowveld Riverine Forest in valley bottoms.

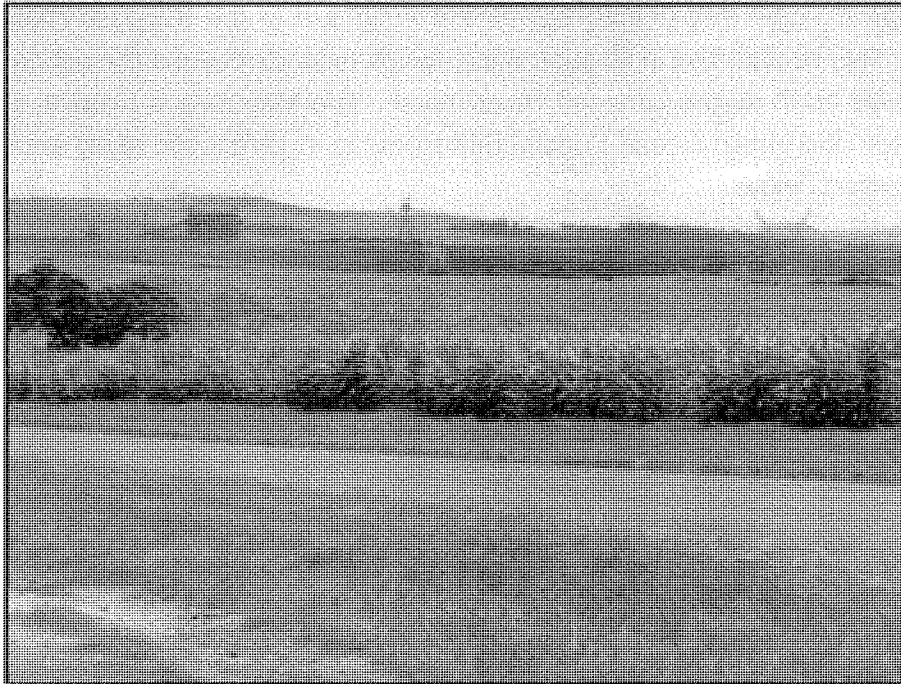


Figure 8-59: Sugar Cane Fields near Empangeni

This unit is considered endangered with a 19% conservation target. None of the area is protected in statutory conservation areas. It is highly transformed (58%), mostly by cultivation. This is high potential agricultural land, which is already much transformed to sugar cane. Most of the area is communal land. Large areas close to towns, such as Mtubatuba, are becoming an urban sprawl. Very little of the natural plant communities remain intact, heavy grazing has depleted the grasslands and wood harvesting has depleted the bush clumps, reducing them to the resistant and less useful species. Stunted forms of many of the woody species (e.g. *Euclea*, *Diospyros*, *Gymnosporia*, *Maytenus*) invade the grasslands in many places. Currently it is rare to find a site still with its natural plant composition. *Themeda triandra*, a 'decreaser species' has declined to critically low levels. Alien plant invasions are a threat, with *Chromolaena odorata* being the most problematic.

KwaZulu Natal Highland Thornveld

The KwaZulu-Natal Highland Thornveld vegetation unit occurs in the KwaZulu-Natal province, in patches scattered immediately above the Eastern Valley Bushveld unit, in river valleys mainly the

Mpisi (in the Thukela River catchment), Mvoti, Umgeni (below the Howick falls), Mlazi, Lufafa (vicinity of Ixopo) and Mtungwane (tributaries of the Mkomazi).

The vegetation is open thornveld dominated by *Acacia* species on undulating plains found on upper margins of river valleys. This unit is considered vulnerable with a 25% conservation target. None of this unit is currently conserved in statutory conservation areas. Approximately 22% has already been transformed by cultivation and some urban or built-up areas.

Indian Ocean Coastal Belt

The Indian Ocean Coastal Belt (IOCB) covers the seaboard in the KwaZulu-Natal and Eastern Cape provinces. This coastal belt in its subtropical facies extends beyond the national borders into Mozambique as far north as the Limpopo River mouth. The Maputaland Coastal Belt is the only vegetation unit from the Indian Ocean Coastal Belt biome in the proposed study area, a description of this unit is provided below:

Maputaland Coastal Belt

The Maputaland Coastal Belt occurs in the KwaZulu-Natal province (and continues into southern Mozambique), and occurs in an up to 35km broad strip along the coast of the Indian Ocean stretching from the Mozambique border in the north to Mtunzini in the south.



Figure 8-60: Maputaland Coastal Belt.

The landscape is characteristic of a flat coastal plain originally probably densely forested in places with a wide range of interspersed non-forest plant communities including dry grasslands (which include palm veld where special conditions prevail), hydrophilous grasslands and thicket groups. Today the vegetation landscape is composed of various forest types (separated into different vegetation units), thickets, primary and secondary grasslands, extensive timber plantations and cane fields.

This vegetation unit is classified as vulnerable with a conservation target of 25%. About 15% is statutorily conserved in the Greater St Lucia Wetland Park as well as Zileza, Enseleni and Amathikulu Nature Reserves. More than 30% has been transformed for plantations and cultivation

and by urban sprawl. Aliens include scattered populations of *Chromolaena odorata* and *Lantana camara*. This vegetation type has a relatively high number of plant taxa at the southernmost and northernmost limits of their distribution range.

Forests

Indigenous forests in South Africa is defined as “a generally multilayered vegetation unit dominated by trees (largely evergreen or semi-deciduous), whose combined strata have overlapping crowns (i.e. the crown cover is 75% or more), and where graminoids in the herbaceous stratum (if present) are generally rare”. The following types of forests are present in the study area and are outlined below:

- Northern Afrotropical Forests; and
- Southern Mistbelt Forests.

Northern Afrotropical Forests

The Northern Afrotropical Forests occur in the Free State, KwaZulu-Natal, Mpumalanga, North West, Gauteng and Limpopo provinces (as well as Lesotho), they are restricted to mountain kloofs and low ridges (Strydpoortberg, Waterberg, Pilanesburg, Witwatersrand, Magaliesburg, Suikerbosrand, Sekhukhuneland) interrupting the relatively flat northern Highveld. This group also comprises forests found in kloofs along the northern and eastern flanks of the Drakensburg and those found on the slopes and scarps of Low Escarpment between Van Reenen's Pass and Pongola Bush near Piet Retief. The westernmost localities of these forests are found in the Koranaberg (close to Thaba 'Nchu).

This vegetation unit is characteristic of relatively species-poor forests of afro-montane origin and some of them still show clear afro-montane character. They can be found in small patches in kloofs and on sub-ridge scarps at high altitudes. The canopy is usually dominated by *Podocarpus latifolius*, *Olinia emarginata*, *Halleria lucida*, *Scolopia mundii*, and rarely also by *Widdringtonia nodiflora*, in drier facies also by *Pittosporum viridiflorum*, *Celtis africana*, *Mimusops zeyheri*, *Nuxia congesta* and *Combretum erythrophyllum*. *Xymalos monospora* sometimes dominate patches of species-poor mistbelt forests of northern KwaZulu-Natal.

This vegetation unit is considered least threatened with a conservation target of 31%. Approximately 30% is statutorily conserved in uKhahlamba Drakensburg Park, Phongols Bush, Vryheid Mountain, Pocoman/Robinson's Bush, Ngome and Ncandu Nature Reserves, Magaliesburg Nature Area, Merville Ridge, Paardeplaats, Rustenburg, Suikerbosrand Nature Reserves, Marekele National Park and Pilanesburg Game Reserve. Some private nature reserves (e.g. Mooibron, Mhlongamvula, Tafelkop, Oudehoutdraai, Oshoek, and Ossewakop) protect some patches too. Occasional hot fires encroaching from the surrounding savanna woodlands, uncontrolled timber extraction, medicinal-plant harvesting, and grazing in forest can be viewed as current major threats.



Figure 8-61: Northern Afrotemperate Forest

Southern Misbelt Forests

The Southern Misbelt Forests occur in the KwaZulu-Natal and Eastern Cape provinces. These forests vary in size and occur in fire-shadow habitats on south and southeast facing slopes and located along the Great Escarpment, spanning a large area from Somerset East, the Amothole Mountains, scarps of Transkei to the KwaZulu-Natal Midlands as far east as Ulundi. In KwaZulu-Natal these forests are found in a wide band sandwiched between the Drakensburg Montane Forests and Northern KwaZulu-Natal Misbelt Forests at higher altitudes and Eastern Scarp Forests at lower altitudes.

On the Great Escarpment (Amothole, Transkei Escarpment) and in the KwaZulu-Natal Midlands these forests are tall (15-20m tall) and multilayered (having two layers of trees, a dense shrubby understorey and a well-developed herb layer). The forests found on low-altitude scarps are low (in places having the character of a shrub forest), and although less structured into different tree layers, they are still species rich. The tall forests show a mix of coarse-grained, canopy gap/disturbance driven dynamics and fine-grained, regeneration characteristics. Further east (Transkei, KwaZulu-Natal Midlands) *Podocarpus henkelii* become prominent in the canopy layer. Deciduous elements play an important role.

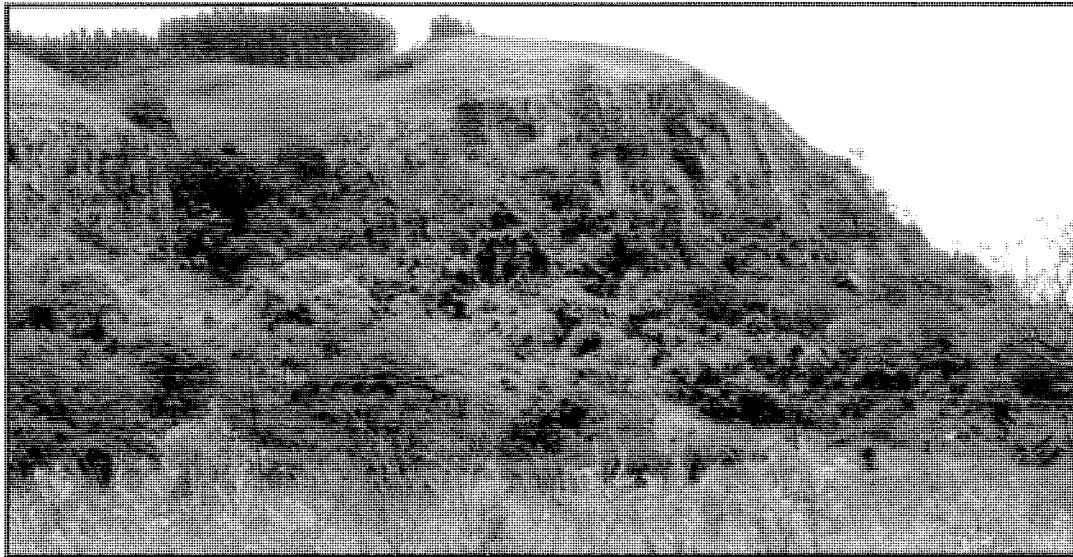


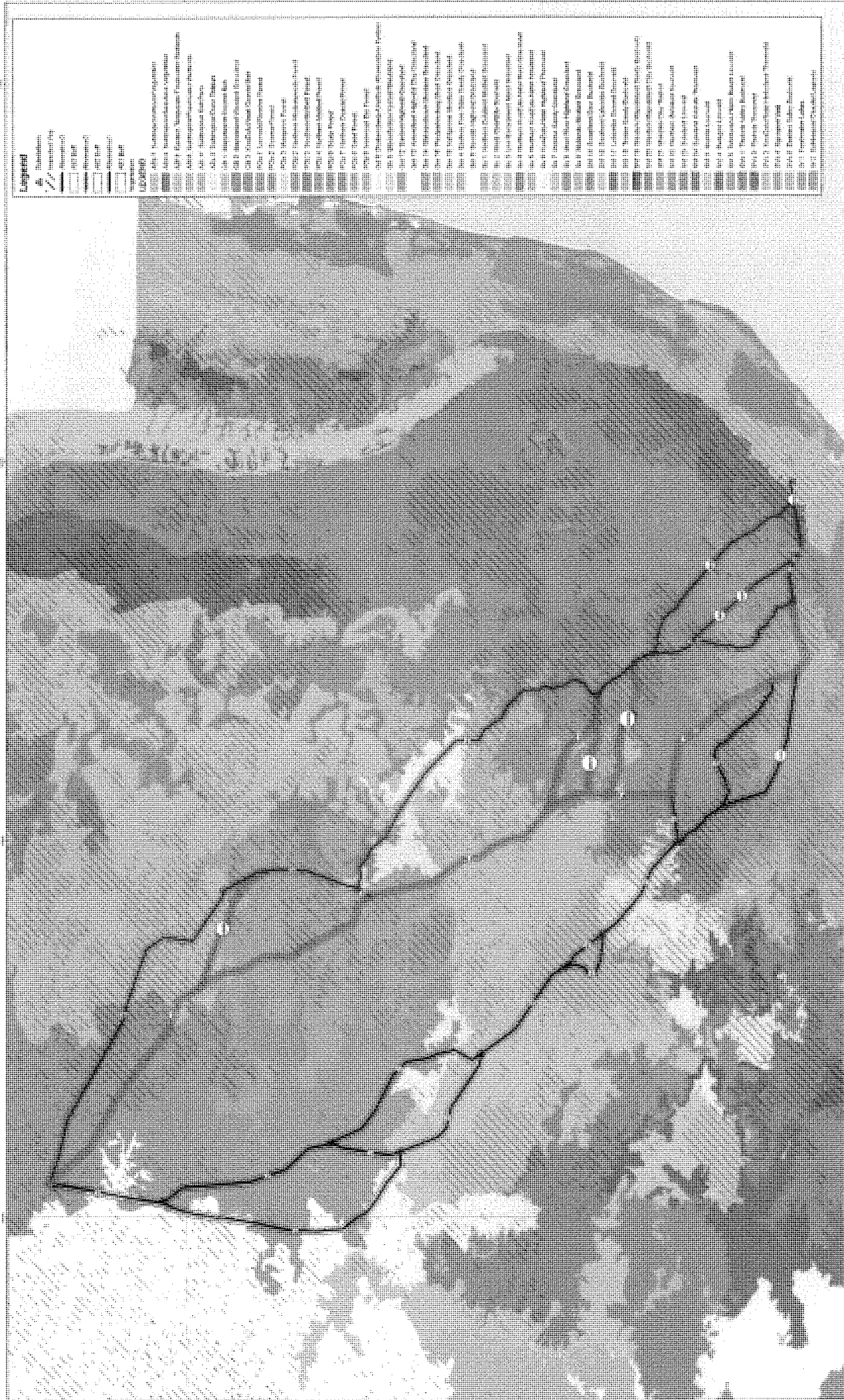
Figure 8-62: Southern Mistbelt Forest on the south slope of a mountain

Disturbance

A major factor found all over the study area is the disturbance of the natural vegetation. Large tracks of land have been changed by cultivation (forestry and sugarcane), mining (coal) and urbanisation. In addition to these there is the impact of subsistence living. Large sections of the tribal lands in Kwazulu Natal have been steadily changed in species composition through years of communal grazing, burning and agriculture. Figure 8-64 below provides an illustration of the scale of the disturbance across the study area. Some examples are also shown below.



Figure 8-63: Disturbances to natural vegetation found along the route



PROJ CODE:
ZP/12619

REF NO:
Ver 2

DATE DRAWN: 2011/02/10
AUTHOR: K. Kruger

PROJECTION:
WGS 84
Hafabeesthoek

SCALE:
1:373,357

DATA SOURCES:
Topo Mapsheets
Survey of General
Eskom Data

TITLE:
Vegetation Map



Figure 8-64: Disturbed Vegetation found along the corridors

Red data Flora Species

The red data species that potentially could occur along the route is listed in Appendix A. A total of 85 red data species potentially occur within the study area.

Site Description – Fauna

Invertebrates

A total of 796 arthropods and 308 butterflies are recorded for the study area. The large number is mainly due to the wide range of habitat available and the large area covered by the various alternatives.

Reptilia

A total of 96 reptilian species were recorded for the study site. The known red data species is the African Rock Python.

Amphibia

Thirty seven species of amphibians were recorded as occurring within the study area and are given in Appendix 1. These species are not restricted in terms of habitat or distribution and none of the species recorded are classified as Red Data species.

Mammalia

Mammal species diversity was low across the bulk of the study area, as very little natural habitat remains. Most of the mammals occur in small pockets of remaining natural vegetation or within games farms or reserves, with a total of 102 species being recorded. Six of these species are listed as endangered, including the Black Rhino, Tonga Red Squirrel, Marley's Golden Mole, Swinny's Horseshoe Bat, the Damara Woolly Bat and Sclater's Forest Shrew.

In addition 12 near threatened species that are included is Honey Badger, Serval, Spotted-necked Otter, Water Rat, Red Squirrel, Darling's Horseshoe Bat, Lander's Horseshoe Bat, Geoffrey's Horseshoe Bat, Anchieta's Pipistrelle, Temmick's Hairy Bat, Schreiber's Long Fingered Bat, and the Lesser Long Fingered Bat. Due to the habitat requirements for all the sensitive species mentioned above, there should be very little conflict with the proposed power line, with the exception being the Black Rhino. Several sections of the proposed routes near the Hluhluwe-Umfolozzi Park is aligned through areas that are prime Black Rhino habitat that have been earmarked by the KZN Provincial Government as an area with high conservation status.

8.1.9 Avi-Fauna

Data Collection and Methodology

An ornithology specialist, Mr Chris van Rooyen, was appointed by Zitholele Consulting to undertake an avi-fauna specialist study. The avi-fauna data was obtained from various published literature sources.

Regional Description

Vegetation structure, rather than the actual plant species, is more significant for bird species distribution and abundance (in Harrison et al 1997). Therefore, the vegetation description below does not focus on lists of plant species, but rather on factors which are relevant to bird distribution. The description of the vegetation types occurring in the study area largely follows the classification system presented in the Atlas of southern African birds (Harrison et al, 1997). The criteria used to amalgamate botanically defined vegetation units, or to keep them separate were (1) the existence of clear differences in vegetation structure, likely to be relevant to birds, and (2) the results of published community studies on bird/vegetation associations. It is important to note that no new vegetation unit boundaries were created, with use being made only of previously published data. The description of vegetation presented in this study therefore concentrates on factors relevant to the bird species present, and is not an exhaustive list of plant species present.

The dominant plants in the grassland biome are grass species, with geophytes and herbs also well represented. Grasslands are maintained mainly by a combination of the following factors: relatively high summer rainfall; frequent fires; frost and grazing. These factors generally preclude the growth of trees and shrubs. Sweet grassland is generally found in the lower rainfall areas. Vegetation is taller and sparser, and nutrients are retained in the leaves during winter. Relatively few bird species favour sweet grassland over sour or mixed grassland. Sour grassland generally occurs in the higher rainfall areas on leached soils. Vegetation is shorter and denser, and nutrients are withdrawn from the leaves during the winter months. Many grassland bird species show a preference for sour grassland over sweet or mixed. Mixed grassland is a combination or a transition between the two grassland types above.

Savanna (or woodland) is defined as having a grassy under-storey and a distinct woody upper-storey of trees and tall shrubs. Soil types are varied but are generally nutrient poor. The savanna biome contains a large variety of bird species (it is the most species-rich community in southern Africa) but very few bird species are restricted to this biome. It is also relatively well conserved compared to the grassland biome.

Two **forest** vegetation types are present in southern Africa, namely Afromontane Forest and coastal forest. The study area contains small areas of Afromontane Forest. The tree-canopy cover in forests is continuous and mainly comprises evergreen tree species. Below the

canopy, vegetation is multi-layered. Epiphytes, lianas and ferns are common in Afromontane Forest. The tall, dense trees result in little ground vegetation and a thick leaf litter. Forests only occur in frost-free regions with a relatively high rainfall and protected from fires. Afromontane forests in the study area are mainly confined to moist valleys which are protected from fires, surrounded by grassland.

Subtropical **thicket** is a closed shrubland to low forest dominated by evergreen, sclerophyllous or succulent trees, shrubs and vines, many of which have stem spines. It is often almost impenetrable, is generally not divided into strata, and has little herbaceous cover. Thicket occurs only in the extreme south of the study area.

Whilst much of the distribution and abundance of the bird species in the study area can be explained by the description of biome types above, it is even more important to examine the micro habitats available to birds. These are generally evident at a much smaller spatial scale than the biome types, and are determined by a host of factors such as vegetation type, topography, land use and man made infrastructure.

Site Description

The micro habitats observed in this study area during the field visit are described below.

- Wetlands and rivers: Both wetlands and dams are of particular importance for birds in the study area particularly for all three crane species that occur in the area. The area contains some very important wetlands and dams, e.g. Fickland Pan, BP's Dam, Clarens Pan, Wim Rabe Pan, Heyshoek Dam, Zaaihoek Dam, Wakkerstroom Vlei, a large wetland west of Utrecht called Boshoffsvlei, (just below the escarpment at the confluence of the Wasbankspruit and Dorpspruit) and Blood River Vlei and associated wetlands situated about halfway between Utrecht and Vryheid. Wakkerstroom Vlei is known to hold a significant proportion of the national Whitewinged Flufftail *Sarothrura ayresi* population, a globally endangered species. Apart from these, the study area also has permanent reed and sedge swamps, several seasonal pans, innumerable small sponges and seeps and numerous farm dams, particularly in the grassland areas (Tarbotton 2001). The study area contains hundreds of small perennial drainage lines for example the Slang River, Wielspruit, Sand River, Buffelspruit, Assegai River and many others. It also contains a few larger rivers, such as the Vaal River, Mhlatuze River, White Mfolozi and Pongolo River. Some drainage lines have been badly infested with Black Wattle. Amongst large terrestrial Red Data species it is especially the three cranes species that depend on shallow, vegetated wetlands that are unpolluted and not excessively disturbed by live-stock and fire (Young 2003). Wetlands are an important foraging habitat for the Southern Bald Ibis *Geronticus calvus* (Young 2003). It is also the preferred roosting and foraging habitat for the African Marsh Harrier *Circus ranivorus* (Hockey et al 2005). In the savanna biome, rivers and dams with shallow edges are important for large raptors and vultures for drinking and bathing purposes, and large trees in the riparian zone often serve as nesting and roosting substrate (Hockey et al 2005). Red Data stork

species such as Black Stork *Ciconia nigra*, Marabou Stork *Leptoptilos crumeniferus* and Woolly-necked Stork *Ciconia episcopus* are also forage in rivers and often roost in tall trees in the riparian zone (Hockey et al 2005). Thick riparian vegetation provides cover for shy species such as the African Finfoot *Podica senegalensis*.

- Grassland: A large portion of the northern part of the study area falls within the Ekwangala Grassland Biosphere Reserve (EGBR), which is regarded as the most important IBA (Important Bird Area) in the whole of South Africa (Important Bird Area SA020)(Barnes 1998). The importance of this area is largely due to it being some of the last remaining rolling grasslands left in South Africa. Rocky slopes, gullies and ravines contain thickets dominated by Ouhout *Leucosidea sericea*, forming thickets in places (Young et.al. 2003). Due to the short growing season, the grasslands in the study area have escaped much of the ecological carnage caused by the transformation of most grasslands into agricultural monocultures. The dominant land use is pastoral with cattle and sheep farming, which is more benign to the environment, resulting in much of the fauna and flora remaining intact. In the southern sections of the study area, the grazing pressure is a lot more intense, resulting in significant erosion and bush encroachment. The grassland habitat is of particular importance for several large, power line sensitive Red Data grassland “specialists” such as Southern Bald Ibis, Wattled Crane, Blue Crane, Grey Crowned Crane, Denham’s Bustard *Neotis denhami*, Blue Korhaan *Eupodotis caerulescens*, White-bellied Korhaan *Eupodotis senegalensis* and Black-bellied Korhaan *Lissotis melanogaster* (EWT 2011a; CAR 2011; Glen Ramke 2011; Young 2003; Hockey et al 2005). The savanna biome also contains grassland areas, which are important for Red Data species such as Blue Crane, Secretarybird *Sagittarius serpentarius*, White-bellied Korhaan and Black-bellied Bustard (CAR 2011; Hockey et al 2005).
- Woodland: The state of the woodland varies from relatively intact in places to a relatively poor state with evidence of heavy overgrazing and pedestrian traffic very evident near towns and settlements. In some areas there has been significant bush encroachment, partly due to sustained overgrazing for more than a century (Young et al 2003). The woodland habitat is generally less sensitive as far as bird habitat is concerned, but some large terrestrial species have been recorded such as Secretarybird and Southern Ground-Hornbill (SABAP2 2011). The woodland habitat is generally less critical as far as large terrestrial species are concerned, but it forms the stronghold of Red Data raptors species such as White-backed Vulture *Gyps africanus*, Cape Vulture *Gyps coprotheres*, Martial Eagle *Polemaetus bellicosus*, Tawny Eagle *Aquila rapax*, and Lappet-faced Vulture *Torgos tracheliotis* (Hockey et al 2005; SABAP2 2011).
- Commercial timber and sugar cane: On the eastern side of the study area, between Ermelo and Piet Retief, and around Vryheid and Paulpietersburg, significant afforestation has taken place over the past fifty years (Young et al 2003). Apart from commercial plantations, there are stands of predominantly *Eucalyptus* species, presumably originally planted as windbreaks. They may be significant for birds in terms of roosting or nesting as few indigenous tall trees exist in the landscape. However, they do not represent an important micro-habitat in the context of this study. In the south near Mbewu substation,

large areas have been converted to sugar cane. The afforestation and sugar cane plantations have caused irreparable damage to the natural habitat, resulting in those areas becoming unsuitable for large terrestrial species.

- Arable land: Limited crop cultivation is practiced, often in conjunction with irrigation, but the sandy soils are generally not very nutrient rich, therefore cultivation is limited. Crops include maize, wheat, sorghum, soya beans, sunflower and a few pastures. This habitat has some importance for cranes, particularly the Grey Crowned Crane and to a lesser extent Blue Cranes, as well as White Storks *Ciconia ciconia*, particularly irrigated pivots. Blue Cranes and Grey Crowned Cranes sometimes use harvested maize fields for foraging (Tarbotton 2001; Young 2003).
- Afromontane Forest: There are several isolated patches of Afromontane forest on southern slopes in the study area. The most extensive patch of Afromontane forest occurs in the Pongolo Bush Nature Reserve, near Paulpietersburg and in the central part of the study area between Vryheid and Ulundi. This habitat is not frequented by most power line sensitive Red Data species, but habitat destruction could be an impact on Red Data forest species such as African Crowned Eagle *Stephanoaetus coronatus* and Orange Ground-Thrush *Zoothera gurneyi*.

Sensitivities

A total of 44 Red Data have to date been recorded by SABAP2 in the QDGCs that are bisected by the various alignments. The table below gives a list of Red Data species with a summary of potential impacts, habitat requirements and biome where impacts could be expected.

Table 8-4: Red Data species recorded by SABAP2 in the study area.

Species	Conservation status	CO	HDD	Preferred habitat (CAR 2011; EWT 2011a; Ramke 2011; Hockey <i>et al</i> 2005; Young <i>et al</i> 2003; Taylor <i>et al</i> 1999; Personal obs.)	Biome
African Marsh Harrier	V	x	x	Wetlands and adjacent grasslands	Grassland and savanna
Southern Bald Ibis	V	x		Cliff faces used for breeding, grassland (particularly burnt), wetlands	Grassland and savanna
Black Harrier	NT	x		High-lying grasslands	Grassland
Black Stork	NT	x		Cliffs, rivers, dams and pans	Grassland and savanna
Black-bellied Korhaan	NT	x		In tall rank grassland	Grassland and savanna
Blue Crane	V	x		Occurs in grassland, wetlands and in harvested maize fields	Grassland and savanna to a lesser extent
Blue Korhaan	NT	x		Occurs widely on the higher lying areas in open flat grassland, preferring shortly grazed areas	Grassland
Cape Vulture	V	x		Cliff faces, but ranges wide over surrounding areas	Woodland
Grey Crowned Crane	V	x		Wetlands, marshes and harvested maize fields	Grassland and savanna to a lesser extent
African Crowned Eagle	NT	x		Afromontane forest	Forest
Grass Owl	V	x	x	Requires rank grassland of at least 75cm high, on the edges of wetlands	Grassland and savanna to a lesser extent
Greater Flamingo	NT	x		Open shallow, eutrophic wetlands	Grassland
Southern Ground Hornbill	V	x		Open woodland, also grassland with few scattered trees	Savanna
Lanner Falcon	NT	-	-	Anywhere in the study area in all habitat types	Grassland and savanna
Martial Eagle	V	x		Occurs widely but sparsely. More common in woodland	Savanna
Secretarybird	NT	x		Grassland and open woodland	Grassland and savanna
Denham's Bustard	V	x		High-lying grasslands but also below the escarpment in grassland habitat. Limited use of stubble lands	Grassland and savanna to a lesser extent
Tawny Eagle	V	x		Woodland	Savanna
Wattled Crane	C	x		Extensive wetlands in high lying grasslands	Grassland
African Whitebacked Vulture	V	x		Woodland	Savanna
White-bellied Korhaan	V	x		Dense grassland. Most common in the interface between grassland and savanna	Grassland and savanna
Woolly-necked Stork	NT	x		Rivers and large dams	Savanna
Bateleur	V	x		Woodland	Savanna

Black-winged Lapwing	NT	-	-	-	Short grassland	Grassland
Blue Swallow	C		X		High rainfall, short montane grassland next to streams	Grassland
Botha's Lark	E	-	-	-	Short, heavily grazed upland grassland	Grassland
Corn Crane	V	-	-	-	Rank moist grassland, but also in dry grassland in open savanna	Grassland and savanna
Great White Pelican	NT	X			Large pans and dams	Savanna
Greater Painted Snipe	NT	-	-	-	Vegetated waterside habitats with exposed mud	Savanna
Half-collared Kingfisher	NT	-	-	-	Clear, well vegetated, fast-flowing streams	Grassland
Lappet-faced Vulture	V	X			Woodland	Savanna
Lesser Flamingo	NT	X			Open shallow, eutrophic wetlands	Grassland
Lesser Kestrel	V	-	-	-	Grassland	Grassland
Marabou Stork	NT	X			Woodland and rivers	Savanna
Melodious Lark	NT	-	-	-	Fairly short climax grassland with open spaces between tuffs	Grassland
Pallid Harrier	NT	X			Grasslands associated with open pans or floodplains, also croplands	Grassland
Orange Ground-Thrush	NT	-	-	-	Afromontane forest	Forest
Red-billed Oxpecker	NT	-	-	-	Woodland	Savanna
Peregrine Falcon	NT	X			Areas with high cliffs	Savanna
Rudd's Lark	C	-	-	-	High altitude grassland with short dense grass	Grassland
White-headed Vulture	V	X			Woodland	Savanna
White-winged Flufftail	C	-	X		Dense sedges in permanent marshes with moist or shallow ground	Grassland
Yellow-billed Stork	NT	X			Shoreline of freshwater bodies	Grassland and savanna
Yellow-breasted Pipit	V	-	-	-	Lush montane grassland	Grassland

8.1.10 Sensitive and Protected Areas

Data Collection and Methodology

As part of the approval of the Scoping Report and the PoSEIA the DEA requested that the protected and sensitive areas along the routes be identified and avoided through the impact assessment. This section aims to satisfy that request.

Data was obtained from the Draft National List of Threatened Ecosystems (Gazette No 32689, November 2009). This was supplemented with the SANBI and DEAT publication, Draft Threatened Ecosystems in South Africa: Description and Maps, May 2009. These two reports provided a list of the threatened ecosystems as per the National Environmental Management: Biodiversity Act (Act 10 of 2004).

Furthermore the SANBI National Protected Areas Expansion Strategy database was also used to identify focus areas for protected areas for future expansion as well as the existing formal and informal protected areas encountered along the alternative corridors.

Site Description

Threatened Ecosystems

The following threatened ecosystems were found along the routes with the route segment indicated in brackets:

- Critically Endangered - none
- Endangered;
 - Bivane Montane Grassland (KD);
 - Chrissiesmeer panveld (AP, AM);
 - Ngame Mistbelt and Forest (MN, PO); and
 - Wakkerstroom/Luneberg Grassland (BK, BC).
- Vulnerable;
 - Bivane Sour Grassland and Bushveld (PO);
 - Eastern Temperate Freshwater Wetlands (Various);
 - Imfolozi Savanna and Sourveld (SIJ, SOI, OI);
 - KaNgwane Montane Grassland (AP, SAM, AM);
 - Low Escarpment Mistbelt Forest (BK, KD); and
 - Paulpietersburg Moist Grassland (AM, MP, AP).

Unfortunately the spatial database is not yet available electronically and therefore a GIS map of the areas could not be produced.

Protected Areas

The route alignments of the various alternatives avoid all the existing formal and informal protected areas as shown in the figures below. The following protected areas occur within 10 km of the routes (SANBI):

- Informal Protected Areas
 - Emlwane Game Park;
 - Utrecht Town Park;
 - Balele Enlanzeni Valley Game Park; and
 - Wakkerstroom Wetland Nature Reserve.
- Formal Protected Areas
 - Sibudeni Nature Reserve;
 - Mome Nature Reserve;
 - Nkandla Forest Reserve;
 - Vungwini Nature Reserve;
 - Enseleni Nature Reserve;
 - Fundimvelo Nature Reserve;
 - Ophate Game Reserve;
 - Matshitsholo Nature Reserve;
 - Ntinini Training Center;
 - Hluhluwe-Imfolozi Game Reserve;
 - Vryheid Mountain Nature Reserve; and
 - Ithala Game Reserve.

When considering the National Protected Area Expansion Strategy (NPAES) there are several of the potential expansion focus areas that fall within the route corridors. The focus areas are:

- Maputland Delagoa Imfolozi;
- Moist Escarpment Grassland; and
- Thukela.

As shown on the figures below there is no single route that can be taken to avoid all the NPAES focus areas.

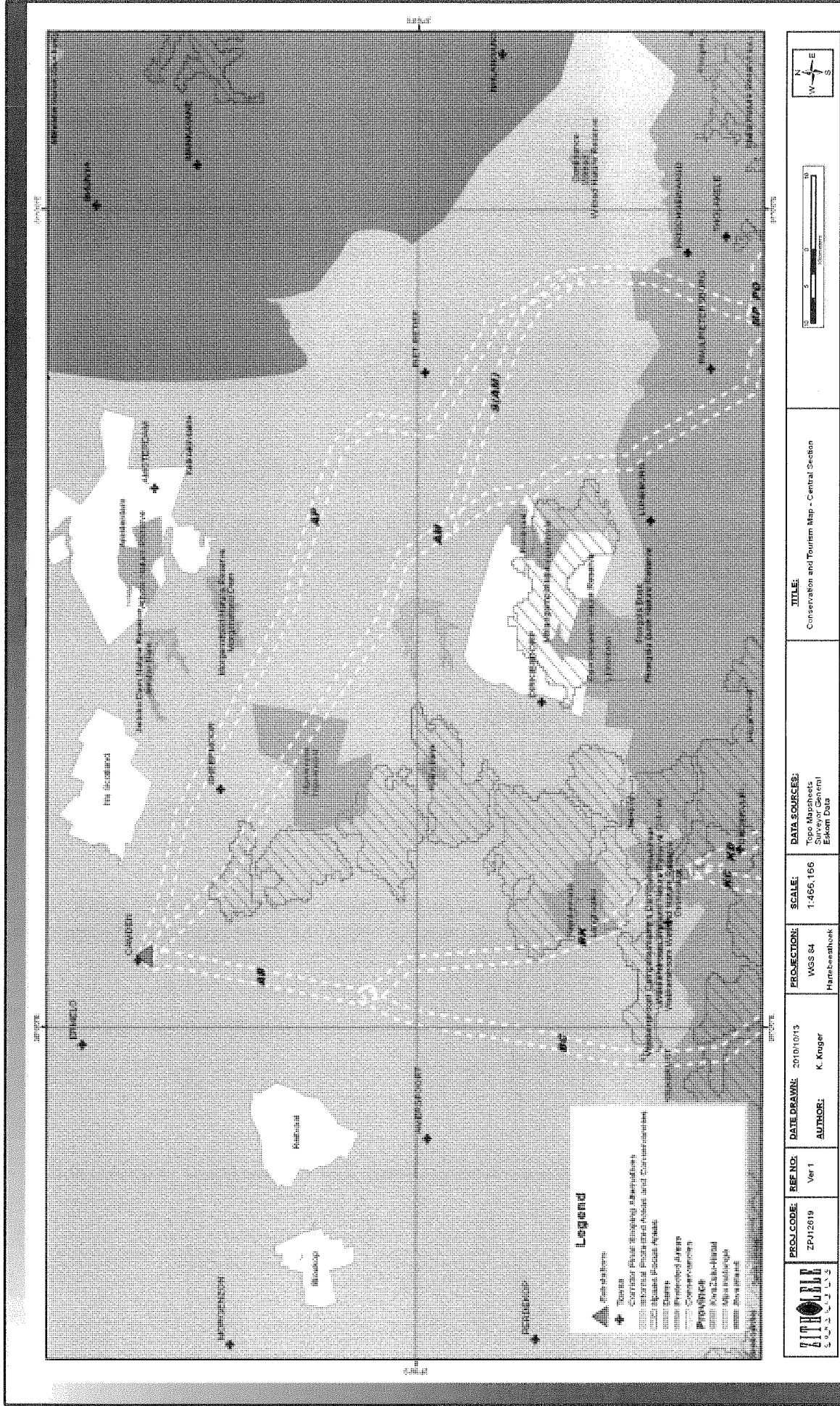


Figure 8-65: Protected areas in the northern portion of the study area.

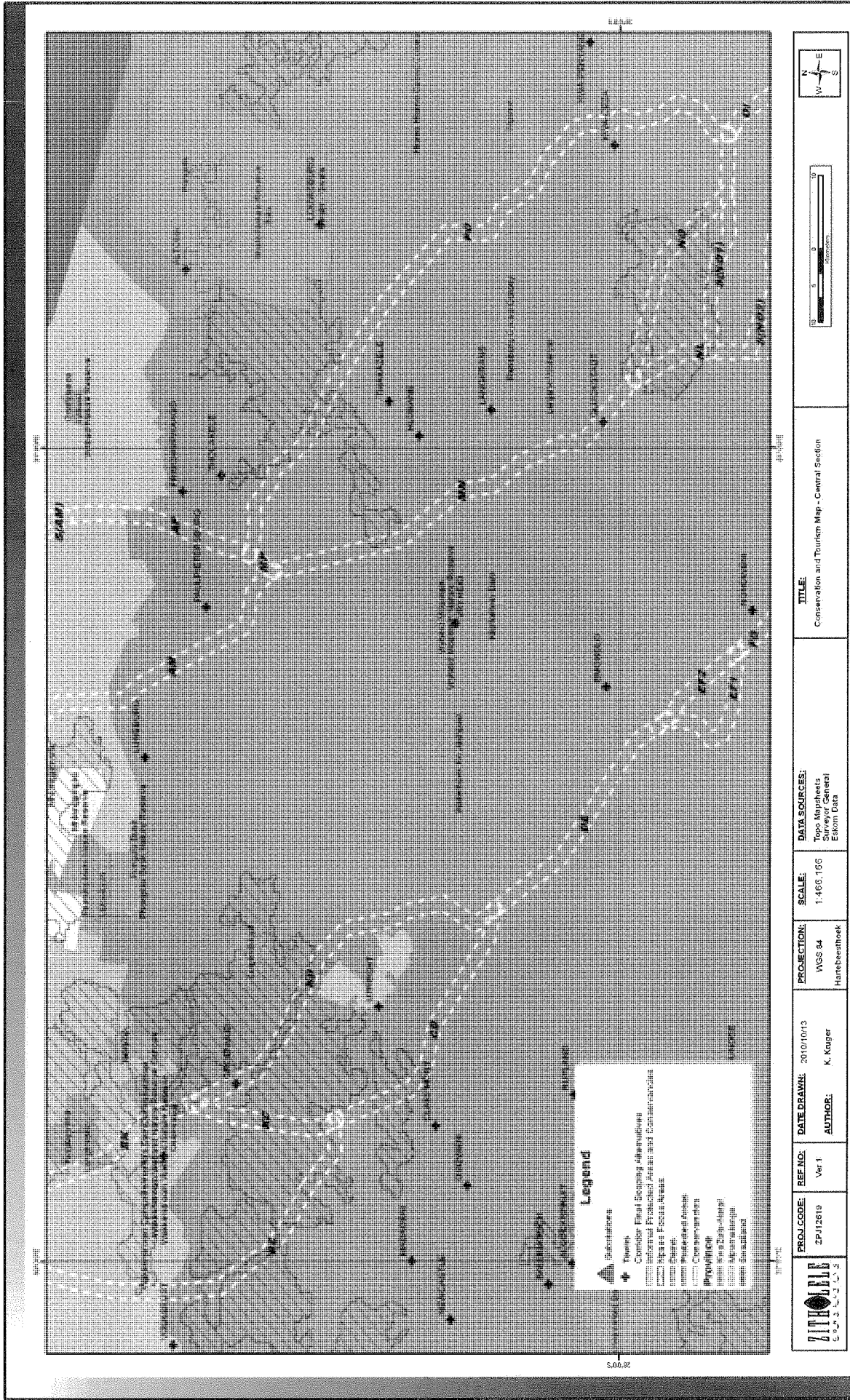


Figure 8-66: Protected areas in the central portion of the study area

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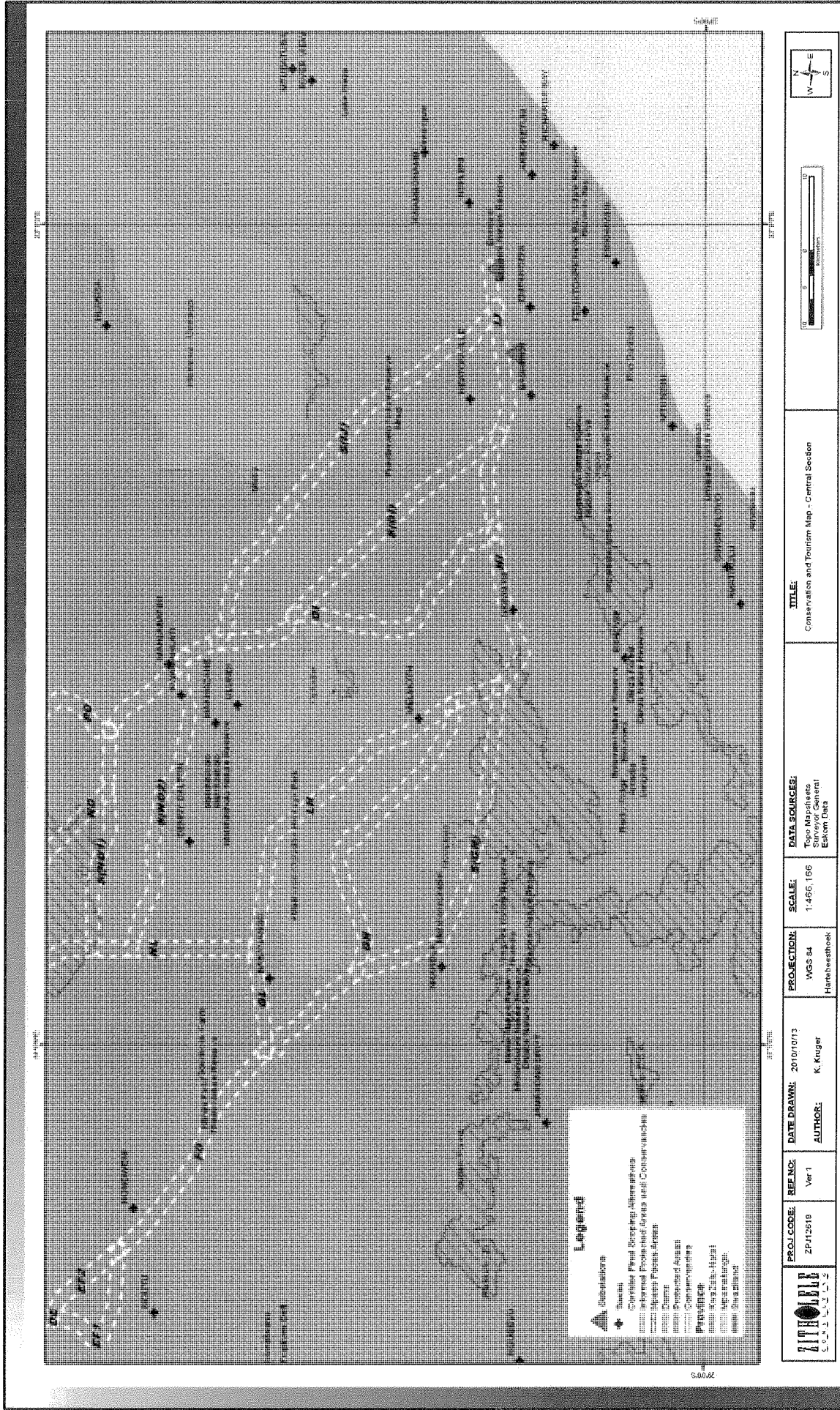


Figure 8-67: Protected areas in the southern portion of the study area

8.1.11 Visual

The proposed power lines are aligned through a wide variety of landscapes, from grazed plains, to Pine and Eucalyptus plantations to mountains and the rolling hills of KwaZulu Natal and the sugar cane plantations of the lowlands. The bulk of the study area is utilised for agriculture with a varying topography.

A number of other existing power lines are found throughout the area including high voltage transmission lines similar to the new lines proposed. However due to the mainly agricultural nature of the land any linear infrastructure like existing power lines and roads featuring prominently in the landscape.

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 power line may be visible (viewshed);
- Identify the locations from which views of the proposed power line 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 power line; 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 52 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 power lines 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 power lines are 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 8-5 have been determined and used in the Visibility Assessment. The criteria are defined in more detail in the subsection following.

Table 8-5: Visual Impact Assessment Criteria

Criteria	Definitions
Category of Viewer	
Static	Farms, homesteads or industries
Dynamic	Travelling along road
View Elevation	
Above	Higher elevation than proposed power lines.
Level	Level view with power lines
Below	Lower elevation than power lines 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 power lines 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 power lines 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 power line infrastructure is constantly changing as well as the visual relationship between the proposed power line 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 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 power line 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 power lines it will mostly be viewed against the sky. The degree of visual contrast between white coloured structures 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. The photos below illustrate this effect, where the view from above is far less visible.

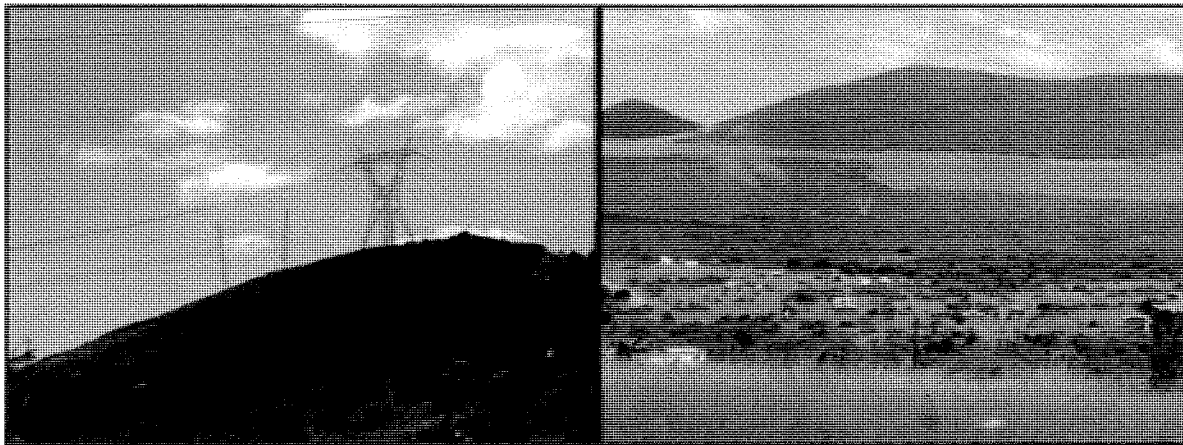


Figure 8-68: Difference in view from below (left) and above (right)

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 power line will generally be associated with farm houses, informal settlements and a couple of towns located within the viewshed. Short term and moderate term views will generally relate to commuters 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 10.
- 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 power line 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 power line 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 power lines some people perceive them in a positive manner because they represent progress essential to the economy of South Africa and contributing the local and national economy. On the other hand some people perceive them negatively due to the large structures that impact on the unspoilt natural landscape.

The potential visual impact of the proposed power line 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 power line and the surrounding landscape will result from one or more of the following visual characteristics:

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

Site Description

Landscape Character

The northern section of the study area can be described as an agricultural landscape with intermittent mining and power generation activities. The proposed Alternative 1 power line will be located on a slope starting at Ermelo (Camden) and moving down the slope towards Volksrust over land that is mainly used for maize and grazing with some isolated sport of tourism like Wakkerstroom. This area has very little screening from topography or vegetation due to the relatively flat nature of the area and the mainly grassland vegetation. Please refer to Figure 8-4 for the topography of the site. The Alternative 2 and 3 alignments traverse eastwards to Piet Retief before turning southwards towards Paul Pietersburg. This area is characterised by large stands of Pine, Poplar and Bluegum plantations forming monocultures. Here the plantations will provide quite significant levels of screening when the plantations are near maturity, however due to the harvesting schedule, there will be a cycle when the visibility will be high when the trees are removed until such time that they have regrown.

In the central section of the study area the routes move down the escarpment and the vegetation changes from grassland to savanna. Alternative 1 traverses through the relatively pristine areas past Groenvlei before entering the farm and tribal lands past Utrecht to Nqutu. Alternatives 2 and 3 traverses from the high lying areas around Paul Pietersburg to the rolling savanna hills around Vryheid and Gluckstadt. The bulk of these areas are open savanna with little cover that can shield the power lines, with the exception being small patches of forestry around Gluckstadt.

In the southern section Alternative 1 traverses through Melmoth and the area has become typified by rolling hills and ridges and the coverage is dominated by plantations and sugarcane fields. Once down the ridges the route turns eastward along the Nkwadini Valley which is a fertile stretch of land with numerous fruit and sugarcane farms. Alternatives 2 and 3 enter the very hilly areas around Ulundi and finally stopping at Empangeni. This area is very hilly with mostly natural scrub

vegetation that provides good cover at short distances, but it is too short to be effective over longer distance views.

There are several major rivers in the area, including the Vaal and White Umfolozi to name but a few. For an illustration of the surface water features please refer to Figure 8-33.

The landscape surrounding the proposed power line Alternatives vary quite substantially and hence so does the screening for the proposed power line. There are also several existing power lines on site. Figure 8-69 below provides a view of some the existing power lines found along the route. Note how the different structures and vegetation influence the visibility of the lines.



Figure 8-69: View of existing power lines in the study area.

Viewshed

It should be noted that the viewsheds for each of the alternatives, which are plotted on the figures below, are an approximation that may vary in some locations. Potential views to the proposed power line 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 power line 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 Alternatives 2 and 3 are relatively small, considering they follow a very similar alignment.

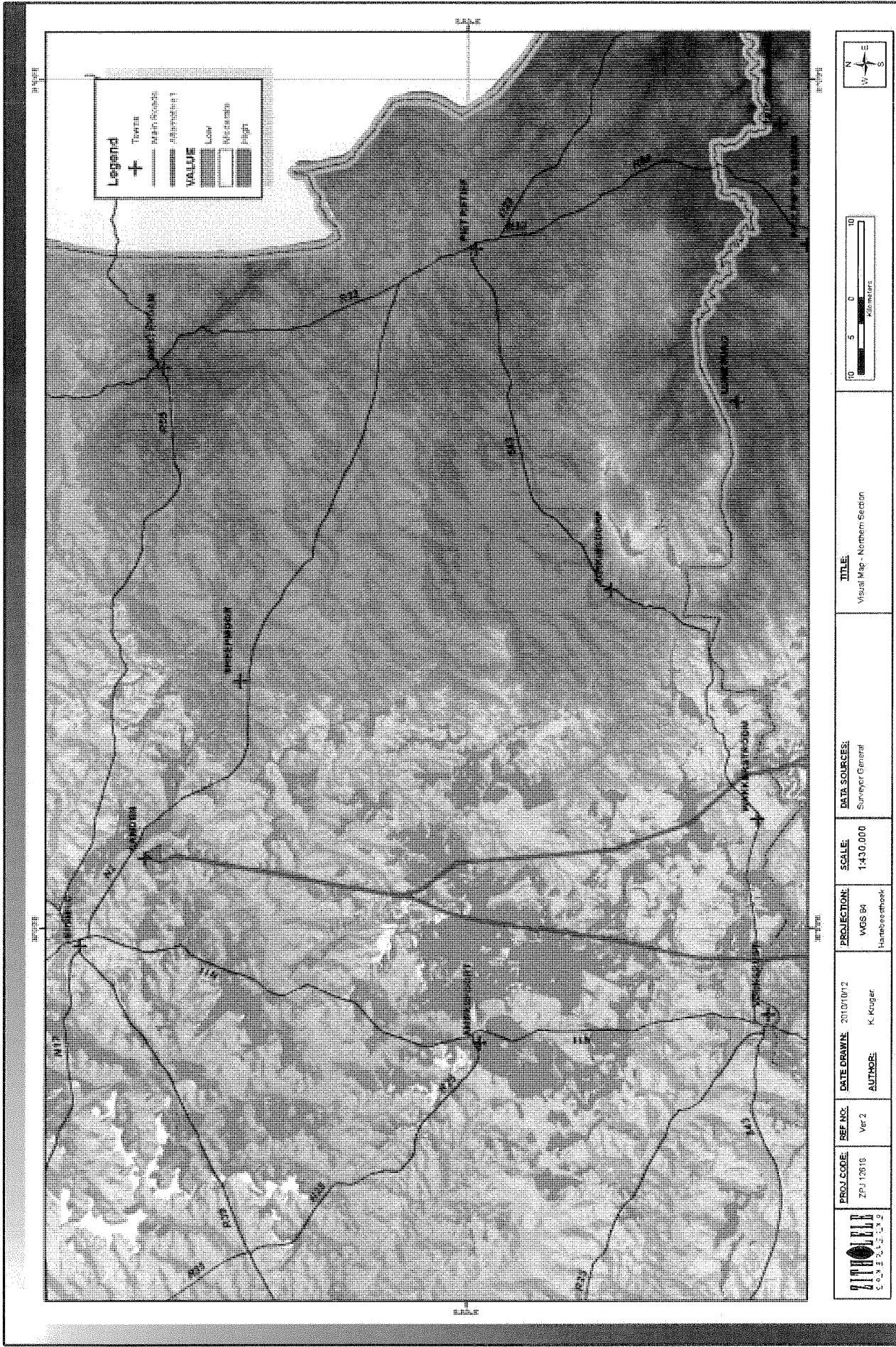


Figure 8-70: Visual Impact from the Alternative 1 alignment.

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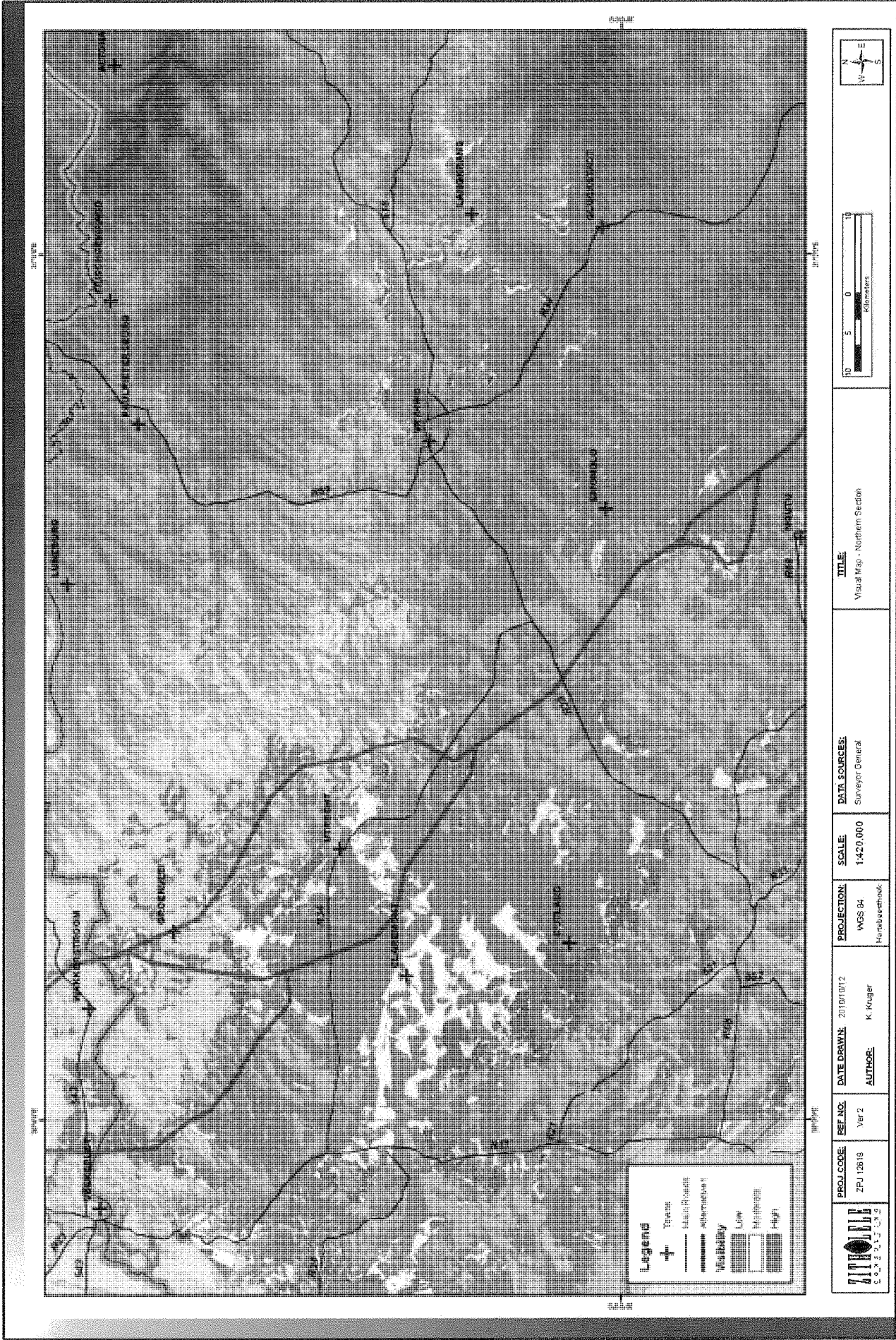


Figure 8-71: Visual Impact from the Alternative 1 alignment

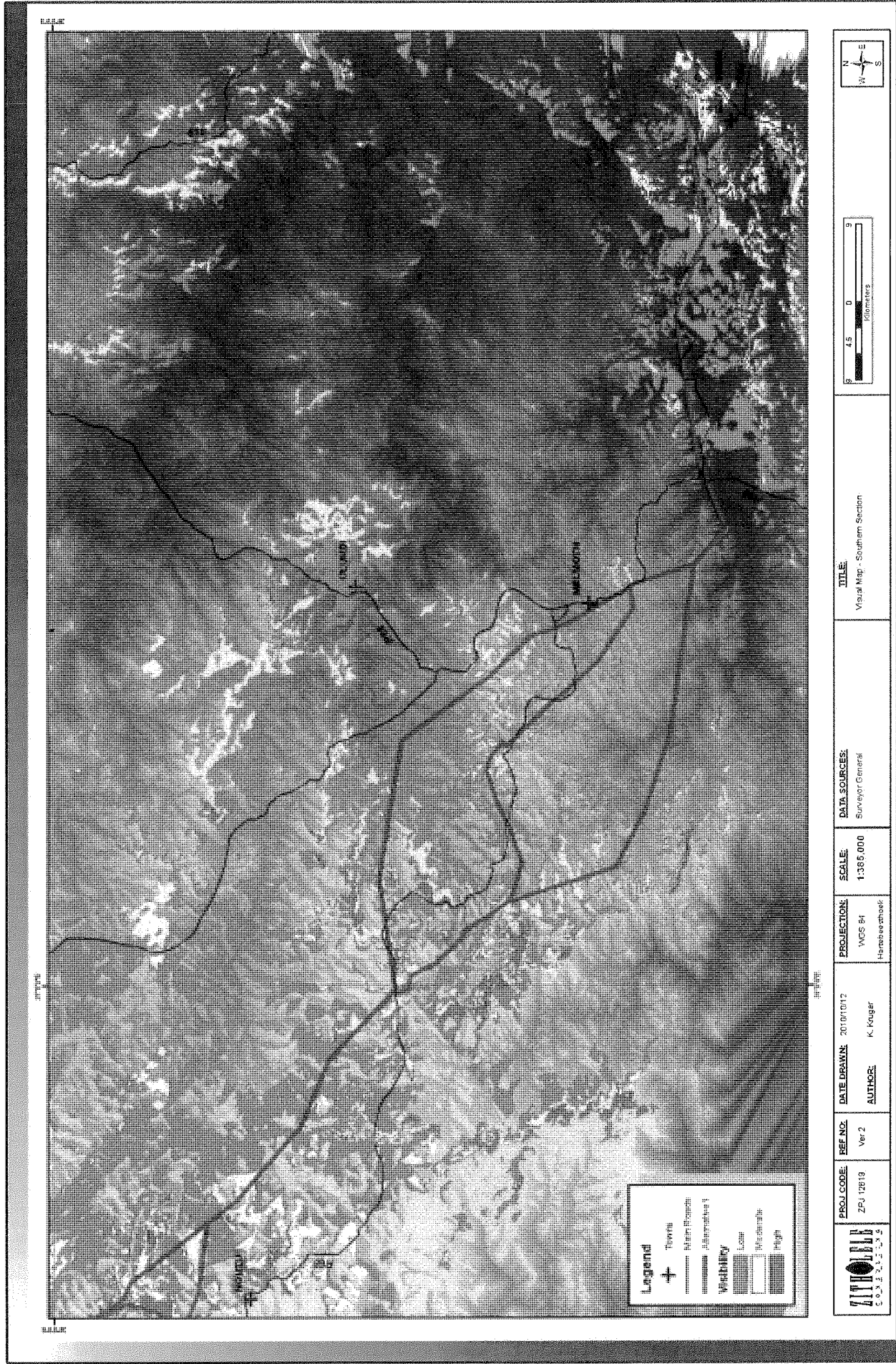


Figure 8-72: Visual Impact from the Alternative 1 alignment

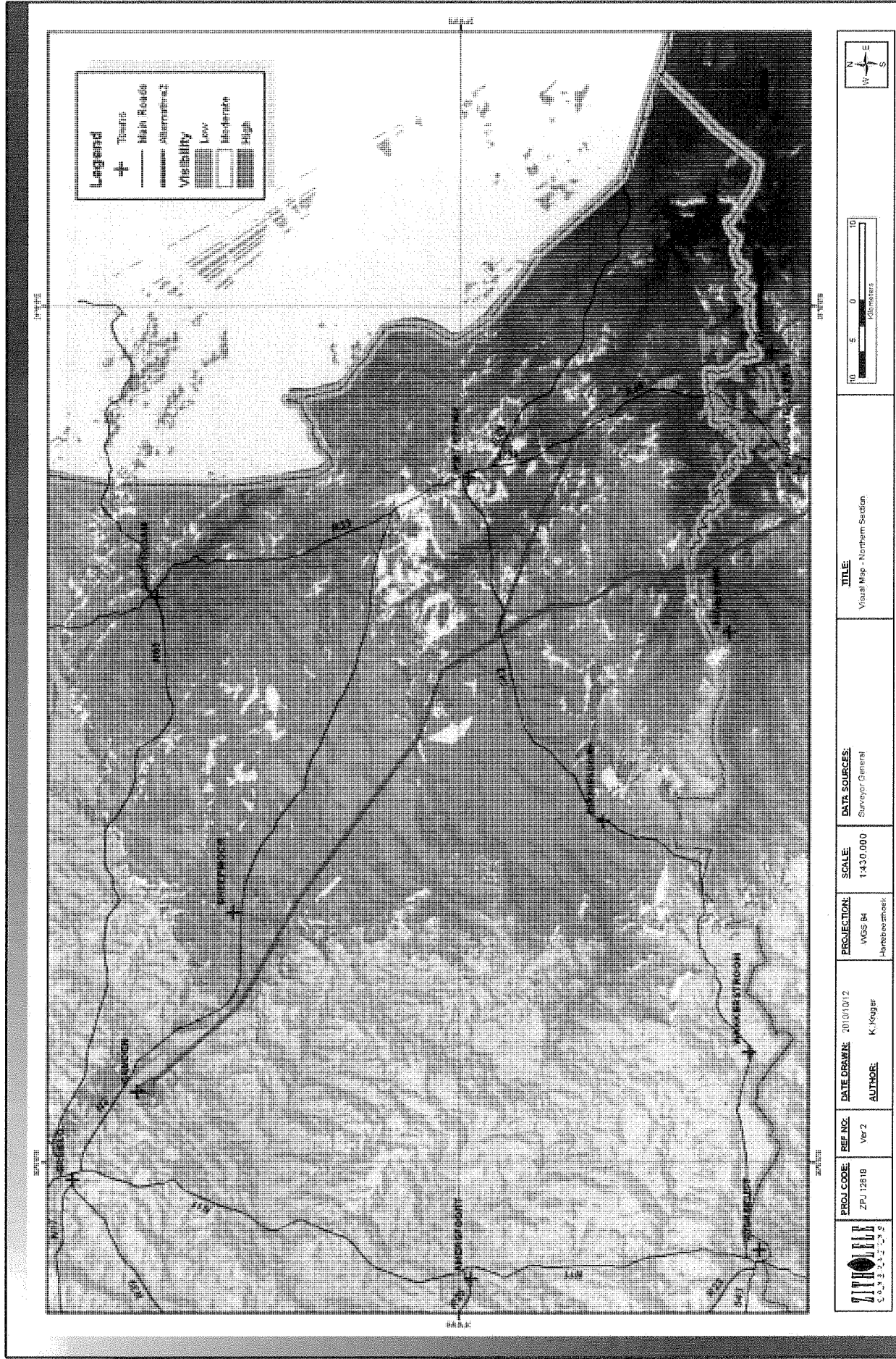
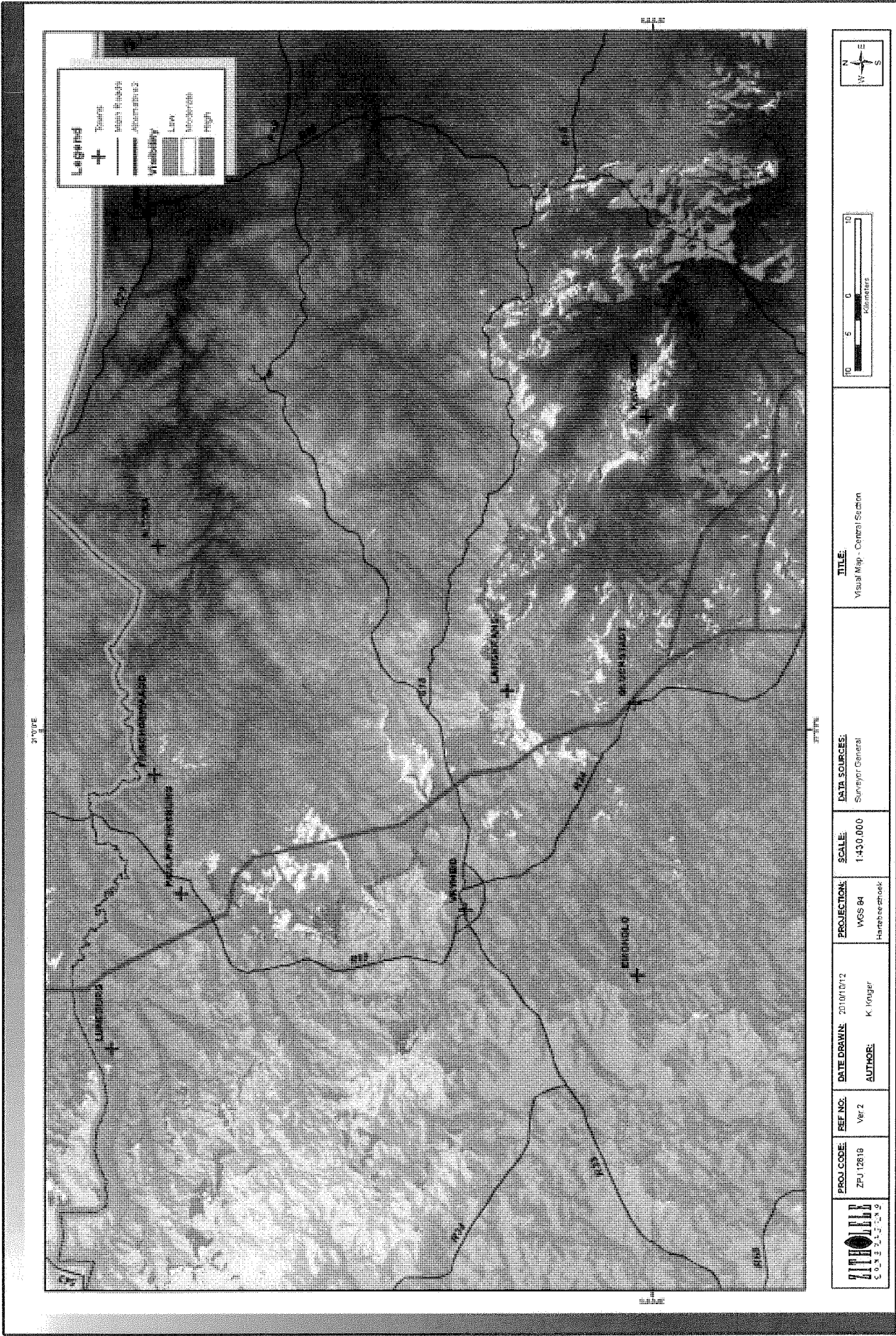


Figure 8-73: Visual Impact from the Alternative 2 alignment



PROJ CODE:
ZPJ 12619

REF NO:
Ver 2

DATE DRAWN: 2010/07/2

AUTHOR:
K. Vinger

PROJECTION:
WGS 84
Horizontal only

SCALE:
1:430,000

DATA SOURCES:
Surveyor General

TITLE:
Visual Map - Central Station

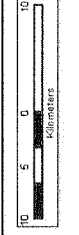


Figure 8-74: Visual Impact from the Alternative 2 alignment

ZITHOLELE CONSULTING

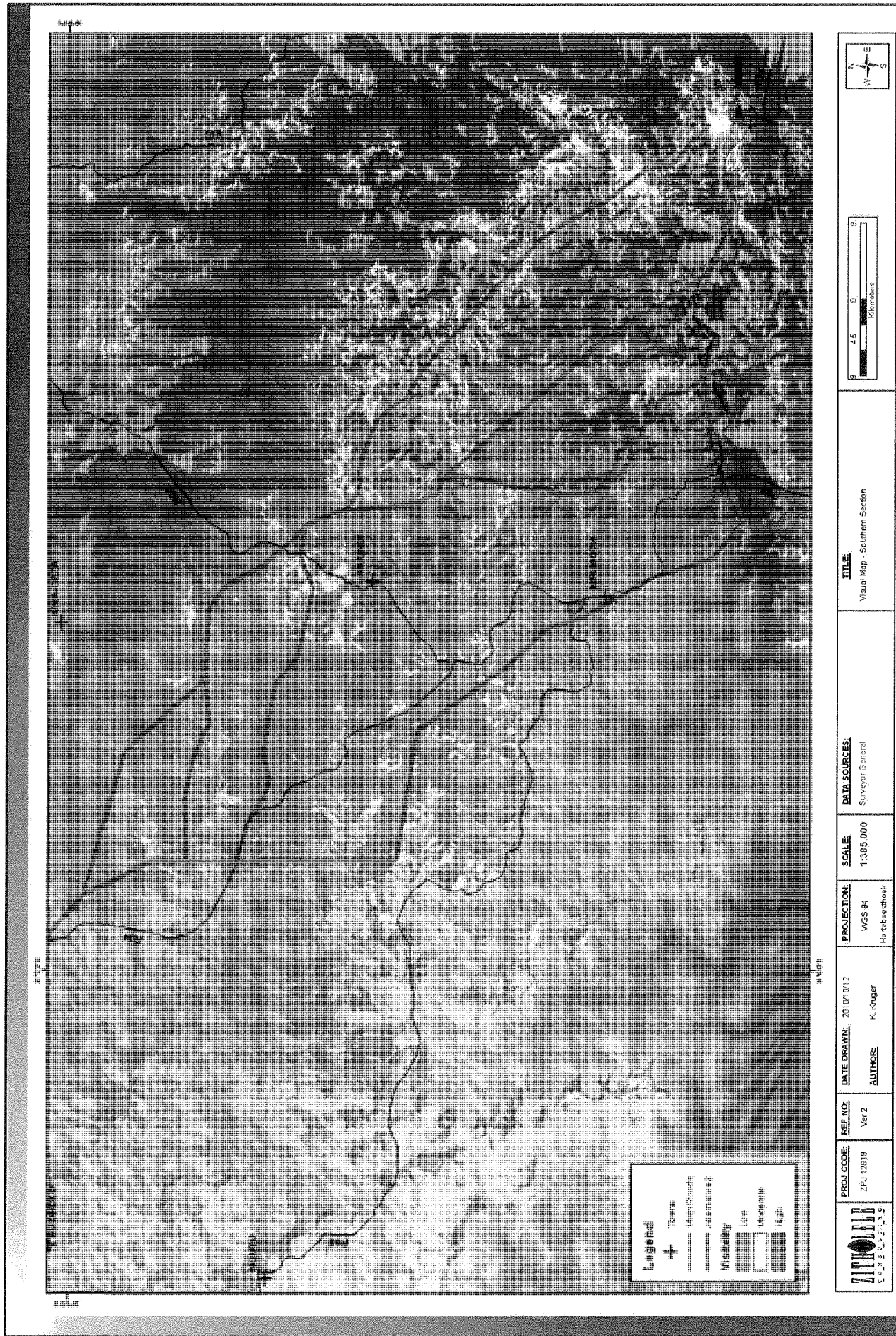


Figure 8-75: Visual Impact from the Alternative 2 alignment

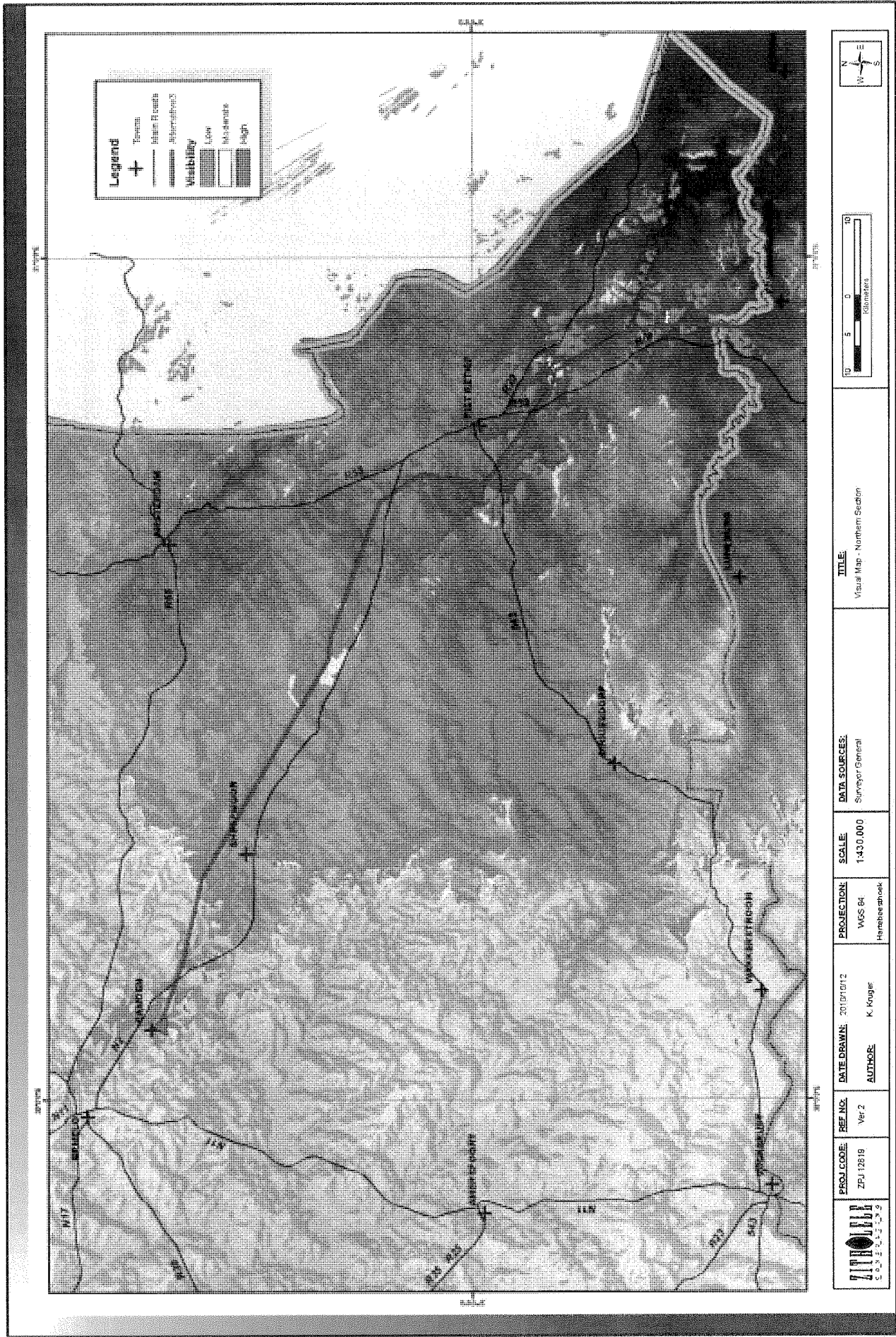


Figure 8-76: Visual Impact from the Alternative 3 alignment

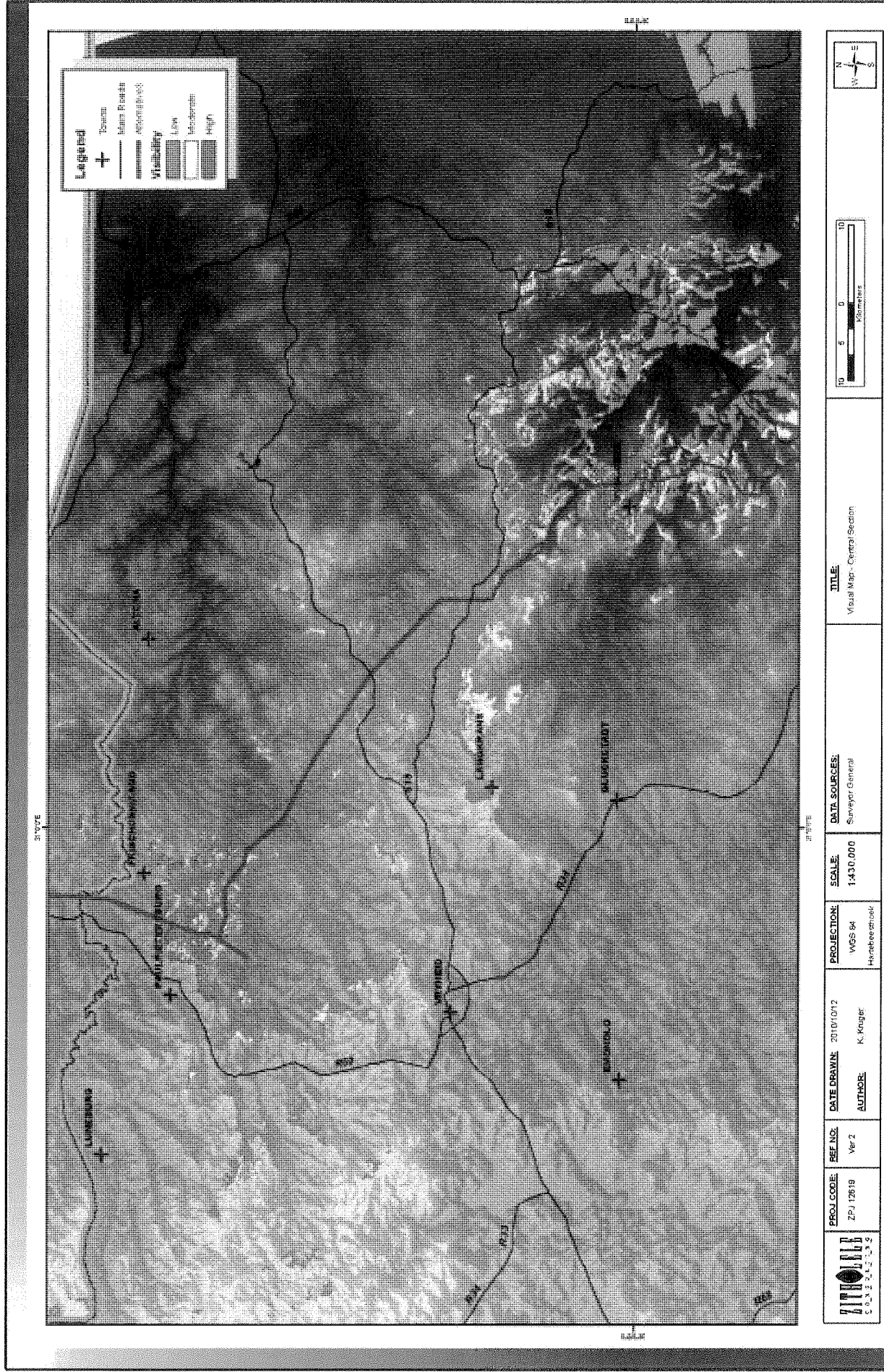


Figure 8-77: Visual Impact from the Alternative 3 alignment

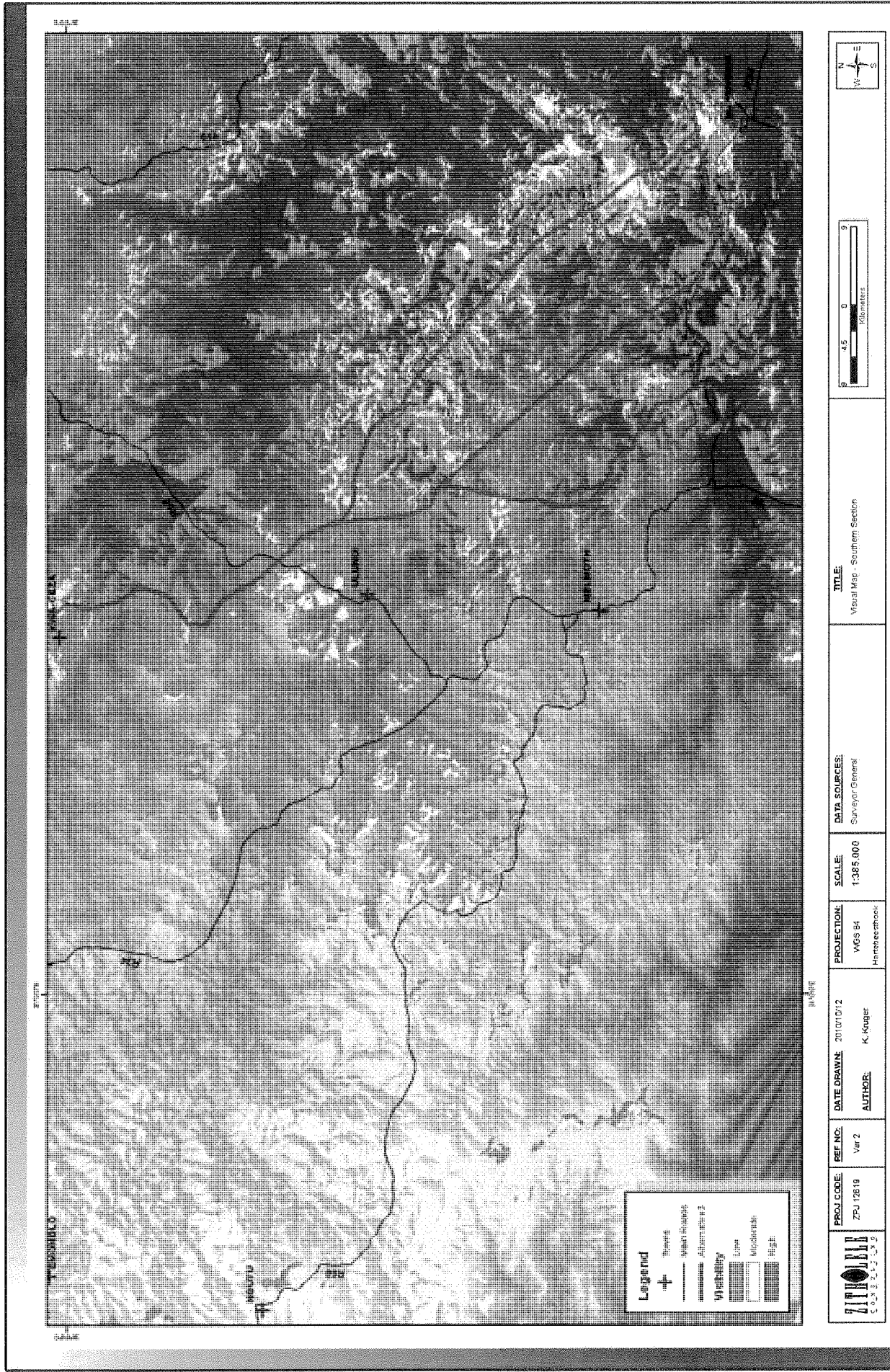


Figure 8-78: Visual Impact from the Alternative 3 alignment

8.1.12 Cultural Heritage Environment

Methodology

A Scoping Heritage Impact Assessment (HIA) was undertaken for the proposed project. This study defined the heritage component of the EIA process. It is described as a first phase Heritage Impact Assessment (HIA). The Heritage Report attempts to evaluate both the accumulated heritage knowledge of the area as well as information derived from direct physical observations. The alternative corridors have been evaluated to determine their cultural heritage significance. Based on this information, an alternative has been selected that will results in least negative impact on the area’s cultural inheritance. The final step in this process was to conduct a physical walk-down of the selected alternative to ensure that no unidentified sites are damaged. In addition a Paleontological Desktop Assessment was also undertaken and supplemented with observations during the Heritage site visit.

8.1.13 Cultural Heritage Environment

Regional Description and Sensitivities

The study area is located within the Mpumalanga and KwaZulu Natal provinces. A number of District Municipalities (DMs) and Local Municipalities (LMs) form part of the study area. These municipalities are depicted in the map below:

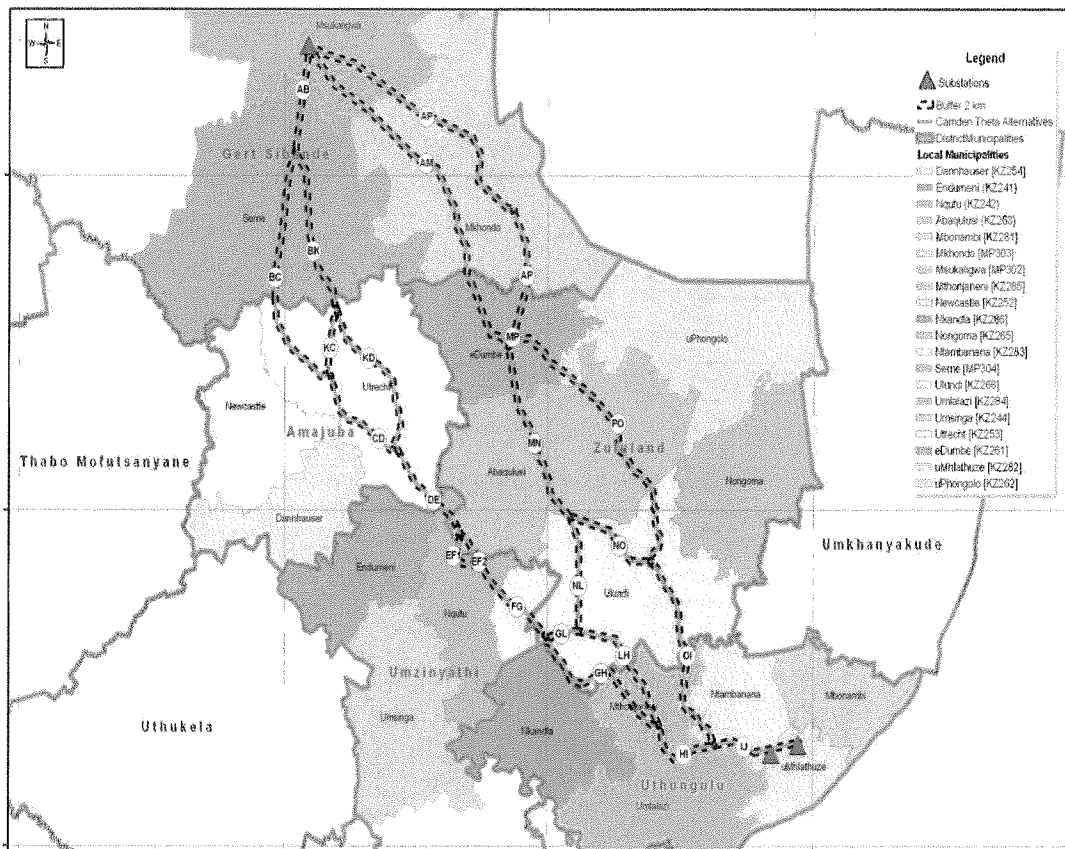


Figure 8-79: District and Local Municipalities within the study area.

Affected District and Local Municipalities

- • Umzinyathi District Municipality: • Nqutu Local Municipality
- • Amajuba District Municipality: • Utrecht Local Municipality
- • Zululand District Municipality:
 - • eDumbe Local Municipality
 - • uPhongolo Local Municipality
 - • Abaqulusi Local Municipality
 - • Ulundi Local Municipality
- • Uthungulu District Municipality:
 - • Nkandla Local Municipality
 - • Mthonyaneni Local Municipality
 - • uMhlathuza Local Municipality
 - • Umlalazi Local Municipality
- • Gert Sibande District Municipality:
 - • Msukaligwa Local Municipality
 - • Seme Local Municipality
 - • Mkondo Local Municipality

Northern Section

This part of the study area comprises the area within the Mpumalanga Province. The regional cultural context for this area is as follows:

Palaeontology

The Barberton Greenstone Belt (BGB) is a geological formation in Mpumalanga that has produced some of the oldest evidence of life anywhere in the World. This formation is not limited to the Barberton area and several versions of it are found close to the study area. These include the Kromberg, Onverwacht and Hoogenoeg sites. The BGB comprises 5 to 6 km of predominantly komatitic and basaltic pillow lavas and sheet flows and related intrusions that are interlayered with cherts and overlain by cherts, banded iron formations, and shales. This magmatic sequence has been interpreted to represent 3480- to 3220-million-year-old oceanic crust and island arc assemblages. These rocks have undergone metamorphism from prehnite-pumpellyite to green-schist facies. Within the originally glassy rims of many BGB pillow lavas, dense populations of mineralized tubular structures 1 to 9,

um in width (average width, 4 Fm) and up to 200 Fm in length (average length, 50 Fm) are observed. These structures consist of fine-grained titanite and extend away from healed fractures along which seawater once flowed.

Stone Age

This area is home to all three the known phases of the Stone Age, nl. The Early (2.5 million – 250 000 years ago), Middle (250 000 – 22 000 years ago) and Late Stone Age (22 000 – 200 years ago). The Late Stone Age in this area also contains sites with rock art from the San and Khoi San cultural groups. Early to Middle Stone Age sites are uncommon in this area, however rock-art sites and Late Stone Age sites are much better known.

Iron Age

The Iron Age sequence is divided into the Early Iron Age (200 – 1400 BP) and the Late Iron Age (1400 – 1900 BP). Although the Early Iron Age is not known from this specific area (EIA sites are know from Lydenburg and Bambata), several Late Iron Age sites of Sotho and Swazi origin is found here By 1400 the second migration of the Nguni with their vast cattle herds arrived in the area. The most prominent of these were the Ndebele tribe. Some Ndebele stone walled sites are also known from this area.

The Historic Era

Historic towns within this section include Ermelo, Piet Retief, Wakkerstroom and Amersfoort. This area is well known for its rich historic character and contains sites connected with several historic military and political conflicts. Historic cemeteries (victim of conflict sites), provincial and private museums, battlefield sites and other historic sites are found here. Around the Wakkerstroom area several historic grave sites associated with the Anglo-Boer war is located. Further historic sites are the house of writer Sir H Rider Haggard and the site of historic battle re-enactments.

Cultural Landscape

The cultural landscape for this area is richly associated with the colonial period as well as its violent past. A unique stone architectural heritage was established in the Eastern Highveld from the second half of the 19th century well into the early 20th century. During this time period stone was used to build farmsteads and dwellings, both in urban and in rural areas. Although a contemporary stone architecture also existed in the Karoo and in the Eastern Free State Province of South Africa a wider variety of stone types were used in the Eastern Highveld. These included sandstone, ferricrete (.ouklip.), dolerite (.blouklip.), granite, shale and slate.

The origins of a vernacular stone architecture in the Eastern Highveld may be ascribed to various reasons of which the ecological characteristics of the region may be the most

important. Whilst this region is generally devoid of any natural trees which could be used as timber in the construction of farmsteads, outbuildings, cattle enclosures and other structures, the scarcity of fire wood also prevented the manufacture of baked clay bricks. Consequently stone served as the most important building material in the Eastern Highveld.

Market Square- Volksrust - This area was renamed Voortrekker Square in 1938. There is the Burger Memorial dedicated to the memory of the women and children who died in the concentration camp and it also commemorates all those who fought for the freedom of the Zuid Afrikaanse Republiek (ZAR).

Convention Bridge - Just outside Volksrust on the Newcastle road are the remains of the Convention Bridge, which originally linked the ZAR to Natal. In 1814 the Swaziland Convention was signed in a railway coach (on the bridge) by Sir Henry Loch and the President Paul Kruger.

British Memoria - This memorial laid out in the form of a cross can be found on the north side of town.

House & Grave of General Piet Joubert - Gen. Piet Joubert's house and grave can be found approximately 25km outside Volksrust on the Vrede road.

Roodedraai School Museum - This museum is situated on a historical farm site approximately 30 km outside of town on the Vrede road. It is full of information about Anglo-Boer War and an English Fort can also be seen.

Volksrust Prison - Volksrust prison was built after the war and its main claim to fame is that on November 5 1913 Mahatma Gandhi's Passive Protest Movement marched through Volksrust, it was stopped and he was sentenced to a period of hard labour or a fine. He spent several months in this prison during his stay in South Africa.

Mount Prospect - General Colley's grave is situated near Mount prospect on the Kwa Zulu Natal's Battlefield's Route and this graveyard can be reached using a 4 x4 vehicle.

Majuba Bushman Paintings - These can be found by travelling 2 km on foot near O'Neill's Cottage. These San paintings have only recently been discovered in the foothills of the mountain. They are to be found under an over-hanging rock, which would have afforded shelter to the San in this area. Nearly seventy San paintings depicting leopards, snakes, the anteater and various species of buck can be seen.

The Concentration Camp - This is situated at Grens Spruit, which adjoined the old Transvaal and Natal borders. The Volksrust Concentration camp was erected in October 1900 and was regarded as being one of the biggest. A total of 1009 people died in this camp: the majority of them were children.

The Concentration Camp Memorial - This Memorial can be found in Market Square and commemorates those who died in the camps. Their names were immortalized on the granite slabs and many of the bodies of those who died have been re-interred on this site.

Volkruist Station - This quaint sandstone station was built in 1885 and is still used.

Steam Locomotive - For Steam train aficionados a fine example of a steam train can be found in Market Square. Steam Trains in this area were phased out in 1937 when the electrification of the Durban ~ Volksrust line was completed.

Nuwe Republiek Museum - This museum in Vryheid housed the council chamber and government offices of the Nuwe Republiek. Displays can also be found in the Carnegie Library and Lucas Meyer house.

Fort Prospect - The outpost in the Vryheid area was manned by 80 British soldiers and was attacked by 400 Boers on September 24 1900. It lasted most of the day but eventually the Boers were forced to withdraw after the Zululand Native Police reinforced the British troops.

Alleman's Neck - In the Volksrust area, this was where the British forces finally broke through into the Transvaal.

Central and Southern Section

The Central and Southern Sections is largely homogeneous in their cultural characteristics and will therefore be discussed as a single section.

Paleontological Sites

Border Cave, a large overhang in the remote Ingwavuma district, has been occupied by humans for about 190 000 years and is one of only a few archaeological sites in the world with a complete stratigraphic record. More than a million artefacts have been excavated from the site. The site is not directly in the study area; however is of such high value that it should be noted here.

Paleontological remains occur in the Cretaceous layer underlying the study area. These are of high significance but should not be impacted on as the ground intrusion is very limited.

Archaeological sites

Pre-Colonial (Pre-Contact) Sites

The eMakhosini Cultural Landscape is probably the most sensitive area within any of the evaluated options from a visual impact approach. This is not a single site or even a group of sites but rather a combination of historic sites, landscapes and history bound by oral

traditions and cultural significance defining the Zulu culture. eMakhosini (literally “the valley of the chiefs”) lies just southwest of the town of Ulundi. Much of the area is defined by the presence of several stone walled sites associated with the powerful Buthelezi and Khumalo clans. These clans among others were key players in the formation of the Zulu kingdom. The famous King Shaka Zulu was born here around 1785 and it is here that his forbearers, Nkosinkulu Zulu, Phunga, Mageba, Ndaba, Jama and Senzangakhona lie buried. The graves and royal residences of four paramount rulers of the Zulu – Shaka, Dingane, Mpande and Cetshwayo- are located in and around the eMakhosini Valley. At Cetshwayo’s royal residence at Ondini there is today also a site museum as well as the KwaZulu Cultural Museum.

Although the eMakhosini valley is of great importance to the Zulu it also bears evidence of the Voortrekkers. Voortrekker leader Piet Retief lays buried in the valley at kwaMatiwane – The Hill of Execution. A monument to Retief and his followers are found not far from the partially reconstructed Mgungundlovu – Dingane’s royal residence. Another famous Voortrekker child hero – Dirkie Uys’s grave has also recently been discovered in the area. Possibly the most important cultural sites in the eMakhosini valley is Nobamba and Siklibheni. At Siklibheni the original nkatha ka zulu – the sacred royal regalia consisting of a ring of special grasses and herbs covered in the skin of a python – was made. Siklibheni was the residence of inkosi Senzangakhona ka Jama Zulu (c. 1757 – 1816), father of Shaka, Dingane and Mpande and grandfather to Cetshwayo.

Not far from here is found the grave site of Senzangakhona’s mother – Mthaniya. Across the hills is the site of Nobamba where the homesteads of Kings Jama and Dinuzulu once stood. Dinuzulu is buried under a granite slab at the foot of the nearby Ntabaye Zulu hill.

Further south is found kwaDukuza, the last royal residence of Shaka Zulu. Shaka came to power in 1816 and reinforced his claim to the Zulu throne after a convincing victory at his early homestead kwaBulawayo in the eMakhosini valley. In 1828, Shaka’s half-brothers, Dingane and Mhlangana had Shaka killed with the help of his Induna, Mbopa. He was stabbed to death on 22 September 1828.

Mgungundlovu was the royal residence to Dingane during his reign of the Zulu kingdom. The city (with up to 7000 inhabitants) was abandoned and burned down after Dingane learned of an advancing Voortrekker party set on revenge for the Bloukrans and Weenen massacres. Much of the site has been excavated in recent years and a section has also been reconstructed.

Close to the entrance to Mgungundlovu is the grave of Nkosinkhulu kaMalandela (1627 – 1709) who is considered to be the founder of the Zulu royal dynasty. His royal homestead is also thought to be close by here.

Approximately five kilometres from Mgungundlovu is Mthonjaneni spring, believed to be the place where Dingane’s wives drew water for his consumption.

Nodwengu on the Mahlabatini plains was the Zulu capital during the reign of King Mpande. Mpande reigned for 32 years and this was one of the most peaceful periods in the history of the Zulu nation. Mpande died a natural death in 1872 and is buried at Nodwengu where there is also a site museum.

Ondini, the royal residence of king Cetshwayo is in fact three different locations. After seceding his father Mpande, Cetshwayo destroyed the original Ondini as per Zulu custom. He then commenced to build the second Ondini in the Mahlabatini plains modelling the design on Dingane's Mgungundlovu. After the British destroyed this site in 1879 at the battle of Ulundi, Cetshwayo was exiled, however on his return he built the third Ondini just south of the second. The second Ondini's remains can be found some 5km south of Ulundi.

Prince Dabulamanzi kaMpande's grave is located at Nondweni. The prince commanded the Undi corps and the uThulwana, inDluyengwe, inDlondlo and uDloko regiments that attacked Lord Frederick Chelmsford's depot at Rorke's Drift. Prince Dabulamanzi was killed by a boer, Paul van der Berg in 1886 after hostilities between him and the Voortrekkers surfaced. His grave is marked by a stone cairn at Nondweni.

Piet Retief's grave. In 1837 Piet Retief (by then a well-known Voortrekker leader) wrote a letter to King Dingane of the Zulu in which he stated that the Voortrekkers wanted to live in peace with the Zulus. Dingane indicated that he would concede land to the Boers if they retrieved stolen cattle from Chief Sekonyela of the Batlokwa (the idea being to gauge the military strength of the Boers). This raid by the Boers was so successful that Dingane decided to plot Retief's death. After being invited to the royal kraal for festivities and being disarmed Retief and his men were overpowered and executed at kwaMatiwane. The bodies of Retief and his men were recovered nearly a year later and reburied at the foot of the mountain.

Colonial (Post-Contact) Sites

British settlers first arrived at Port Natal (Durban) in 1824 when Shaka, King of the Zulu was firmly in charge of the hinterland. Thirteen years later a party of Boer families trekked in from the Free Sate. Between 1860 and 1911 shiploads of Indians arrived to work in the coastal sugar plantations. Since then, immigrants from around the world have brought with them different cultures, enriching the character of the province in many ways.

Northern and central KwaZulu-Natal is strewn with sites of battles between the Zulu, Boer and British during the 1800's and 1900's. The British final conquered the Zulu in the Anglo-Zulu War of 1879 and later the Boers in the First and Second Anglo Boer wars. These conflicts are now collectively known as the South African War. A result of these conflicts was the construction of many forts in the area. One such is Fort Nolela where the British rallied before the decisive battle for Ulundi. Several grave sites, monuments, stone cairns and statues are the legacy of this violent time in our history. These remains are found scattered throughout the study area.

Ncome / Blood River. By November 1838 Andries Pretorius was leading the Voortrekkers in outright hostilities against Dingane's Zulus after the murders of Piet Retief and his party. Near the Ncome river scouts reporting seeing a large Zulu Impi. Pretorius formed a laager (interconnected wagon perimeters) with three canons in-between wagons. The Zulu attack had to forge the Ncome River and fire from the laager as well as mounted surge parties massacred the Zulu numbers to the effect that the water in the river turned red – resulting in the battle being known forever as Blood River. After defeating the large Zulu battalion Pretorius turned his attention the Mgungundlovu, however by the time they reach the settlement it had been torched. For many years the 16th of December was known as the Day of the Vow, however nowadays it is known as the Day of Reconciliation. A monument and site museum with full-scale bronze ox wagons is located at the battle site today.

Isandlwana. Probably one of the two most significant battles of the Anglo-Zulu War. On 22 January 1879 an Impi of around 20 000 warriors attacked the British forces camped at the mountain known as Isandlwana. The British lacked sufficient defensive structures and by the afternoon the camp had been overrun. The British lost 1 357 men as well as the battle. Isandlwana was the worst defeat ever suffered by a colonial power in Africa. The area at the foot of the mountain is scattered with graves and monuments to the men who lost their lives here. In 1883 a mission church was also built at this site under Bishop William Kenneth Macrorie.

Rorke's Drift. This site was a well-known crossing place of the Buffalo River. On the same day that the British forces were overrun at Isandlwana another Zulu war party attacked the British camp at Rorke's drift. This time the Zulu attack was kept at bay by less than 100 soldiers. Today a small museum is found here in a thatched house that served as a hospital at the time of the battle.

Khambula. On 29 March 1879 a 20 000 strong Zulu Impi attacked the British at Khambula in the north of Zululand. The Zulu were led by Chief Mnyamana Buthelezi while the British were under the command of Colonel Sir Evelyn Wood. After losing over 2000 men the Zulus had to retreat in defeat. Today a memorial commemorates this battle site.

Grave of Piet Lafras Uys. Piet Uys was the son of the well-known Voortrekker leader of the same name and brother to the young hero, Dirkie Uys. His father and brother were both killed in 1838 at the battle of Ithaleni. Fighting under the British Colonel Redvers Buller, Uys's small party was overrun by a Zulu impi. They managed to break through the Zulu lines and regroup with the remaining force. While Colonel Buller remained and received the Victoria Cross for valor, Uys fought his way back to the men isolated behind the lines where he was stabbed in the back by a Zulu soldier. A monument to him was erected on this site by his men in 1881.

Ulundi. A domed monument is found at the site of the final battle of the Anglo-Zulu war. Here an organized assault by the British resulted in 1500 Zulu being killed before King Cetshwayo finally surrendered.

Prince Imperial Cross. A most unlikely victim of the Anglo-Zulu War was the French Prince Imperial, Napoleon Eugene Louis Jean Joseph. While serving as an aide-de-camp to Lord Chelmsford he and a number of mounted soldiers were sent on a routine mission along the Ityotyoti River. In the afternoon they were ambushed and attacked by a Zulu regiment. The young prince had dismounted and his horse bolted, trampling him. Here he turned to face his attackers and was stabbed 17 times. After the war the Zulu warriors who led the attack spoke highly of the prince's bravery saying that "he fought like a lion". A stone cross commemorates the site of his demise.

Laing's Nek. On 28 January 1881 a British force of 1200 men were repulsed by Commandant-General Piet Joubert at Laing's Nek just south of Volksrust. There is a historic marker found at this site

Schuinshoogte. On 7 February 1881 the mail wagon was ambushed by the Boers. General Colley of the British army decided to escort the wagon the next day when it was again attacked by the Boers at the Ingogo River. The British retreated after losing 139 men. A historic marker is found here.

Majuba. On 26 February 1881 General Colley of Schuinshoogte fame took the hill at Majuba with 370 men. From here they rained small arms fire on the Boer encampment. Although the British held the high ground, they were not well entrenched and Boer volunteers quickly overrun their position. Colley and 91 of his men were killed, 134 wounded and 59 taken prisoner. A memorial to this battle and several grave sites are found at the foot of Majuba hill.

O'Neil's Cottage. This small homestead is located at the foot of Majuba mountain. Some of the wounded at Majuba was cared for here and three men who subsequently died were also buried in the small cemetery. An armistice was signed at the cottage on 23 March 1881 allowing for the independence of the Zuid-Afrikaansche Republic. After the truce was signed, the documents in respect of retrocession of land to the Boers were signed at Hilldrop House, home to the writer, Sir H Rider Haggard.

Block houses. The study area was the scene for many military Block-houses used to control access to certain areas. Always within firing distance of each other these miniature forts would form a line that could easily be defended. Several remains of these structures are still found within the study area.

Utrecht Museum. This museum housed in the old parsonage depicts life in Utrecht and also the history of the Dutch Reformed Church.

Fort Amiel. This was an important military base from 1867 to 1902. During the Anglo Zulu and Boer Wars it was used as a transit camp hospital and commissariat store. Today it houses a historical and military museum.

The Old Cemetery. British soldiers are buried in the old cemetery in Utrecht. One of these graves is of Steven Thorton Philimore, deputy commissioner of the British Army during the Anglo Zulu War.

Pokorowsky Memorial. A marble slate commemorating Captain Leo Pokorowsky, a Pole who was an officer in the Russian Army. He fought with the Boer forces during the Anglo Boer War and was killed in a skirmish on Christmas Day 1900 when he and his men attacked the British garrison in Utrecht.

Blood River Poort Battlefield. Fought on September 17 to prevent Louis Botha's attempt to invade Natal, the British were outflanked and in the 10 minute action lost 16 officers, 273 men and 3 guns. On the D251. Follow the signs. After 8-km turn into Goedgelooft farm. Graves 1-km on the right side of the road.

Holkrans Battlefield. On this site in the Vryheid area 56 Burgers were killed on May 6 1902 in a surprise attack by a Zulu impi on Zuinguin Mountain. 22-km from Vryheid on the Paulpietersburg road.

Hlobane Battlefield. British forces were defeated by a Zulu impi on Hlobane Mountain in the Vryheid area on March 28 1879. 20-km from Vryheid on the Hlobane road.

Gqokli Hill: Located 10 km south of Ulundi is the site of an epic battle between the forces of King Shaka and the Ndwande people in 1818. It may be viewed from a lay-bye on the road to Ulundi.

Ondini Historical Reserve – site of the last battle of the Anglo-Zulu War. A historical reserve and monument, it includes an interpretative centre, stadium, tourist accommodation and the Kwa-Zulu Natal Cultural Museum.

8.1.14 Palaeontology

Regional Description

Alternative 2 and 3 pass through mostly very old and non-fossiliferous rocks but there are potentially a few fossiliferous sites. If alternative 3 is approved for construction, there would be less potential impacts on the palaeontology. Alternative 1 passes mostly through potentially fossiliferous Karoo deposits. The Archaeozoic rocks of the Swazian and Randian Eras are not discussed in the next section as they are too old for fossils.

Site Description and Sensitivities

Alternative 1

Around Ermelo there are exposures of Permian rocks of the Vryheid Formation which contains fossil plants of the *Glossopteris* flora but no vertebrates. The Drakensberg

Formation has only rare foot prints, leaf impressions and fossilised wood but these have not been recorded from this area. East of Amersfoort there are exposures of the Adelaide Group that could have Beaufort plants and animals. Between Amersfoort and Utrecht there is the Vryheid Formation, near Bloedrivier rocks of the Pietermaritzburg Formation outcrop. Dwyka exposures are near Nondweni. These are usually glacial pavements, diamictites and mudrocks. Fossil leaves, wood and trackways have been recorded from the south and northwest but not from KwaZulu Natal. Potentially these outcrops could contain fossil material.

The Ordovician-Silurian deposits near Melmoth may contain very early forms of plant life. Around Empangeni there are deposits of the Volksrust Formation with *Ecca* fossil plants and Emakwazini Formation that could have plants and animals of Beaufort age. Outcrops of the Emakwazini Formation at Kwa Yaya railway siding and Emakwazini station have particularly well preserved and important floras. Various coal mines in the region have good fossil floras too.

Alternative 2 and 3

Around Ermelo, there are Vryheid Formation deposits that could have the *Glossopteris* flora plants. Heading south east, ancient rocks are common but near Hlobane at the quarry an extensive *Ecca* flora has been recorded and must be fairly widespread. Melmoth to Empangeni has the same formations as along Alternative 1, i.e. Ordovician-Silurian, Volksrust and Emakwazini.

8.2 Socio- Economic Environment

8.2.1 Infrastructure

Methodology and Data Sources

Infrastructure was identified using the 1:50 000 topocadastral maps of the area, and information provided by Eskom regarding existing services. A site fly over was undertaken to verify this information.

Regional Description

Roads

There is an extensive network of provincial tar roads that form the access backbone to the study area. Secondary district dirt roads provide access to all the more rural areas, plantations and farms through which the proposed lines will pass. Access to the proposed lines may only need to be constructed in tribal land where there are no existing roads and for the last short distances on private land serviced by the existing road network.

Only one national road is present in the direct study area, namely the N17/N2 which is intersected by segment alternative AP several times north of Piet Retief. Other major roads in the study area are the R33, R34, R66, R68 and R69.

Other roads in the area provide linkages between different rural settlements and are generally of a poor standard and poorly maintained. This prevents physical integration and encourages segregation due to physical constraints and distances between settlements

Railways

Alternative segment AP runs parallel to the railway line between Ermelo and Paulpietersburg and IJ runs parallel to the railway between Nkwalini and Empangeni. Additionally the following segments cross over existing railway lines:

- Segment MN crosses over the railway line between Vryheid and Langkrans;
- Segment AM crosses over the railway line between Ermelo and Paulpietersburg;
- Segment DE crosses over the railway line between Dundee and Vryheid;
- Segment CD crosses over the railway between Newcastle and Utrecht
- NL 2 crosses over the railway between
- BC crosses over the railway between Amersfoort and Wakkerstroom and again between Wakkerstroom and Volksrust.
- OI crosses over the railway between Nseleni and Makhazane

Power Lines

There are several existing power lines in the study area, the majority of which are 400kV power lines. A 765kV power line runs from an area between Amersfoort and Perdekop, along alternative segment BC to the west of Wakkerstroom in a south easterly direction to an area north of Dennydalton.

Airfields

Several airfields are present in the study area. These airfields must be avoided to ensure that they remain operational and are safe to the users. The airfields are mainly utilised for crop spraying and fire fighting purposes. An effort has been made to ensure the power line corridors avoid airfields where possible.

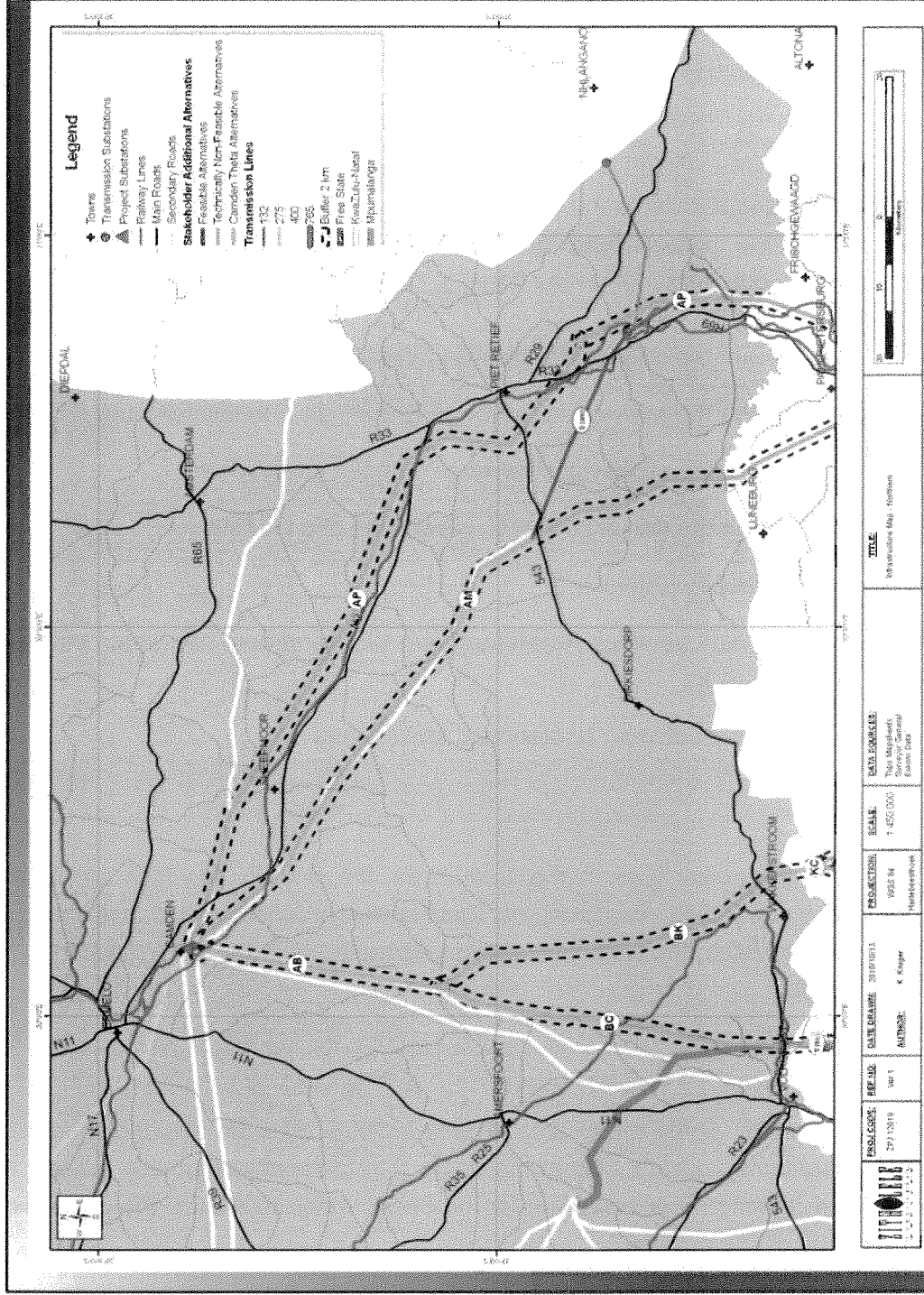


Figure 8-80: Infrastructure in the northern portion of the study area.

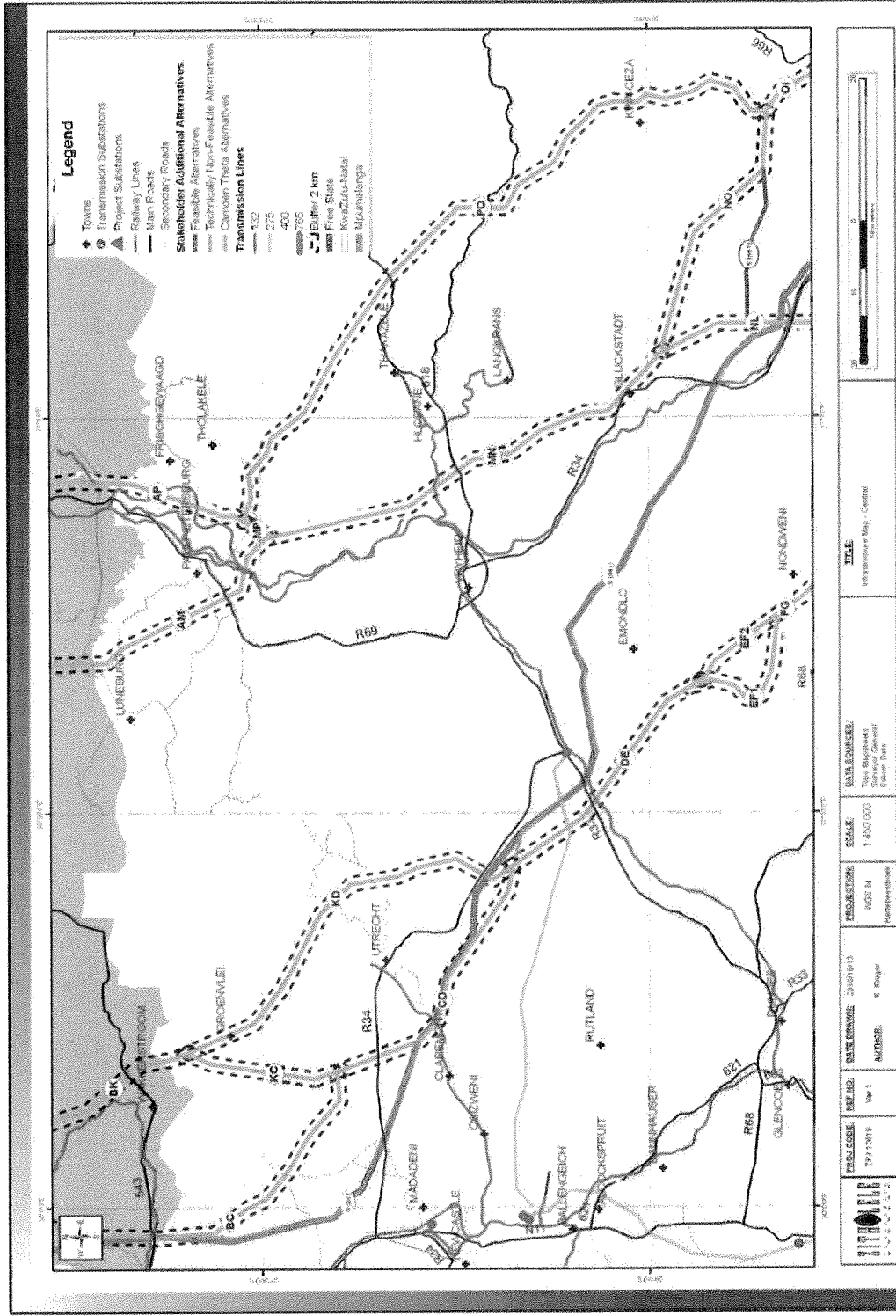


Figure 8-81: Infrastructure in the central portion of the study area.

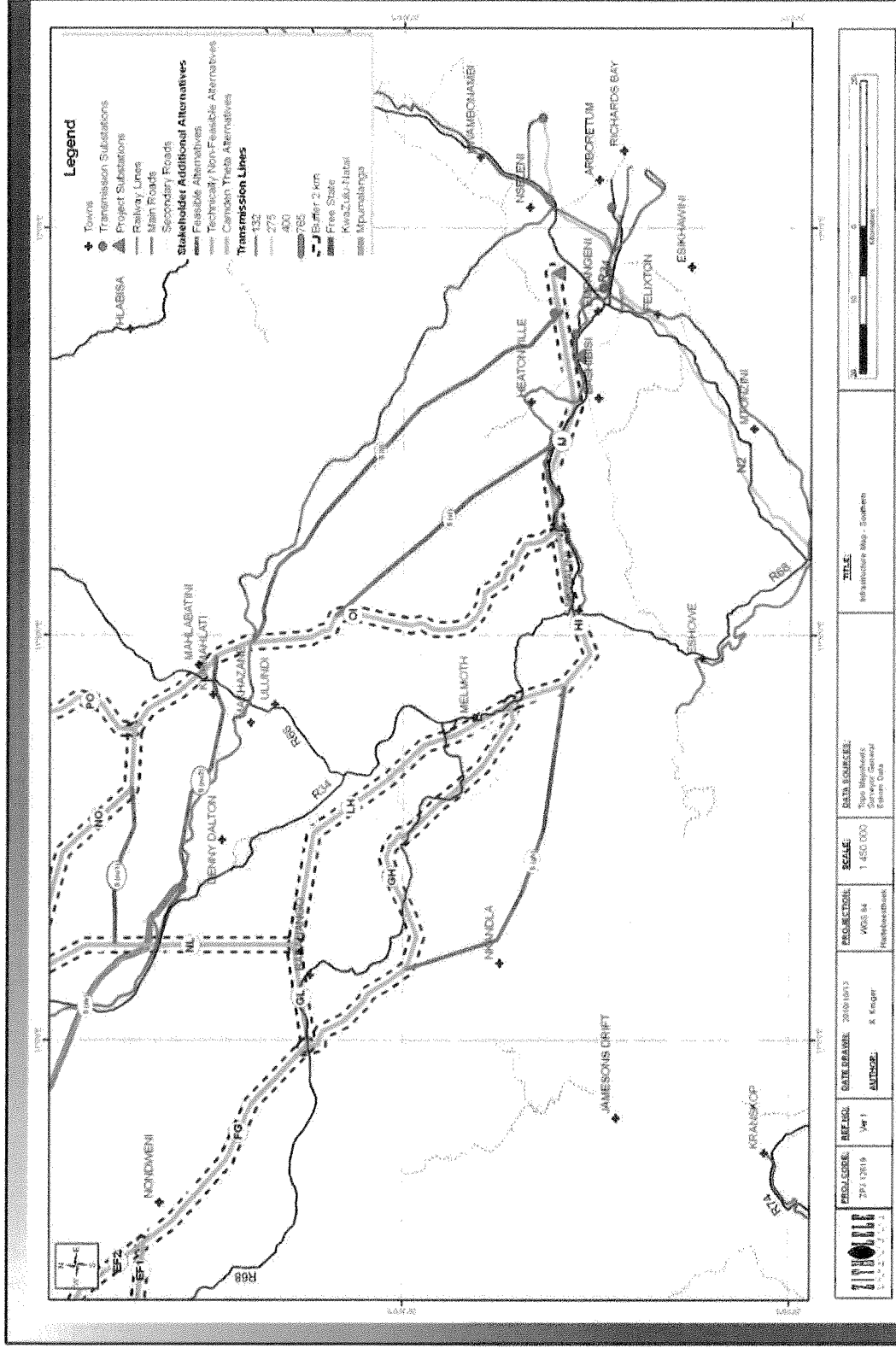


Figure 8-82: Infrastructure in the southern portion of the study area.

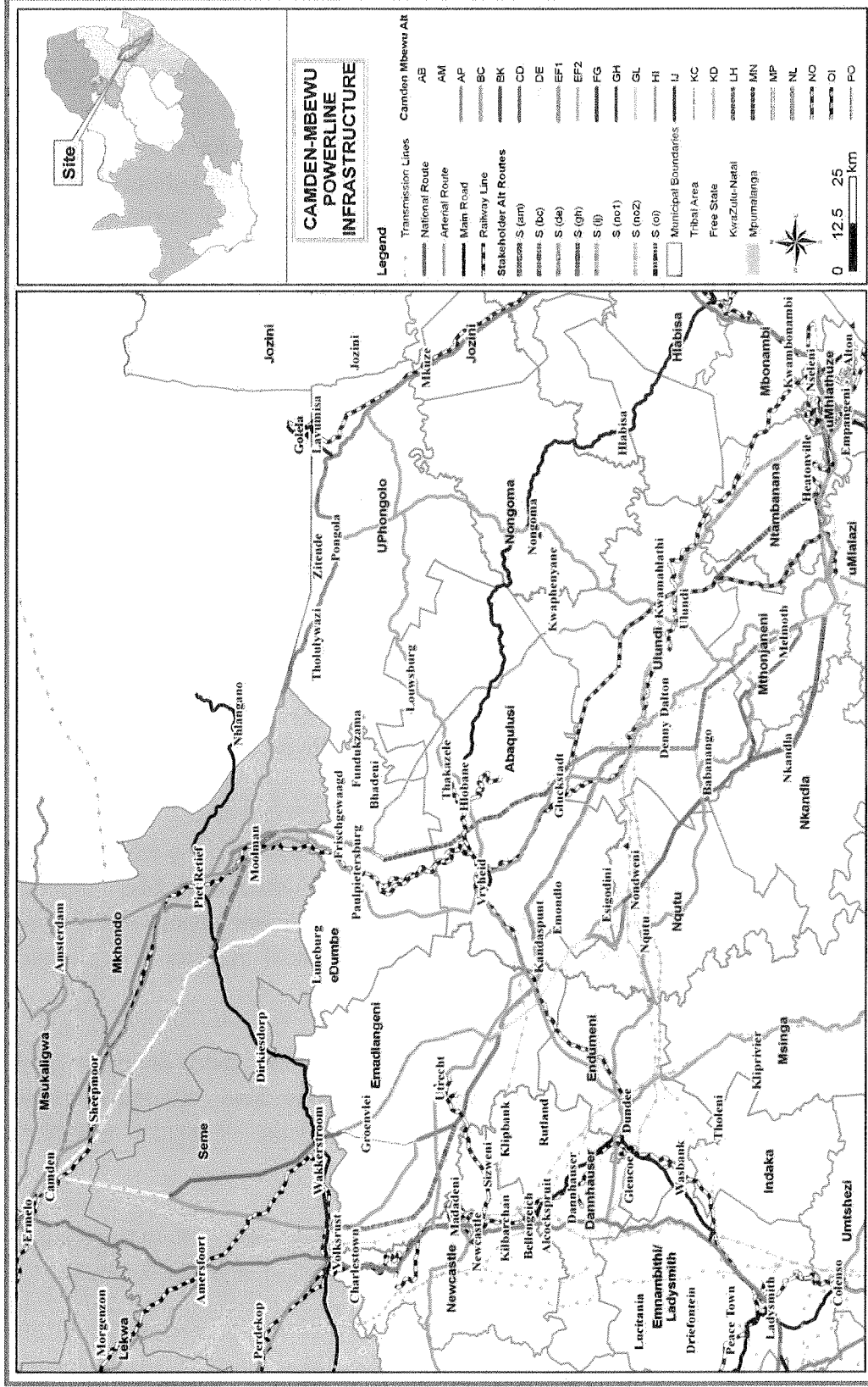


Figure 8-83: Infrastructure in the study area.

8.2.2 Social Environment

Methodology and Data Collection

The information used in the study was based on a literature review, professional judgement based on experience gained with similar projects; and focus group and individual meetings with affected parties. Scientific social research methods were used for the assessment. Primary data was collected through personal interviews as well as through group interviews. Representatives from forestry industry, sugar cane industry, commercial farmers, tourism, tribal authority, and farm workers.

Regional Description

Mpumalanga Province

The Mpumalanga Province is located in the north eastern part of South Africa and covers an area of approximately 82 333 km² (www.mputopbusiness.co.za). It borders the Limpopo Province, Gauteng, the Free State, KwaZulu Natal and internationally Swaziland and Mozambique. The word Mpumalanga means “place where the sun rises”.

The province consists of three district municipalities, namely Gert Sibande, Nkangala and Ehlanzeni. Nelspruit is the provincial capital and other major towns include Barberton, Delmas, Ermelo, Hazyview, Komatipoort, Malelane, Mashishing (Lydenburg), Middelburg, Piet Retief, Sabie, Secunda, Standerton, Volksrust, White River as well as Emalahleni (Witbank) (www.mpumalanga.com).

Mpumalanga is South Africa's major forestry production area and is also the world's largest producer of electrolytic manganese metal. Six major industrial clusters have been identified in Mpumalanga (Mpumalanga PGDS) in which numerous investment opportunities exist, namely stainless steel; agri-processing; wood products; chemical industry and chemical products; agri-products and tourism.

Extensive mining is done in the province. Minerals found include: gold, platinum group metals, silica, chromite, vanadiferous magnetite, argentiferous zinc, antimony, cobalt, copper, iron, manganese, tin, coal, andalusite, chrysotile asbestos, kieselguhr, limestone, magnesite, talc and shale.

Mpumalanga also accounts for 83% of South Africa's coal production. Ninety percent of South Africa's coal consumption is used for electricity generation and the synthetic fuel industry. Coal is situated close to the coal deposits.

The province mainly exports primary products from its mining and agricultural activities with little value addition. Mpumalanga will be able to increase its share of export contribution

towards the provincial GDP by adding value to its export products through beneficiation (Mpumalanga Economic Profile).

KwaZulu Natal Province

The province of KwaZulu Natal is located in the south eastern part of South Africa and covers an area of approximately 94 361km² (en.wikipedia.org). It is bordered by the provinces of Mpumalanga, Free State and Eastern Cape. The province also shares an international border with Mozambique, Swaziland and Lesotho.

The provincial capital of KwaZulu- Natal is Pietermaritzburg and other main towns include Durban, Ulundi, Eshowe, Newcastle, Richards Bay, Ladysmith, Margate, Kokstad, Pinetown, Port Shepstone and Umhlanga Rocks (www.tikzn.co.za ; www.kzntopbusiness.co.za).

The province has three distinct geographical areas, namely a lowland region along the Indian Ocean coast that is extremely narrow in the south but widening in the northern part of the province. The central region is the Natal Midlands, an undulating hilly plateau rising towards the west and then two mountainous areas, namely the Drakensberg mountains in the west and the Lebombo mountains in the east (www.southafrica.com).

Although one of the province's strengths is that it has a diversified economy, four key sectors have been identified as the drivers of economic growth (www.kzntopbusiness.co.za). These are:

- Agriculture and agri-industry.
- Industry, including heavy and light industry and manufacturing.
- Tourism, including domestic and foreign tourism.
- Services sector, including financial, social, transport, retail and government.

KwaZulu Natal has a larger area of high quality agricultural land than any of the other provinces. The Midlands area between Pietermaritzburg and the Drakensberg is the heart of this high quality agricultural area with a concentration of vegetable, dairy and stock-farms. The KwaZulu-Natal coastal belt yields sugar cane, wood, oranges, bananas, mangoes and other tropical fruit. Forestry in the areas around Vryheid, Eshowe, Richmond, Harding and Ngome is another major source of income (www.kzntopbusiness.co.za).

The diversified manufacturing sector is the second largest in the country after Gauteng and is geared for export with nearly a third of South Africa's manufactured exports being produced here. The largest manufacturing industries are the automobile and component sector, pulp and paper products, chemicals and petrochemicals, and food and beverages (www.kzntopbusiness.co.za). Economic activities are concentrated around the areas of

Durban, Pietermaritzburg and Richards Bay with the two key ports of the province situated at Durban and Richards Bay (www.tikzn.co.za).

KwaZulu Natal is the market leader for domestic tourism in South Africa and holds the second position in terms of international tourism (www.kzntopbusiness.co.za). The tourism attractions of the province centres around four components, namely coastal holidays; wildlife game parks in the north; the Drakensberg mountains as well as the historical battlefields (www.tikzn.co.za). There are two World Heritage sites in the province, namely the Greater Lucia Wetlands Park, and Ukhahlamba/Drakensberg Mountain Reserve. Zulu cultural village activity and the African township experience have emerged strongly as new areas of interest that needs to be marketed.

Site Description**Table 8-6: Community Survey 2007 Population, growth and household estimates (sources: CS2007; IDP's; www.kzntopbusiness.co.za)**

	Approximate population size	Approximate number of households	Average population density (number of people per km ²)	Average household density (number of people per household)	Estimated growth in population size since 2001 (in %)	Estimated growth in number of households since 2001 (in %)	Estimated change in household sizes since 2001 (in %)
Mpumalanga	3,643,435	940,403	45.84	3.9	8.2	19.7	-0.4
Gert Sibande DM	890,699	247,518	27.97	3.6	-1.0	17.0	-0.7
Mkhondo LM	106,452	29,926	21.87	3.6	-25.5	7.4	-1.6
Msukaligwa LM	126,268	31,750	24.15	4.0	1.2	6.9	-0.2
Pixley Ka Seme LM	65,932	21,605	12.62	3.1	-18.3	20.0	-1.4
KwaZulu Natal	10,259,230	2,234,129	111.39	4.6	7.0	5.5	0.1
Amajuba DM	442,266	101,054	64.00	4.4	-5.5	4.5	-0.5
Dannhauser LM	91,366	18,057	60.27	5.1	-11.1	-6.5	-0.3
Emadlangeni LM	23,263	5,211	6.57	4.5	-27.9	-15.8	-0.8
Newcastle LM	327,637	77,786	176.62	4.2	-1.6	9.3	-0.5
Umzinyathi DM	495,737	104,534	61.36	4.7	3.2	11.5	-0.4
Endumeni LM	54,447	13,755	33.78	4.0	6.5	12.0	-0.2
Msinga LM	161,894	32,592	64.76	5.0	-3.6	0.3	-0.2
Nqutu LM	164,887	32,169	113.64	5.1	-2.4	9.7	-0.6
Uthungulu DM	894,260	184,506	109.00	4.8	0.9	7.6	-0.3
Mbonambi LM	118,081	21,632	97.99	5.5	10.4	13.0	-0.1
Mthonjaneni LM	47,010	10,671	46.92	4.4	-6.7	5.6	-0.6
Nkandla LM	127,451	22,387	69.76	5.7	-4.6	-7.6	0.2
Ntambanana LM	94,190	14,845	86.89	6.3	11.1	19.3	-0.5
uMhlatuze LM	332,156	81,005	417.81	4.1	14.9	20.7	-0.2
uMlalazi LM	175,372	33,966	76.25	5.2	-20.7	-11.7	-0.6
Zululand DM	902,890	155,883	58.99	5.8	15.7	10.3	0.3
Abaqulusi LM	247,628	39,866	59.17	6.2	29.6	11.0	0.9
eDumbe LM	75,096	15,147	38.57	5.0	-8.7	0.3	-0.5
Nongoma LM	244,501	35,293	111.90	6.9	23.2	11.8	0.6

	Approximate population size	Approximate number of households	Average population density (number of people per km ²)	Average household density (number of people per household)	Estimated growth in population size since 2001 (in %)	Estimated growth in number of households since 2001 (in %)	Estimated change in household sizes since 2001 (in %)
Ujundi LM	197,908	39,837	52.72	5.0	4.7	17.6	-0.6
uPhongolo LM	137,756	25,740	42.64	5.4	15.0	3.7	0.5

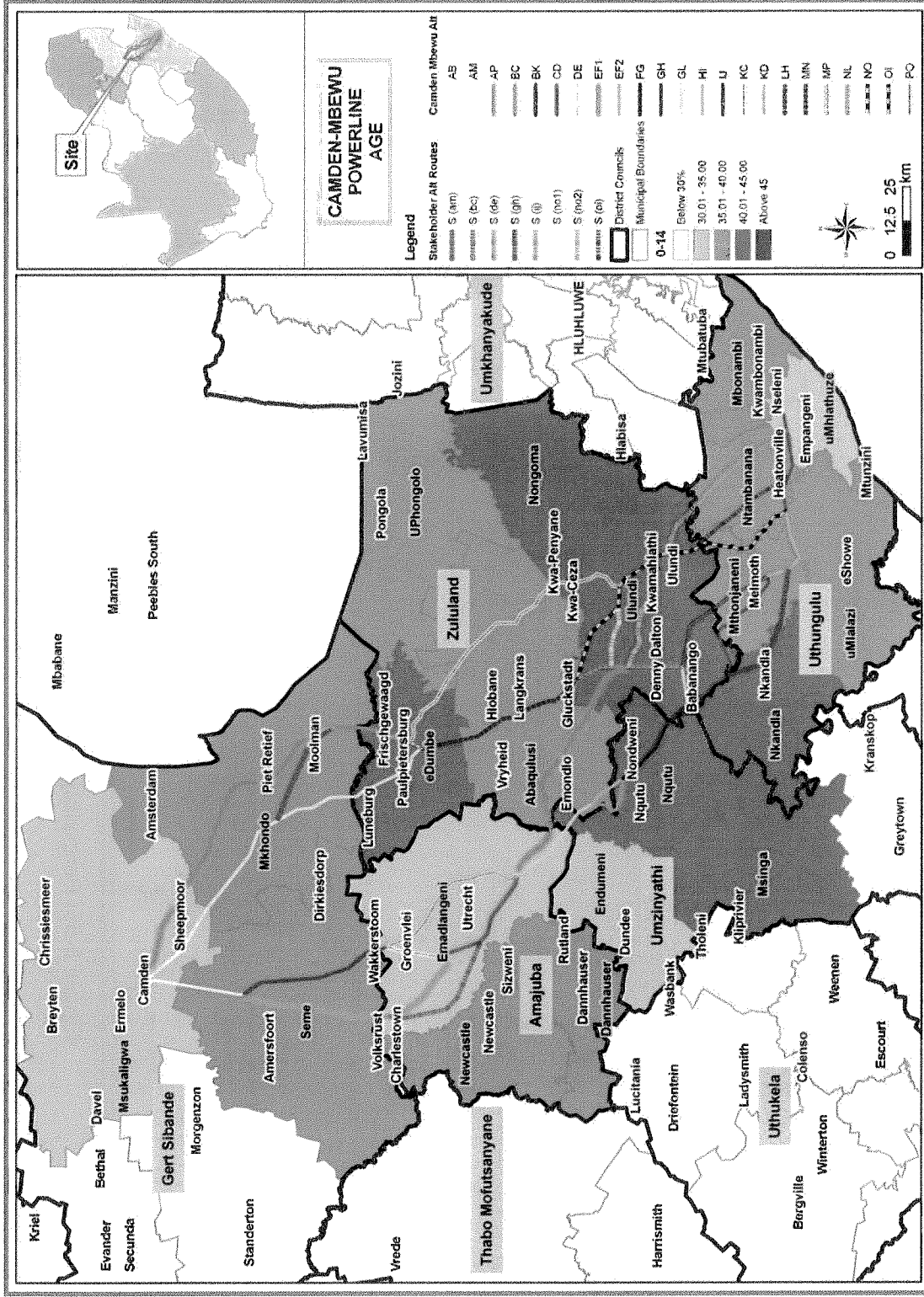


Figure 8-84: Percentage of population aged 14 years or younger (source: CS 2007)

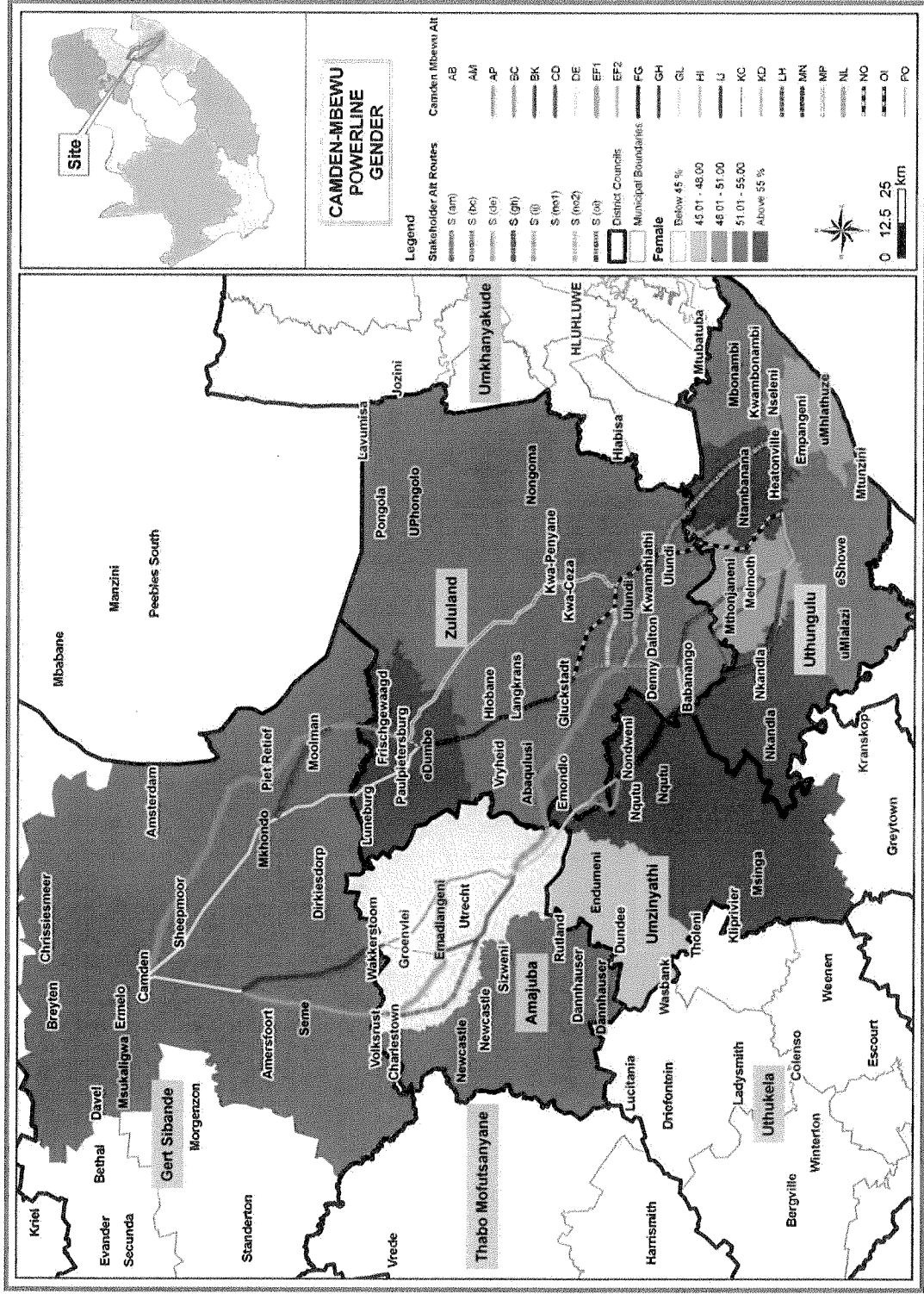


Figure 8-85: Percentage of females in population (source: CS 2007)

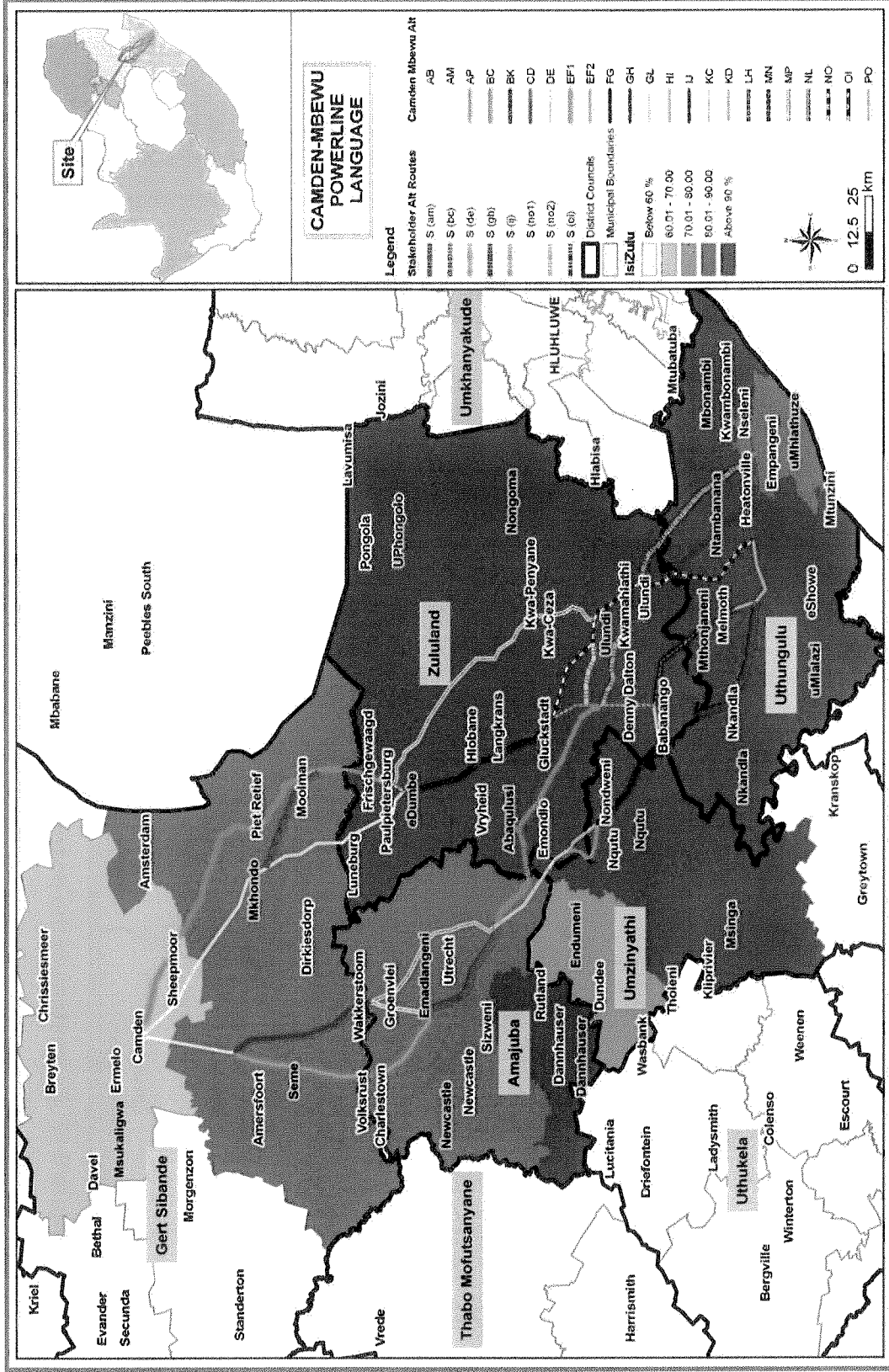


Figure 8-86: Percentage of the population with Zulu as home language (source: Census 2001)

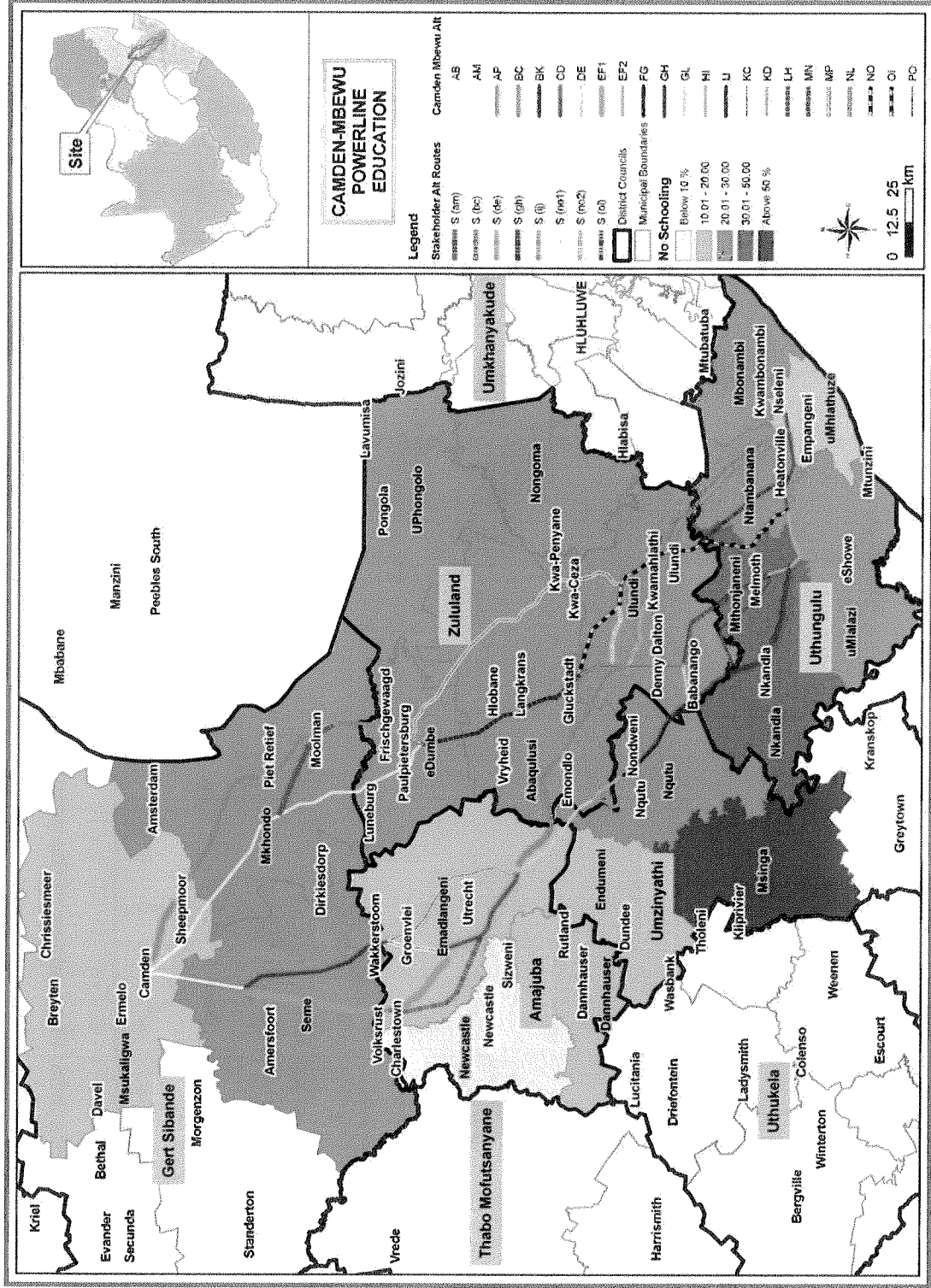


Figure 8-87: Percentage of the population 20 years or older with no schooling (source: CS 2007)

Table 8-7: Average age in years (source: Community Survey 2007)

	Males	Females	Total
Mpumalanga	25.01	26.89	25.98
Gert Sibande DM	25.36	26.67	26.03
Mkhondo LM	22.36	25.12	23.85
Msukaligwa LM	25.09	27.34	26.27
Pixley Ka Seme LM	24.94	27.01	26.07
KwaZulu Natal	24.39	27.59	26.07
Amajuba DM	23.89	26.83	25.42
Dannhauser LM	22.36	26.21	24.42
Emadlangeni LM	26.19	27.17	26.62
Newcastle LM	24.12	26.99	25.62
Umzinyathi DM	21.44	26.98	24.50
Endumeni LM	25.35	26.29	25.80
Msinga LM	19.15	28.21	24.33
Nqutu LM	20.36	25.51	23.20
Uthungulu DM	22.96	26.08	24.61
Mbonambi LM	22.85	26.11	24.52
Mthonjaneni LM	22.36	27.41	24.89
Nkandla LM	19.99	26.02	23.43
Ntambanana LM	21.85	26.34	24.33
uMhlathuze LM	24.50	25.51	25.01
uMlalazi LM	22.70	26.64	24.86
Zululand DM	21.73	25.16	23.57
Abaqulusi LM	22.78	25.38	24.14
eDumbe LM	21.71	25.11	23.63
Nongoma LM	20.70	25.01	23.05
Ulundi LM	21.77	26.04	24.03
uPhongolo LM	21.57	23.82	22.76

8.2.3 Economic Environment

Data Collection and Methodology

This information is extracted from the Economic Impact Assessment undertaken by Urban-Econ and attached in Appendix O3. The methodology adopted for the project comprised of primary and secondary data analysis, and included the following key steps:

- **Baseline socio-economic profiling:** a review of the socio-economic indicators of the study areas was conducted to create an understanding of the local and regional economic and social conditions. Primary and secondary data was used to compile the profiles.
- **Impact modelling:** modelling of impacts was done using national and provincial Social Accounting Matrices (SAM) updated to 2011 figures. The SAM is a comprehensive, economy-wide database that contains information about the flow of resources that takes place between the different economic agents in an economy. Using the SAM, it was possible to identify direct, indirect, and induced effects of the

construction and operational expenditure of the Camden-Mbewu (Theta) transmission power line, as well as effects of the loss of agricultural potential in the area on the local and national economies.

- **Comparative and implications analyses:** using results of the impact modelling exercise, a comparative analysis of the alternative routes was performed. Based on the findings of this analysis, implications of establishing the transmission line along any of the proposed routes were identified. The interpretation focused on identifying the significance of socio-economic impacts that would be felt by directly affected industries and industries that would experience spillover effects of the project, whether these impacts are positive or negative. The analysis also examined the change in the economy of the study area and the extent by which this economy would grow/decline and experience structural transformation if the project is to be implemented
- **Recommendations:** to minimise negative impacts and maximise benefits, from an economic, agricultural and tourism impact point of view that could be associated with the proposed project and particularly the option that would be chosen as the preferred alternative, a number of best scenario alternatives were identified. Furthermore, a monitoring system aimed at tracking the impacts and management thereof was formulated.

Regional and Site Description

Socio-economic profile of the study area

Demographics

The population of the primary study area equalled approximately 1 891 777 people in 2010, representing 410 874 households. Approximately 3 721 024 people resided in the secondary study area of which the uThungulu DM had the largest population size. The tertiary study area had a total population of 14 263 022 people of which 75% was represented by the KwaZulu-Natal province and 25% by the Mpumalanga Province. The population of all three the study areas have been growing over the past few years, however the population growth rates have been slowing down over the past decade. The population in the primary study area has been growing at 1.1% since 1995. The population growth rate for the secondary area was fairly similar – 1.0%, however the growth rate for the tertiary area was a bit higher 1.2%. The Zululand District within the secondary study area had the highest population growth rate of 1.6%, whereas the Amajuba DM had the smallest – 0.6%. By 2015 the population of the primary study area is expected to grow to 1 917 902 people, 1 944 387 people in 2020, and 1 971 238 people in 2025.

Along with the population the numbers of households within the study area have also been projected to increase. The size of households has also started to decrease over the past few years, which mirrors the trends found in the population growth.

The average monthly household income for the primary study area is approximately R5 862 per month (2011). This is considerably lower than that of the average monthly household

income for the country, which is about R 8 087 per month. Mpumalanga had the largest average monthly household income – R6 412 per month. In all three of the study areas a large percentage, more than 40%, of the households earned less than R2 200 per month. The households in the secondary study area had the lowest average household income of R5 611 per month. Household expenditure, in all the study areas, on services and non-durable goods is without doubt the two most dominant expenditure items. Percentage share of income spent on non-durable goods is the same throughout all the study areas (40%).

Economy

In 2010 the primary study area had an estimated 1.09 million people within the working age population, of these 669 764 people were non-economically active and 423 341 people were comprised in the labour force. Therefore the labour participation rate within the study area was 38.7%, which is fairly lower than that of the other three study areas. The number of employed people within the study area amounted to just below 300 000 people, leaving 124 465 people, or 29.4% of the labour force unemployed. The unemployment rate was fairly similar for all the study areas, with the primary study area having the largest percentage of unemployment and the KwaZulu-Natal province, having the smallest percentage (23.2%). The Mpumalanga province had the largest labour force participation rate of 49.8%. The historical dynamics of the employment situation within all the study areas revealed that employment has started to decline from 2008/2009. Based on the historical trends, it is projected that in the next 15 years employment will increase, and the primary study area will employ 346 295 people by 2025. However it is important to take into consideration the new targets set by government with respect to unemployment rates. Government is currently busy formulating a new economic policy outlining the growth path for the country. It targets to reduce the unemployment rate from the current 25% level to 15% level by 2020, which translates in the creation of five million new jobs between 2010/2011 and 2020.

Business sales within the primary study area amounted to R116 172 million in 2010, which equated to R53 419 million value added. Over the years the primary study area's economy has been growing at a faster pace than that of the other study areas, which translates to better economic growth and development within the primary study area. The economies of the study areas have been very sensitive to changes on global and regional arenas. The major global financial and local electricity crisis in 2008 had a significant influence on the dynamics of the country's economy.

The global economy, as well as South Africa's economy, is slowly recovering from turmoil of the past couple of years. The most recent data suggest that the global economy would grow by 4.8% in 2010 and 4.2% in 2011 (World Economic Outlook, October 2010). South Africa has also started to recover, and during 2010, the national economy has expanded by 4.6% q/q in the first quarter, 2.8% q/q in the second quarter and 2.6% q/q in the third quarter (StatsSA, 2010). This positive trend is expected to continue in future. Taking this into consideration and assuming that the new economic growth path target is achieved, it is projected that the turnover for the primary study area's economy will grow to R229 324

million in 2010 prices by 2025, whilst the GDP-R will increase to R85 627 million in 2010 prices.

The study areas' economies is defined as service economies, as the biggest share of their GDP-R is created by the tertiary sectors in particular the finance and business services sector and the trade sector. The Mpumalanga province however has a slightly different economy that that of the other three study areas, in that it has a fairly larger primary sector, specifically its mining sector. The majority of all the study areas' population are employed within the tertiary sector, particularly the wholesale and trade sector.

Detailed analysis of selected agricultural activities and land use types

From an agricultural perspective, the potential areas is dominated by sugarcane farming and forestry plantations

The sugarcane industry is an important contributor to employment. The South African sugarcane industry employs about 84 870 workers in total. In 2009/2010 there were approximately 35 336 registered sugarcane growers within the country. During the 2009/2010 period, approximately 391 483 hectares of sugarcane were planted, which was a fairly large decrease from 413 552 hectares in the 2008/2009 season. The sugarcane farms within South Africa are delineated into 14 areas linked to specific sugar mills. The two sugar mill areas that will be affected by the proposed transmission line are the Felixton and Amatikulu mills. These two mill areas delivered a total of 2711465 tons of sugarcane in the 2009/2010 season.

The FTTP industry in the potentially affected area is represented by the forestry plantations that supply raw materials to primary processing facilities. The majority of the plantations within the study area are Eucalyptus that is primarily managed for pulp production. The industry is vertically integrated, which means that timber produced at these plantations is largely processed further by the companies owning these plantations.

The forestry plantation for pulpwood in 2008/2009 amounted to 733 003 hectares and the pulpwood sales for the same period were approximately 10 396 380 tons.

The afforested area in the country has been declining with the area under eucalyptus plantations decreasing at a faster pace than other species. At the same time the supply of timber cannot meet the demand, particularly with respect to the secondary processing industries such as furniture and wood products manufactured for construction. As a result considerable amount of wood products is being imported to the country to keep utilisation of assets at a high rate

In addition to sugarcane and forestry areas, the potentially affected area has a number of conservational sites and nature reserves to be taken cognisance of as discussed in Section 8.1 above.

9 IMPACT ASSESSMENT METHODOLOGY

In order to ensure uniformity, a standard impact assessment methodology has been utilised so that a wide range of impacts can be compared. 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 9-1.

Table 9-1: Quantities rating and equivalent descriptors for the impact assessment criteria.

Rating	Significance	Extent scale	Temporal scale
1	VERY LOW	<i>Isolated route / proposed route</i>	<u>Incidental</u>
2	LOW	<i>Study area</i>	<u>Short-term</u>
3	MODERATE	<i>Local</i>	<u>Medium-term</u>
4	HIGH	<i>Regional / Provincial</i>	<u>Long-term</u>
5	VERY HIGH	<i>National</i>	<u>Permanent</u>

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

9.1 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 (1000 km²) 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 9-2 below.

Table 9-2: 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 is 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.

9.2 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 9-3.

Table 9-3: Description of the spatial 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 route corridor.
2	Study Area	The impact will affect a route corridor not exceeding the boundary of the corridor.
1	Isolated Sites / proposed site	The impact will affect an area no bigger than the servitude.

9.3 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 9-4.

Table 9-4: 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 the line.
4	Long term	The environmental impact identified will operate beyond the life of operation.
5	Permanent	The environmental impact will be permanent.

9.4 Degree of Probability

Probability or likelihood of an impact occurring will be described as shown in Table 9-5 below.

Table 9-5: Description of the degree of probability of an impact accruing.

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

9.5 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 the table below. 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 9-6: 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.

9.6 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:

$\text{Impact Risk} = \frac{(\text{SIGNIFICANCE} + \text{Spatial} + \text{Temporal})}{3} \times \frac{\text{Probability}}{5}$	
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An example of how this rating scale is applied is shown below:

Table 9-7: Example of rating scale

Impact	Significance	Spatial scale	Temporal scale	Probability	Rating
	LOW	<i>Local</i>	<u>Medium Term</u>	<i>Could Happen</i>	
Impact to air	2	3	<u>3</u>	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 5 classes as described in the table below.

Table 9-8: 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.

9.7 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**

Duration – in underline

Probability – in italics and underlined.

Degree of certainty - **in bold**

Spatial Scale – *in italics*

10 IMPACT ASSESSMENT

The impact assessment was undertaken for the construction and operation phases. Impacts to each environmental element documented in the baseline are described under initial assessment, additional impact, cumulative impact, mitigation measures and residual impact. The initial assessment outlines the existing level of impact by current activities. The additional impact assesses the potential impact of the development on a criterion. Mitigation measures for the additional impact are then prescribed and a residual impact is calculated. The residual impact and initial impacts are then combined to describe the cumulative impact to the environment.

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

- Soils and Agricultural Potential (Land Capability)
- Terrestrial Ecology
- Avi- Fauna
- Visual
- Cultural Heritage Environment
- Palaeontology
- Social Environment
- Economic Environment

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.

10.1 Construction Phase

During the construction phase, the 765kV power lines will be erected. A 765kV Transmission line requires a servitude width of A 94 metre and 104 metre in plantation areas (47 or 52 metres on either side of the power line). The power line cables are strung between pylons / towers, which are steel structures erected on concrete footings fixed in the substrate (soil or rock) below the pylon.

The major impacts during construction occur as a result of the following construction activities associated with the erection of the power lines and include, amongst others, heavy vehicle movement, excavation and handling of soil, construction of an access road and any wastes generated.

10.1.1 Soils and Agricultural Potential

Soils and land capability need to be grouped together, because the type of soil will determine the capability of the land and what the land can be used for in the future. If the soil is arable, then it is suitable for farming and the land use will be agriculture.

Initial Impact

The study area is dominated by agricultural land with patches of industry, rural and urban settlements. The bulk of the existing impacts to soils along the route come in the form of disturbance from tillage and plantations. It is well documented that plantations of pine and Blue Gum actually modify the soils on which they grow. Furthermore large erosion scars have been found along the route, especially in the KZN midlands. Here the erosion is aggravated by overgrazing by rural livestock.



Figure 10-1: Erosion Scars

The initial impact to soils and land capability is **probably** a MODERATE negative impact acting over the long term, and is presently occurring in *isolated sites*. As indicated in the Table below the impact rating class is a Moderate Impact.

Table 10-1: Soil and Land Capability Initial Impact Assessment

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Soils	MODERATE	<i>Isolated Sites</i>	<u>Long Term</u>	<u>Is occurring</u>	Moderate
	3	1	4	5	2.67

Additional Impact

The additional impact from the new power lines will mainly be as a result of the construction of the power line pylons and their footings. The heavy vehicles traversing can compact the soils and the soils at each pylon footing will be excavated. The route alternatives are approximately 360 km in length and each will have a single line. Therefore if using the average pylon distance of 450m it can be assumed that there would be 800 pylons constructed. At the time of writing this report, the proponent has not determined which of the various pylon designs will be utilised, and therefore the actual impact could vary. For this analysis the worst case scenario is assumed, which are self supporting strain towers with 4 footings impacting on the soils per pylon.

In addition to the pylon footings the soils will also be disturbed by the establishment of a construction road as well as the movement of construction vehicles. The impact from each of the routes are summarised below.

As indicated in Section 8 above, Alternative 2 crosses more sensitive soils than Alternatives 1 and 3. That said, the impact rating class between the two alternatives differ and is therefore rated separately. For Alternative 3 the additional impact to soils and land capability is **probably** a LOW negative impact acting over the long term, and will definitely occur at *isolated sites*. As indicated in the table below the impact rating class is a Moderate Impact.

Table 10-2: Soil and Land Capability Additional Impact Assessment – Alternatives 1 and 3

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Soils	Low	<i>Isolated Site</i>	<u>Long Term</u>	<u>Will occur</u>	Moderate
	2	1	4	5	2.3

For Alternatives 1 and 2 the additional impact to soils and land capability is **probably** a MODERATE negative impact acting over the long term, and will definitely occur at *isolated sites*. As indicated in the table below the impact rating class is a Moderate Impact.

Table 10-3: Soil and Land Capability Additional Impact Assessment – Alternative 2

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Soils	Moderate	<i>Isolated Site</i>	<u>Long Term</u>	<u>Will occur</u>	Moderate
	3	1	4	5	2.67

Cumulative Impact

The cumulative impact to soils if a pylon is placed in an already disturbed area remains as assessed for the initial assessment, i.e. a Moderate impact.

Mitigation Measures

- Avoid unnessacary removal of vegetation cover.
- Use existing access roads as far as possible;
- If a new road is constructed, ensure that some measure of erosion prevention is followed;
- Take land use into consideration when choosing pylon types, it is recommended that smaller footprint pylons be used in cultivated areas;
- Avoid placement of pylon footings in clay soils;
- Spread absorbent sand on areas where oil spills are likely to occur, such as the refuelling area in the hard park;
- Oil-contaminated soils are to be removed to a contained storage area and bio-remediated or disposed of at a licensed facility;
- Use berms to minimise erosion where vegetation is disturbed, including hard parks, plant sites, borrow pit and office areas;
- If soils are excavated for the footing placement, ensure that the soil is utilised elsewhere for rehabilitation/road building purposes; and
- Ensure that soil is stockpiled in such a way as to prevent erosion from storm water.

Residual Impact

The residual impact remains a Moderate Impact, as the mitigation measures will not reduce the overall impact of the power line construction.

10.1.2 Flora

Initial Impact

The vegetation in and around the study area has significantly been transformed by farming activities, urbanisation and industrial activities. In addition, the remaining natural vegetation is being utilised for grazing and is being invaded by alien invasive species. Thirty six (36%) percent of the study area vegetation has been disturbed in some way.

Table 10-4: Flora Initial Impact Rating Scale

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Flora	MODERATE	<i>Local</i>	<u>Long Term</u>	Is occurring	High
	3	3	4	5	3.3

The initial impacts to flora include extensive grazing, cultivation and alien invasive colonisation. The initial impact to flora is **definitely** MODERATE negative impact acting over the long term, and is presently occurring in the *local area*. As indicated in Table 10-4 above the impact rating class is a High Impact.

Additional Impact

Additional impacts will be the removal of vegetation within the servitude for the construction of the new power lines and the associated servitude roads. There is a major concern to the effects on endangered and threatened endangered vegetation types. There is concern about the loss of vulnerable and threatened vegetation types and the table in Section 8 illustrates the length that each route alternative will cross over each vegetation types identified. From the table it can be seen that Alternative 1 impacts on the least endangered vegetation but quite a large section of vulnerable vegetation. Alternative 3 has a similar overall impact but impacts on a larger section of endangered vegetation while Alternative 2 has the largest impact.

Table 10-5: Vegetation Additional-Impact Rating Scale Alternative 1

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Vegetation	MODERATE	<i>Study Site</i>	<u>Long Term</u>	<i>It's going to happen</i>	Moderate
	3	2	4	5	3

The additional impact to vegetation is MODERATE, occurs in *Study site* and will be Long Term and It's going to happen. A rating of 2.2 gives an impact class of Moderate.

Cumulative Impact

The cumulative impacts take into account the affects that the construction and the initial impacts have on the vegetation. In areas where the vegetation has already been disturbed the lines will not increase the impact rating. In areas that have not yet been disturbed the impact will be increased to the rating as per the initial assessment i.e. a High impact.

Mitigation Measures

- All construction areas should be demarcated prior to construction to ensure that the footprint of the impacts are limited (including areas where vehicles may traverse);
- A suitable seedmix of indigenous plants should be used in all rehabilitation programmes on the site.
- All alien invasive species on site should be removed and follow up monitoring and removal programmes should be initiated once construction is complete
- The sensitive vegetation unit should be avoided and construction limited to 100 m from the edge of the wetlands and streams;
- Alternative 1 should be considered as the preferred alternative;
- Adhere to the ESKOM vegetation management guideline.

Residual Impact

The successful implementation of the mitigation measures will ensure that the impact of the power line is limited to the study area, thereby reducing the cumulative impact to a Moderate impact.

Table 10-6: Vegetation Residual-Impact Rating Scale

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Flora	MODERATE	<i>Study Site</i>	<u>Long Term</u>	Is going to happen	Moderate
	3	2	4	5	3

The residual-impact, as calculated in Table 10-6 above, will be Moderate, occur in *Study sites* and will be Long Term and is going to happen. A rating of 3 is a Moderate impact class.

10.1.3 Fauna

Initial Impact

As described in the habitat assessment in Section 5, the site is relatively disturbed with the disturbed/grazed grassland, the undisturbed/natural grassland and the wetland and riparian

zones the main habitat still available for fauna. The remaining natural areas did show high species diversity, indicating that the existing impact is quite significant.

The current impact on fauna is **probably** of a HIGH negative significance, affecting the *region*, and acting in the long-term. The impact has occurred. The impact class is classified as a High impact.

Table 10-7: Fauna Initial Impact Assessment

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Fauna	HIGH	<i>Region</i>	<u>Long Term</u>	<u>Has occurred</u>	High
	4	4	4	5	4

Additional Impact

The power lines will not directly impact on fauna, but the removal of habitat within the power line servitude is an impact. The species subceptable to direct impact is mostly avifauna, which is assessed seperately in another specialist report. Small mammals can also be displaced during construction.

The impact to fauna during the construction phase of the power lines will mostly be in the form of disturbance from the removal of habitat, construction workers and vehicle noise. It was found that three particular areas have habitat for sensitive species that should be avoided and these include the Wakkerstroom/Groenvlei wetlands and Montane grassland, and the Black Rhino habitat adjacent to the Hluhluwe Umfulozi Park. These areas are unsuitable and hence the impact assessment described below is for the remainder of the route.

The additional impact to fauna is **probably** MODERATE negative impact acting over the short term, and will occur in *isolated sites*. As indicated in Table 10-8 below the impact rating class is a Low Impact.

Table 10-8: Fauna Additional Impact Assessment

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Fauna	MODERATE	<i>Isolated Site</i>	<u>Short Term</u>	<u>Will occur</u>	Low
	3	1	2	5	2

Cumulative Impact

The cumulative impact to fauna remains as assessed for the initial impact assessment due to the large scale of the existing impact. Therefore the impact remains a High impact to Fauna.

Mitigation Measures

- All construction areas should be demarcated prior to construction to ensure that the footprint of the impacts are limited (including areas where vehicles may traverse);
- The sensitive habitat should be avoided and construction limited to 50 m from the edge of the wetlands and streams;
- Align routes to avoid sensitive habitats;
- All alien invasive species on site should be removed and follow up monitoring and removal programmes should be initiated once construction is complete;
- All construction and maintenance activities should be undertaken in accordance with Eskom Transmission's environmental best practice standards.
- Care should be taken not to unnecessarily disturb any birds along the servitude.
- The Environmental Control Officer should identify any sensitive areas along the servitude, particularly large terrestrial species and notify the fauna specialist of these so that advice can be given on how to best deal with the situation.
- The construction of new access roads in particular should be limited to a minimum.
- All vehicle and pedestrian movement should be restricted to the actual construction site and, in the case of maintenance patrols, to the actual servitude.
- Adhere to the ESKOM vegetation management guideline; and
- Install power lines according to the ESKOM bird collision prevention guideline.

Residual Impact

The mitigation measures proposed above will ensure that the construction of the proposed power line remains a Moderate impact but the Residual Impact remains High.

10.1.4 Avi- Fauna

Initial Impact

The initial impact on avi-fauna in the area is mainly due to the large presence of existing power lines. The natural grassland is the preferred habitat of the majority of power line sensitive Red Data species in the grassland biome. Grassland and savanna comprises the majority of the study area. The following high risk factors, irrespective of biome, were identified: Blue Crane, Grey Crowned Crane and Wattled Crane breeding localities.

Table 10-9: Total percentage per biome taken up by the proposed corridors/ routes

Biome	Percentage of total surface area of corridors
Forest	0.01%
Grassland	48.02%
Savanna	47.29%
Thicket	4.67%

Table 10-10: Initial Impact on Avi- Fauna (Alternative 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Initial impact on avi-fauna	HIGH	<i>Local Area</i>	<u>Medium Term</u>	<i>Has Occurred</i>	High
	4	3	3	5	3.3

Additional

The additional impact of the construction of the power lines will cause further disturbance. Some habitat will be lost, especially considering the servitude that will be used for the powerline (94m). The largest impact will result from the overhead traction equipment and the power lines. The three alternatives all cross over streams, savanna and grassland biomes. Alternative 1 and 3 crosses over more than alternative 2 and also impact the habitat for a longer length. Therefore Alternative 2 is recommended. The following potential impacts on birds were identified:

- Collisions with the earthwire of the proposed transmission line
- Habitat destruction and disturbance which could lead to displacement of birds

Table 10-11: Additional Impact on Avi- Fauna (Alternative 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Additional impact on avi-fauna	HIGH	<i>Study area</i>	<u>Long Term</u>	<i>Very Likely</i>	Moderate
	4	2	4	4	2.7

Cumulative

The cumulative impact of both the previous impacts and the proposed development remain as assessed for the initial impact assessment.

Table 10-12: Cumulative Impact on Avi- Fauna (Alternative 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Initial impact on avi-fauna	HIGH	<i>Local Area</i>	<u>Medium Term</u>	<i>Has Occurred</i>	High
	4	3	3	5	3.3

Mitigation Measures

- There are many methods that can be used to mitigate avian power line interactions (for example, APLIC 1994) and several investigations dealing with the collision problem have focused on finding suitable mitigation measures (see APLIC 1994 for an overview).
- The most proactive measures are power line route planning (and the subsequent avoidance of areas with a high potential for bird strikes) and the modification of power line designs (this option includes line relocations, underground burial of lines, removal of

over-head ground wires, and the marking of ground wires to make them more visible to birds in flight).

- The phase conductor should be insulated for a distance of one metre on either side of the insulator for all three phases to prevent any risk of phase-earth electrocution.
- Install power lines according to the Eskom bird collision prevention guideline.

The mitigation of bird impacts caused by power lines is to a large extent determined by the microhabitat within a zone of a hundred metres to about 1km on both sides of the line. This is particularly relevant as far as mitigation for bird collisions are concerned.

Residual Impact

With the successful implementation of the above mitigation measures the impact to avi-fauna can be mitigated to a moderate impact.

Table 10-13: Residual Impact on Avi- Fauna (Alternative 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Residual impact on avi-fauna	MODERATE	<i>Local Area</i>	<u>Long Term</u>	<u>Very Likely</u>	Moderate
	3	3	4	4	2.7

10.1.5 Surface Water and Wetlands

Surface water features are demarcated as sensitive because of the high variety of fauna and flora that occur in such areas. Areas such as rivers, dams and wetlands provide habitats for many plant and animal species that are endangered, which makes these areas very sensitive and of a high conservation value.

Initial Impact

There are a number of streams and drainage lines that have been dammed which may have caused damage to downstream aquatic life. The presence of agriculture and urban areas will also have had an affects on surface water flow. The construction of the existing power lines have had minimal affect on surface water flow, as they span most of these features.

Table 10-14: Surface water Initial Impact Rating Scale

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Surface water	VERY LOW	<i>Isolated sites / proposed site</i>	<u>Medium Term</u>	<u>Could happen</u>	Low
	1	1	3	3	1.6

The initial impact for surface water is VERY LOW, occurs in *Isolated sites / proposed site* and will be Medium Term and It's going to happen / has occurred. This results in a rating of 1.6 or a Low impact class.

Additional Impact

The construction of the proposed power lines should have no affect on drainage lines because of the distance between pylons, but it should be noted that many drainage, streams, rivers and wetlands cross over the proposed and existing lines. It is recommended that buffer zones should be in place to project sensitive aquatic areas.

Waste generated during the construction phase may enter the environment through surface water runoff i.e. litter or pollution such as hydrocarbons can be washed into aquatic systems affecting those systems negatively. Storm-water flowing over the site will also mobilise loose sediments, which may enter the surface water environment affecting water quality. Storm-water containing sediment can be discharged to grassland buffers to ensure sediments fall out prior to water entering surface water bodies. Care must be taken that storm-water containing hydrocarbons and other pollution sources are not discharged.

Table 10-15: Surface water Additional-Impact Rating Scale

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Surface water	VERY LOW	<i>Isolated sites / proposed site</i>	<u>Medium Term</u>	<u>Could Happen</u>	Very Low
	1	1	3	3	1

The additional impact for surface water is VERY LOW, occurs in *Isolated sites / proposed site*, will be Long Term and Could Happen to occur. This results in a rating of 1 or a Very Low impact class.

Cumulative Impact

The cumulative impact of the current activities and the future activities will not increase the impact rating from a Low Impact as rated in the initial impact assessment.

Mitigation Measures

- ☉ No construction camps or pylons should be placed within 50m from the edge of a surface water body.
- ☉ Demarcated areas where waste can be safely contained and stored on a temporary basis during the construction phase should be provided at the hard park;
- ☉ Waste is not to be buried on site;
- ☉ Hydro-carbons should be stored in a bunded storage area;

- All hazardous materials inter alia paints, turpentine and thinners must be stored appropriately to prevent these contaminants from entering the environment;
- Spill-sorb or similar type product must be used to absorb hydrocarbon spills in the event that such spills should occur;
- Care must be taken to ensure that in removing vegetation adequate erosion control measures are implemented;
- A storm-water management plan, including sufficient erosion-control measures, must be compiled in consultation with a suitably qualified environmental practitioner / control officer during the detailed design phase prior to the commencement of construction; and
- The propagation of low-growing dense vegetation suitable for the habitat such as grasses, sedges or reeds is the best natural method to reduce erosion potential in sensitive areas.

Residual Impact

The mitigation measures proposed will reduce the risk of the additional impact occurring, but it will not reduce the residual impact class, which remains at a Low impact as rated in the initial impact assessment.

10.1.6 Visual

Initial Impact

The visual impact for each of the routes is described in Section 8. The present visual landscape is one dominated by agriculture with intermittent rural residences, urban areas and industrial or mining activities. The initial impact to the visual environment is LOW negative acting in the long term, and has already occurred. The impact has **definitely** impacted on the *local region*

The study site has several existing high voltage power lines that impact on the visual character of the landscape.

Table 10-16: Visual Initial Rating Scale

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Visual	LOW	<i>Local</i>	<u>Long Term</u>	<i>Has occurred</i>	Moderate
	2	3	4	5	3

Additional Impact

During the construction phase, the local residents will be able to see the construction workings. This will impact negatively on the visual character of the landscape but is of short

duration. Several very pristine areas were found along the route as well as areas that are used for tourism. These routes should be avoided if possible and include Wakkerstroom, Groenvlei, Utrecht, Black Umfolozi and near the Hluhluwe Umfolozi Park. In addition several routes have existing power lines along the route alignments, and should rather be used than creating a new impact.

Table 10-17: Visual Visual Additional Impact Rating Scale

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Visual	LOW	<i>Local</i>	<u>Short Term</u>	<u><i>It's going to happen</i></u>	Low
	2	3	2	5	2.33

The additional impact to the visual landscape is LOW, occurs in *Local area* and will be Short term and *It's going to happen*. A rating of 2 gives an impact class of Low.

Cumulative Impact

The cumulative impact will not change and the cumulative impact remains a Moderate impact.

Mitigation Measures

- Only the servitude of the proposed power line should be exposed. In all other areas, the natural vegetation should be retained;
- Dust suppression techniques should be in place at all times during the construction phase;
- Access roads should be minimised to prevent unnecessary dust; and
- Utilise non-shiny structures for the hard park and toilets, i.e. avoid unpainted roofs.

Residual Impact

The initial visual impact of the power lines can not be mitigated and therefore the mitigation measures merely ensure that the additional impact is managed responsibly. The residual impact remains a Moderate impact.

10.1.7 Cultural Heritage Environment

Initial Impact

Impacts that could occur to historically significant structures are limited to the physical removal of graves and historical buildings, vandalism or renovations to these structures

resulting in permanent damage. There is presently no indication that any existing impacts to any historical structures have taken place and therefore there is no initial impact rating.

Additional Impact

As already established impacts to heritage sites occur as a result of physical destruction / disturbance to the land surface and alteration of the sense of place of sites of heritage significance. Although power lines affect long sections of landscape, the impact of the power lines themselves is minimal when the effect on the ground is evaluated. The most direct impact on the surface of the landscape will be the construction of the footing for the pylons. These will consist of concrete platforms set into excavated foundations. The direct impacts of these could be mitigated through pylon placement, as well as through the selection of the type of pylon design. Short-term impacts are also anticipated during the construction phase of the power line when construction camps and other activities could directly affect the surface of the surrounding areas.

It is therefore anticipated that the direct surface impact of power lines will be with the largest impact expected on the cultural landscape character.

Alternative 1 and 2

Alternative 2 passes through some areas that are rich in post-contact (colonial) archaeology. Most of this is associated with the South African War and includes sites of battles, graves of victims of conflict and concentration camp sites. Further sites are also found associated with the Voortrekker / Zulu conflicts. Major sites such as the eMakhosini Cultural Landscape is located close to Ulundi.

Based on these findings from the specialist consultant, the additional impacts on historical structures and graves would probably be LOW. The impacts identified if not mitigated would be permanent, unlikely to occur at isolated sites.

Table 10-18: Additional impact on cultural and archaeological sites (Alternative 1 and 2)

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Additional impact on cultural and archaeological sites	LOW	<i>Isolated sites</i>	<u>Permanent</u>	<u>Unlikely</u>	Low
	2	1	5	2	1.1

Alternative 3

Alternative 3 passes through some areas that are rich in post-contact (colonial) archaeology. Most of this is associated with the South African War and includes sites of battles, graves of victims of conflict and concentration camp sites. Further sites are also found associated with the Voortrekker / Zulu conflicts. No major sites are located along this route.

Many of the towns in this region also hold buildings and sites of historic importance (to be discussed under Built Environment section). Some of the old farm homesteads along this route also have historic significance. Many of the conflict sites, such as battlefields, have very little material remains, however their location is of great importance. Most direct impacts on the surface can be mitigated through micro-alignment of pylons during the walk-down phase of the project. The cultural landscape associated with Alternative 3 is similar to that found at Alternative 2 except for the occurrence of very sensitive cultural landscapes such as eMakhosini. Alternative 3 is seen as the least destructive alternative from a heritage management point of view.

Provided an archaeologist is involved during the walk-down planning phase of the project, NO IMPACTS are anticipated for this alternative.

Table 10-19: Additional impact on cultural and archaeological sites (Alternative 3)

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Additional impact on cultural and archaeological sites	NO IMPACT				

Cumulative Impact

There is not expected to be any cumulative impact on the heritage environment.

Mitigation Measures

- It is recommended that a palaeontologist do spot-checks on excavated base foundations during the construction phase of the power line.
- For Alternative 1, it is recommended that alignment alternative **EF2** be chosen over **EF1** due to its proximity to the monuments and cultural landscape associated with the *Ncome/Bloodriver monument*.
- Further south, alternative **GH** is preferred over alternative **LH**. This will by-pass the culturally important *eMakhosini Cultural Landscape* area (and area already identified as a no-go area).
- The alignment option **NL** is indicated as a NO-GO area.
- The Volksrust and Utrecht areas are very similar in their cultural significance, however the Wakkerstroom area shows indications of higher sensitivity and therefore option **BC** and **CD** is recommended for this area.
- Option **LH** is indicated as a no-go area by the provincial heritage authority.
- To minimize the effects on the landscape, it is recommended that the existing corridors be used, as far as possible. Pylon designs should be kept consistent.

Residual Impact

If the above mitigation measures are implemented, and adhered to then the residual impact on the cultural and archaeological sites will possibly have a VERY LOW impact.

Table 10-20: Residual impact on cultural and archaeological sites (Alternative 1- 3)

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Residual impact on cultural and archaeological sites	LOW	<i>Isolated sites</i>	<u>Permanent</u>	<i>Practically impossible</i>	Very Low
	1	1	5	1	0.5

10.1.8 Palaeontology

Initial Impact

Initial impacts to palaeontology (from existing activities in the area) were not assessed during this study.

Additional Impact

No palaeontological sites of significance were identified along any of the potential alignments. Although desktop studies indicated that the further east the routes the less likely they would be to impact negatively on potential palaeontological site.

Due to the limited size of the pylon footprints, NO IMPACTS are anticipated on palaeontological sites within these two corridors. It is possible, but unlikely, that fossiliferous deposits could be identified during the excavation of the pylon bases or any associated excavations. This possibility is seen as positive since the scale of the impact will be low compared to the value of discovering new fossil bearing sites.

Cumulative Impact

There is not expected to be any cumulative impact on palaeontology.

Mitigation Measures

- Alternative 3 would have the least risk of impact on the palaeontological heritage.
- Ground-truthing is necessary to confirm the presence of fossils but as this is a large area the visits should be prioritized once the complete scoping and impact exercise has been completed.

- Little data have been published on these potentially fossiliferous deposits. Around the coalmines there is most likely to be good material and yet in other areas the exposures may be too poor to be of interest. When they do occur, fossil plants are usually abundant and it would not be feasible to preserve and maintain all the sites, however, in the interests of heritage and science such sites should be well recorded, sampled and the fossils kept in a suitable institution.
- One or two sites must be preserved for posterity, the selection of them being determined by quality of the fossils, and practical issues such as being far away from development and interference by people and livestock, and also have some means of monitoring the safekeeping in place.
- Once construction has begun and if good exposures are found then the contractors and/or Eskom should contact a palaeontologist urgently to do a rescue operation.

Residual Impact

No Residual Impact

10.1.9 Social Environment

The impacts to the socio-economic environment were assessed by a specialist consultant. The Social Impact Assessment (SIA) is attached in Appendix O6. The social impacts are summarised in the section below, but more detail can be obtained by reading the full report in the attached report.

Initial Impact

The initial impacts of existing activities on the existing social fabric were not assessed.

Additional Impact

Table 10-21 represents the social change processes that have been identified and the possible social impacts that may result because of these processes. It also identifies the stakeholder group that is most likely to be affected by the process.

Table 10-21: Summary of socio-economic impacts.

Social Change Process	Possible Social Impact	Affected stakeholder group
In-migration	<ul style="list-style-type: none"> • Increased pressure on local services & infrastructure • Increased incidence of STD's, HIV & AIDS • Disruption to existing power relationships and decision-making structures • Social nuisance e.g. prostitution, damage to property, discrepancy in income of workers 	<ul style="list-style-type: none"> • Vulnerable communities • Surrounding towns • Tourism • Farmers

Social Change Process	Possible Social Impact	Affected stakeholder group
Resettlement	<ul style="list-style-type: none"> • Range of social impacts – specific procedures to be followed, best to be avoided • Uncertainty about future 	<ul style="list-style-type: none"> • Vulnerable communities
Change in land use	<ul style="list-style-type: none"> • Decreased access to sources of livelihood resulting in poverty and/or drop in standard of living • Loss of productive land leading to loss of profit leading to job losses • Long term conflict about management of servitudes • Environmental nuisance e.g. noise, dust • Safety hazards • Communication and arrangements surrounding access to properties & management of servitude – can be positive or negative • Loss of sense of place 	<ul style="list-style-type: none"> • Industry • Farmers • Vulnerable communities • Tourism
Deviant social behaviour	<ul style="list-style-type: none"> • Increase in crime and disorder • Acts of sabotage • Breakdown of traditional values 	<ul style="list-style-type: none"> • Vulnerable communities • Farmers • Industry • Tourism • Surrounding towns
Employment opportunities	<ul style="list-style-type: none"> • Loss of workers to construction process because of higher pay • Opportunity for local low skill employment • Indirect employment opportunities 	<ul style="list-style-type: none"> • Vulnerable communities • Farmers • Industry • Tourism • Surrounding towns
Legal processes	<ul style="list-style-type: none"> • Uncertainty resulting from EIA process (selection of route) • Fear and anxiety related to the land acquisition process • Feelings related to past experiences of management of servitude – Eskom's social license to operate. 	<ul style="list-style-type: none"> • Industries • Farmers • Vulnerable communities • Tourism • Surrounding towns

The assessment for each of the aforementioned impacts is summarised in Table 10-22.

Table 10-22: Additional impact on social environment (Alternative 1- 3)

Finding	Magnitude	Duration	Scale	Probability	Significance
Pressure on infrastructure	HIGH	<u>Short term</u>	<i>Regional</i>	<i>Has occurred</i>	High
	4	2	4	5	3.7
Leave behind infrastructure for community	VERY HIGH	<u>Permanent</u>	<i>Regional</i>	<i>Unlikely</i>	Low
	5	5	4	2	1.9
Increase in STDs	HIGH	<u>Medium-term</u>	<i>Regional</i>	<i>Very likely</i>	Moderate
	4	3	4	4	2.9
Social nuisance	HIGH	<u>Short-term</u>	<i>Local</i>	<i>Has occurred</i>	Moderate
	4	2	3	5	3.0
Resettlement	VERY HIGH	<u>Short term</u>	<i>Local</i>	<i>It's going to happen</i>	High
	5	2	3	5	3.3
Sense of place	HIGH	<u>Permanent</u>	<i>Regional</i>	<i>It's going to happen</i>	Very High
	4	5	4	5	4.3
Loss of productive land	VERY HIGH	<u>Permanent</u>	<i>Regional</i>	<i>It's going to happen</i>	Very High
	5	5	4	5	4.7
Management of servitude	HIGH	<u>Long term</u>	<i>Regional</i>	<i>Very Likely</i>	High
	4	4	4	4	3.2
Safety hazards	MODERATE	<u>Long term</u>	<i>Local</i>	<i>Could Happen</i>	Low
	3	4	3	3	2.0
Environmental nuisance	MODERATE	<u>Medium term</u>	<i>Local</i>	<i>It's going to happen</i>	Moderate
	3	3	3	5	3.0
Increase in crime & disorder	HIGH	<u>Short term</u>	<i>Regional</i>	<i>Very Likely</i>	Moderate
	4	2	4	4	2.7
Acts of sabotage	VERY HIGH	<u>Short term</u>	<i>Local</i>	<i>Very Likely</i>	Moderate
	5	2	3	4	2.7
Loss of workers to construction team	HIGH	<u>Short term</u>	<i>Regional</i>	<i>It's going to happen</i>	High
	4	2	4	5	3.3
Local job opportunities	HIGH	<u>Short term</u>	<i>Regional</i>	<i>Very Likely</i>	Moderate
	4	2	4	4	2.7
Indirect employment opportunities	HIGH	<u>Short term</u>	<i>Local</i>	<i>Very Likely</i>	Moderate
	4	2	3	4	2.4
Uncertainty caused by EIA process	HIGH	<u>Short-term</u>	<i>Regional</i>	<i>It's going to happen</i>	High
	4	2	4	5	3.3
Fear & anxiety caused by land acquisition process	HIGH	<u>Short-term</u>	<i>Local</i>	<i>Very likely</i>	Moderate
	4	2	3	4	2.4
Feelings in relation to past experience with Eskom	VERY HIGH	<u>Long term</u>	<i>Regional</i>	<i>It's going to happen</i>	Very High
	5	4	4	5	4.3

Cumulative Impact

Potential cumulative impacts:

- Will be felt by landowners with more than one servitude on their farm i.e. additional people wanting to access the servitude; additional fire risk; and more opportunity for invader species to take over.
- In areas where people have had negative experiences with the management of servitudes their expectation will be to have similar experiences, should Eskom not improve their service the impact will be felt much more intensely.
- In rural areas where there are already heavy vehicles travelling on a daily basis;
- In some places in the project area, where other construction activities are underway, the influx of people has already resulted in increased crime levels. Acts of sabotage is already used by some of the local residents as a form of retribution. There is a risk that this may become the accepted way of dealing with grievances in the eyes of the affected communities.
- Cumulative impacts on local entrepreneurs will be positive and assist in developing their businesses further.
- Local businesses in some parts of the project area have already lost labour to other construction processes and this process may escalate that impact.
- People lose faith in the EIA process if they experience a number of these processes in a negative light. The less faith they have in the process the higher the levels of stress and anxiety will be. If Eskom reportedly continues to conduct themselves the way they are currently doing, their public image will get irreparable damaged and this will filter through in acts of sabotage or denial of access. It can also result in extended legal battles.

Mitigation Measures

- Alternative 1 is the recommended alternative
- Infrastructure such as roads should be maintained in the present condition or improved on. The contractor should be responsible for managing this impact on private property.
- Contractors must adhere to the rules as set down by the property owner. This aspect should be included in their scope of work to ensure that they provide the financial means to execute the necessary maintenance and repair work required. Should they disobey the local rules regarding speeding a fine system must be implemented.
- Eskom must appoint an environmental and social monitor (or farm liaison officer) for the project. These people must be independent from the contractor. The social monitor can also act as the community liaison officer.
- Any incidences must be reported in a complaints register that should be inspected by the social and environmental monitor on a weekly basis. Eskom must audit this document on a monthly basis.
- When provincial and national roads are involved, the expectation is not that the contractors are responsible, but that the responsibility lies with Eskom, and they should

consult with the relevant roads agency to ensure that they do not contribute to the deterioration of roads without taking some responsibility for the impact that their vehicles have on the road during construction.

- The site of construction camps must be discussed with local government structures (or traditional structures in tribal areas) and opportunities for co-operative development should be investigated. The government may for example donate the land and services, whilst the contractor donates the physical infrastructure such as buildings. This should (where possible) then be left behind after the construction process for the use of the local communities.
- The contractor should have a person trained in first aid on site to deal with smaller incidents that require medical input.
- If construction camps with local barracks are used these should adhere to strict environmental requirements.
- Services should be negotiated with landowners and local municipalities and Eskom should audit the agreements that must be put in place to ensure that essential services are not taken away from communities.
- Industry requirements such as those from the Forestry Stewardship Council must be adhered to.
- Local landowners should be allowed to produce a set of rules to which contractors must adhere if they are on private property. The environmental and social monitor should inspect this.
- The landowner must sign a release form when the construction team leave his property to ensure that there is no unfinished business on his property. The social monitor must check in with the affected landowners on a weekly basis whilst there are construction activities on the property.
- There must be a well-published, culturally appropriate grievance mechanism. This must be agreed with local communities at the start of the construction period in the area. The communities must give input in the process to ensure ownership.
- Grievances must be dealt with within a certain period.
- All grievances must be recorded in a register stating the grievance, date that it occurred and action taken.
- The aggrieved person should sign a form that explain the grievance, the process followed and what the outcomes were.
- Communication and grievance channels must be explained in writing. The landowners must not be sent on a wild goose chase between Eskom and the contractors if they have grievances or complaints.
- Should the provision of bulk-services to contractors be to the detriment of the affected communities, these services should be brought in from outside the affected area.

- When investigating existing accommodation the contractor should ensure that the necessary sanitation services are available and have the capacity to meet the additional needs. This assurance should be given to the contractor in writing.
- Eskom cannot control squatter settlements surrounding towns. The contractor must ensure that no squatter settlements are erected near or adjacent to construction camps. People should be asked to leave before they have the opportunity to settle. The assistance of the local police in this matter will be crucial.
- The contractor must put up signs that no recruitment will take place on site, and all jobseekers must be shown away from site.
- The contractor should not allow his staff to utilise services from squatters. There must be a formal trading area for informal traders, but they must not be allowed to sleep where they trade or set up camps in close proximity to the construction camp.
- HIV/AIDS and Sexually Transmitted Disease (STD) awareness training must form part of the induction of staff.
- Condoms must be freely available on site. Condoms should also be distributed in local places such as schools, clinics, shebeens and other recreational facilities.
- STD and HIV / AIDS awareness training should be provided in conjunction with local NGOs or the Department of Health, these awareness training programmes must also be given at local schools and clinics.
- STD and HIV / AIDS awareness training should include discussions about birth control and the potential long-term risks associated with casual sex.
- The workforce must be discouraged from engaging in casual sexual relationships with local people and informed of the consequences.
- Local people must be discouraged from entering the construction camp.
- Access to the construction camp should be controlled. Visitors should be signed in and out and no overnight visitors should be allowed.
- The code of conduct as agreed with the affected communities and landowners should be adhered to.
- No alcohol should be sold in the camps, and the amount of alcohol allowed in the camp should be limited.
- Prostitutes should not be allowed to enter the camp.
- There should be fines for breaking the rules.
- Frequent inspections of the camps should take place, and if non-conformances are found payment to the contractor must be withheld until it is corrected.
- The contractor must take out insurance for the damage of local property – this should be a condition of the contract. The insurance should take the external environment into

consideration. In forestry areas, for example, insurance against fires should be taken out. Proof of this insurance must be given to Eskom.

- Become member of community organisations such as community police forums, fire management areas etc.
- Develop and implement community relations programme.
- Involve the community in the process as far as possible – encourage co-operative decision-making and management and partnerships with local entrepreneurs;
- Be accessible and sensitive to community needs.
- Should resettlement be required a detailed resettlement action plan should be compiled specifically for the community that will be affected by such a process.
- There are international best practice guidelines compiled by the IFC that should be adhered to in the event that resettlement is required.
- A specialist in the field of relocation should conduct the process of resettlement, and the community must be actively involved in the process to ensure participatory decision-making and that cultural significance is taken into consideration.
- Unspoilt natural areas should be avoided as far as possible and infrastructure should rather be erected in areas where similar infrastructure already occur, whilst considering cumulative impacts.
- To ensure local service providers benefit as much as possible from the proposed project, the use of these establishments by Eskom and its contractors is recommended. This should be on a rotation basis to ensure that the benefits are distributed across the service providers.
- In the case of the forestry and sugar cane industry loss of productive land cannot simply be compensated for by looking at the financial value of the piece of land in question. The replacement cost of the land must be considered. The availability of alternative land and cost of permitting should be considered. The time it will take to obtain a new permit during which there will be a decrease in production should also be considered. Time that it takes for trees to mature must also be considered.
- In some areas people already have infrastructure such as railways, roads and power lines on their properties. Putting another line over such a property may make it no longer economically viable. In such instances the entire property should be purchased. The landowner should be compensated in such a way that they can replace their property with something similar.
- Given the potential economic impact on the timber farmers, and the secondary impacts that this will have on vulnerable communities it is recommended that timber areas should be avoided.

- Sugar cane farmers will be able to continue with their farming activities in certain areas, depending on the terrain. They would, however, need to change their farming practices to something much more costly and harder to implement. If changes in farming practices are required, it should be taken in consideration when compensation is determined.
- It must be considered that impacts on the sugar cane industry will also have far-reaching social consequences therefore it is recommended that any sugar cane operations are avoided as far as practically possible.
- Eskom must work in conjunction with the farmer's associations and any security systems that they have.
- Farmers should be informed the day before there is any activity on the servitude. If there is an emergency and this cannot happen, the farmer must be informed at least before his property is entered.
- Eskom staff must wear identification cards and farmers should have access to a phone number that they can call to confirm that the person on the card is authorised to be in the servitude.
- A multi-lock and chain system should be used to ensure that gates remain locked but that all the relevant people always have access to the servitude.
- There must be a designated person at Eskom that deal with the community affected by the servitude. All affected landowners must have direct access to this person.
- Landowners should only have to deal with one person and be allowed to establish a relationship of trust with this person.
- Eskom must contribute to fire-fighting equipment and adhere to the protocols of different fire protection areas. They must utilise the local knowledge available in the project area to assist them with all fire-related matters.
- A more flexible approach to switching off lines for burning purposes should be followed.
- Where possible dust suppression must be used.
- No construction work should take place on Sundays, public holidays and during the night.
- Working hours in the timber industry is from 5am to about 3pm and in the sugar cane industry it is from 6am to about 3pm. It is recommended that the working hours for the construction team should be between 7am and no later than 6pm to avoid crowding in peak travel times.
- Eskom must approach local schools and community organisations in the project area to present information sessions about the safety risks associated with power lines. The responsibility of contacting these organisations is on Eskom, and not on the organisations.
- Access to the site and the servitude should be controlled as far as possible.

- Construction camps must be fenced and local security companies must be employed to patrol the areas where there are active construction activities.
- Local unemployed people must be given preference in the recruitment process.
- Contractor must refrain from employing people who are currently employed in permanent positions.
- There must be employment desks in the towns or settlement areas.
- No recruitment may take place in the construction camps.
- A standard recruitment policy must be implemented across the project area, especially if more than one contracting firm is used.
- The local recruitment process must be agreed with local leadership. This process must then be advertised in an accessible way – radio advertisements, community meetings and press releases in local languages.
- No false expectations must be created and it must be underlined that the employment opportunities are specifically for the unemployed.
- Women must make up a percentage of the workforce.
- Eskom and the contractor must support local entrepreneurs as far as possible.
- Eskom should consider a local economic development programme that can stretch across all its operations. An example would be to buy a mobile kitchen, and train women along the construction route to cater for the construction forces. This kitchen can move with the labour force and women in different areas will be given the opportunity to get trained and earn an income.
- It must be acknowledged that there will be local entrepreneurs trying to sell their goods to the construction force. Unless managed carefully this may lead to squatter camps near the construction camps. The contractor should provide a designated area where such services can be provided – the area should ideally form part of the construction camp and be cleared and fenced.
- No open fires must be allowed. Food should rather be prepared off-site and transported in. Vendors must travel in and out of the area and should not be allowed in the construction area. The social monitor must assist in managing this process.
- In the ground-truthing phase of the project when a physical route will be determined by in-depth investigations, the affected landowners must be consulted and kept informed about the future actions. The social monitor should be appointed in this phase to start building relationships with affected communities and looking for opportunities to link with local entrepreneurs.
- An effort should be made to engage with affected parties in a culturally sensitive manner in the next phase of the project, especially since all routes potentially affect vulnerable communities.

- The land acquisition process must be explained to affected parties in a language of their choice. They must also be supplied with a written document spelling out the process. It must be considered that this process would need to be explained repeatedly to affected parties to allow them to digest it. Two land valuers that work independent of each other should be appointed. One of them should have local knowledge and knowledge of the affected industry, if relevant. The other should have experience in similar projects across the country.
- A community relations programme should be implemented (take note that this is different from a public relations programme). Eskom must insure that personnel with appropriate qualifications are appointed and that communication channels with communities are established and maintained.

Residual Impact

Many of the impacts cannot be mitigated to such an extent that they are no longer significant. Many of the impacts will be short term, and disappear after the construction phase. Residual impacts that are mentioned are those impacts that will be long term or permanent. Many of these impacts cannot be managed or controlled by Eskom, as some occur on an individual level.

Damage to roads may not be repaired for a long period, and as a result local communities and travellers will be exposed to safety risks. The mitigation of this impact lies outside the scope of Eskom. Although they can enter into negotiations with the relevant parties, the influence that they have to prioritise repairs may be limited.

Another residual impact is STDs and HIV/AIDS. For all practical purposes this is a permanent impact that will be felt on an individual level.

Unplanned pregnancies resulting in female-headed households are also a long-term residual impact that Eskom can do little about.

Changes in power relationships in power relationships and community cohesion may have long-term implications resulting in permanent changes in the community. It must be acknowledged that social change occurs in any event, and that communities can adapt to this change.

It takes years for a community to stabilise after resettlement. It will have a permanent impact on the affected communities. Whilst physical things can be mitigated quite easily with financial aid, psychological and social impacts will take time to recover. It must be

considered that when dealing with social change and social impacts that second or higher order change/impacts often cause more harm than first order change/impacts. 1

The residual impacts on the forestry and sugar cane industry will be significant. There will be a socio-economic impact that will be felt on a broad scale, but especially by the grassroots communities. It will take a long time to recover from this impact. Should some of the members of the sugar cane industry be forced to change their operations there will be an adaptation period that will have an economic impact on these individuals. For people who will be forced to sell their properties the residual impact will be experienced in the long term, because they will be forced to relocate and start new businesses elsewhere. The residual impact on tourism is difficult to anticipate, but in all likelihood there will be a change in the profile of people visiting the area.

There may be a breakdown of traditional values as a result of crime and external influences.

Residual impacts will be a positive impact on skills development and economic growth for small-scale entrepreneurs. There may be a negative impact on workers who were temporarily employed and lost their jobs, in that they might struggle to find new employment opportunities.

Should Eskom implement the mitigation, especially related to a community relations programme the results will be a long term and positive in terms of neighbourly relationships.

The residual impact after mitigation has been assessed and is reflected in Table 10-23.

Table 10-23: Residual social impact (Alternative 1- 3)

Finding	Magnitude	Duration	Scale	Probability	Significance
Pressure on infrastructure	MODERATE	<u>Short term</u>	<i>Regional</i>	<i>It's going to happen</i>	Moderate
	3	2	4	5	3.0
Leave behind infrastructure for community	VERY HIGH	<u>Permanent</u>	<i>Regional</i>	<i>Could Happen</i>	Moderate
	5	5	4	3	2.8
Increase in STDs	MODERATE	<u>Long term</u>	<i>Regional</i>	<i>Could Happen</i>	Moderate
	3	4	4	3	2.2
Social nuisance	MODERATE	<u>Short-term</u>	<i>Local</i>	<i>Could Happen</i>	Low
	3	2	3	3	1.6
Resettlement	VERY HIGH	<u>Permanent</u>	<i>Regional</i>	<i>It's going to happen</i>	Very High
	5	5	4	5	4.7

¹ Social change processes/impacts that result directly from the intervention, the so-called "first order changes/impacts" can lead to several other social changes/impacts - the second and higher order change processes/impacts.

Loss of productive land	HIGH	<u>Long term</u>	<i>Regional</i>	<u>Very likely</u>	High
	4	4	4	4	3.2
Management of servitude	MODERATE	<u>Long term</u>	<i>Regional</i>	<u>Could Happen</u>	Moderate
	3	4	4	3	2.2
Safety hazards	LOW	<u>Long term</u>	<i>Local</i>	<u>Unlikely</u>	Low
	2	4	3	2	1.2
Environmental nuisance	LOW	Medium term	<i>Local</i>	<u>It's going to happen</u>	Low
	2	3	3	5	1.6
Increase in crime & disorder	MODERATE	<u>Short-term</u>	<i>Regional</i>	<u>Could Happen</u>	Low
	3	2	4	3	1.8
Acts of sabotage	HIGH	<u>Short-term</u>	<i>Local</i>	<u>Could Happen</u>	Low
	4	2	3	3	1.8
Loss of workers to construction team	MODERATE	<u>Short-term</u>	<i>Regional</i>	<u>Could Happen</u>	Low
	3	2	4	3	1.8
Local job opportunities	VERY HIGH	<u>Short-term</u>	<i>Regional</i>	<u>Very likely</u>	Moderate
	5	2	4	4	2.9
Indirect employment opportunities	VERY HIGH	<u>Short-term</u>	<i>Regional</i>	<u>It's going to happen</u>	High
	5	2	4	5	3.7
Uncertainty caused by EIA process	MODERATE	<u>Short-term</u>	<i>Regional</i>	<u>Could Happen</u>	Low
	3	2	4	3	1.8
Fear & anxiety caused by land acquisition process	MODERATE	<u>Short-term</u>	<i>Local</i>	<u>Very likely</u>	Moderate
	3	2	3	4	2.1
Feelings in relation to past experience with Eskom	HIGH	<u>Long term</u>	<i>Regional</i>	<u>Very likely</u>	High
	4	4	4	4	3.2

10.1.10 Economic Environment

Initial Impact

The initial status of the economic environment was not assessed.

Additional Impact

Economic Impact

Economic impacts associated that are expected to take place during the construction and operation periods of the transmission line were assessed based on the assumptions with respect to the costs of the project and its duration.

It is expected that during the construction phase nationwide positive impacts will be created such as the increase in new business sales, generation of additional Gross Value Added (GVA), creation of new employment opportunities, and increase in local government earnings. The analysis indicated that the AM, AP and PO alternative segments will deliver the largest positive impacts, mainly due to the large tracks of servitude that will be cleared and hence the opportunities for job creation.

Agricultural Impact

Following on the assessment of economic impacts, the evaluation of the project's effects on the agricultural potential and associated economic activities was done. The comparison of the identified alternative segments in terms of the loss of agricultural potential revealed that a number of the segments are associated with a noticeable loss of agricultural potential. Furthermore, alternatives imply a trade-off between forestry plantations and sugarcane.

With respect to selected indicators, sugarcane and forestry plantations compare as follows:

- *From a soil erosion point of view, forestry plantations tend to have a considerably smaller erosion rate than sugarcane. However, sustainable environmental practices such as organic sugarcane growing and avoidance of sugarcane burning can considerably reduce the negative impact on soil erosion and even have positive implications realised in higher yields and additional job creation.*
- *From a pollution point of view, both industries are associated with release of harmful chemicals in the atmosphere, land, or water. Environmental impact associated with the use of chemicals and pesticides are also applicable to both.*
- *From an agricultural production point of view, sugarcane tends to generate a higher value added per hectare per annum than short-rotation hardwood as the former produces harvest within a maximum of 24 months, while the latter requires 8-10 years. The direct impact of one ton of sugarcane is higher than that of one ton of timber for pulpwood (in the situation of sustainable harvesting); on the other hand, though forestry plantations have by far greater backward and forward linkages than sugarcane.*
- *Both, sugarcane and forestry plantations offer opportunities for small scale growers or farmers and both are equally important in poverty alleviation as sugarcane farms and forestry plantations tend to appear in rural areas where employment opportunities are limited. Due to the nature of the industries, sugarcane, however, has a slightly higher direct employment multiplier than forestry; although forestry plantations have higher indirect labour multipliers among forward and backward industries.*

In summary, both sugarcane and forestry plantations are important contributors to job creation, economic development, and even export earnings of the country. Also, both of them have certain degrees of impact on the environment, although they differ depending on the receptor. Since, the impact assessment focuses on the potential loss of agricultural land associated with its economic value; the identification of the preferred alignment is done on the basis of the potential loss of value added in the economy where average yields per hectare and industry multipliers are taken into account.

The following table illustrates the impact ratings associated with each alternative segment that was identified as having an impact on the agricultural potential of the area.

Cumulative impact ratings on agricultural potential – without mitigation

Segment	Nature	Scale	Duration	Probability	Magnitude
AB	Negative	National (4)	Permanent (5)	Highly Prob (4)	Low (4)
AM	Negative	National (4)	Permanent (5)	Highly Prob (4)	Low (4) to Moderate (6)
AP	Negative	National (4)	Permanent (5)	Highly Prob (4)	Low (4)
BC	Negative	National (4)	Permanent (5)	Highly Prob (4)	Low (4)
BK	Negative	National (4)	Permanent (5)	Highly Prob (4)	Low (4)
FG	Negative	National (4)	Permanent (5)	Highly Prob (4)	Moderate (6) to High (8)
GH	Negative	National (4)	Permanent (5)	Highly Prob (4)	Moderate (6) to High (8)
GL	Negative	National (4)	Permanent (5)	Highly Prob (4)	Low (4)
HI	Negative	National (4)	Permanent (5)	Highly Prob (4)	High (8)
IJ	Negative	National (4)	Permanent (5)	Highly Prob (4)	Moderate (6)
KD	Negative	National (4)	Permanent (5)	Highly Prob (4)	Low (4)
LH	Negative	National (4)	Permanent (5)	Highly Prob (4)	Moderate (6)
MN	Negative	National (4)	Permanent (5)	Highly Prob (4)	Low (4)
MP	Negative	National (4)	Permanent (5)	Highly Prob (4)	Low (4)
NL	Negative	National (4)	Permanent (5)	Highly Prob (4)	Low (4)
OI	Negative	National (4)	Permanent (5)	Highly Prob (4)	Low (4)
PO	Negative	National (4)	Permanent (5)	Highly Prob (4)	Low (4)
S(AM)	Negative	National (4)	Permanent (5)	Highly Prob (4)	Low (4)
S(GH)	Negative	National (4)	Permanent (5)	Highly Prob (4)	Low (4)
S(IJ)	Negative	National (4)	Permanent (5)	Highly Prob (4)	Low (4) to Moderate (6)
S(NO2)	Negative	National (4)	Permanent (5)	Highly Prob (4)	Low (4)
S(OI)	Negative	National (4)	Permanent (5)	Highly Prob (4)	Low (4)

Cumulative Impact

Due to the lack of the initial economic information the additional impact above is taken as the cumulative impact.

Mitigation Measures

The abovementioned impacts could however be considerably minimised resulting in its magnitude rating dropping to “low” if necessary mitigation measures are put in place. These include:

- If possible, align the route to cross forestry plantations and farms (a) next to their borders to reduce affected area under crop or forestry and/or (b) along the area of the farm that is not used for any economic activity

- If possible, give preference to the route the large-scale farm than small-scale farms to minimise the impact on small-scale farmers who are more susceptible to the loss of area under cane.
- Investigate altering the tower designs (higher towers) in the sugarcane areas in order to allow for burning and farming under the power lines.
- If possible, prioritise the route over farms were the transmission line would cross it in the width rather than the length to allocate the adverse effects over a number of farms than cluster it over one farm and pose a threat to that farms viability.
- Encourage farmers, and if possible, assist them financially and through training to engage in other crop cultivation within the servitude to increase the production output and income from the land.

Besides the irrevocable impact on sugarcane and forestry plantations, the construction of the transmission line could have a negative impact on agricultural production during construction.

Movement of workers and machinery from the camp to the site could damage some of the crops and result in loss of livestock. This impact is of a temporary nature and could be reversed once the construction phase is complete. However, specific mitigation measures such as strict control over movement and activities of workers, selection of construction sites on areas free of economic activities, and use of existing roads could negate the potential negative impacts.

Residual Impact

As mentioned above the successful implementation of the mitigation measures can result in the economic impact of the proposed activity to reduce to a LOW permanent negative impact, acting in the *national* extent. This is a likely impact and the rating is therefore a **Moderate impact**.

10.2 Operational Phase

The main impacts during the operational phase are the electro magnetic field associated with the power lines and the occurrence of the physical structures in the landscape. See *Electric and Magnetic Fields – A summary of Technical and Biological Aspects* (2006). for a detailed discussion regarding the impact of electro magnetic fields (Appendix P).

10.2.1 Soils and Land Capability

The impact assessment does not change from that of the construction phase, refer to section 10.1 above.

10.2.2 Flora

Once the operational phase is entered the flora within the servitude should be managed according to the Eskom Vegetation Management guideline. This guideline describes how any vegetation that poses a fire risk requires to be removed or cut to manage the risk. This impact is identical to the servitude clearance described in Section 10.1 under the additional impact and hence the impact remains a Moderate Impact.

10.2.3 Fauna

During the operational phase the power lines will be energised and according to the document on electric and magnetic fields associated with power lines, there is no negative impacts associated with electro magnetic fields. Therefore the only impact will be the electrocution of fauna, which in this case is avifauna which is assessed separately. Therefore the impact during operations to terrestrial fauna remains as assessed in Section 10.1, i.e. a Low impact.

10.2.4 Avi- Fauna

Initial Impact

The initial impact remains as assessed in Section 10.1.4.

Additional

Once constructed the risk to avifauna from the operation of the power line includes bird collisions, electrocutions, and habitat destruction.

Collisions are the biggest single threat posed by transmission lines to birds in southern Africa (van Rooyen 2004). Most heavily impacted upon are bustards, storks, cranes and various species of waterbirds. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines (van Rooyen 2004, Anderson 2001). The following high risk species, irrespective of biome, were identified: Blue Crane, Grey Crowned Crane and Wattled Crane breeding localities.

During the operational phase maintenance of power lines and substations, some habitat destruction and transformation inevitably takes place. This happens with the clearing of servitudes and the levelling of substation yards. Servitudes have to be cleared of excess vegetation at regular intervals in order to allow access to the line for maintenance, to prevent vegetation from intruding into the legally prescribed clearance gap between the ground and the conductors and to minimize the risk of fire under the line, which can result in electrical flashovers. These activities have an impact on birds breeding, foraging and roosting in or in close proximity of the servitude through transformation of habitat. Similarly, the above

mentioned construction and maintenance activities impact on bird through disturbance, particularly during breeding activities. This could lead to breeding failure if the disturbance happens during a critical part of the breeding season.

Due to the large size of the clearances on overhead lines of 765kV, electrocutions are ruled out as even the largest birds cannot physically bridge the gap between energised and/or energised and earthed components.

The impact to avi-fauna during the operational phase of the power line will **probably** be of a HIGH significance, acting in the medium term, and affecting the *local* extent. The impact *is going to happen*. The impact is categorised as **High**.

Table 10-24: Additional Impact on Avi- Fauna (Alternative 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Additional impact on avi-fauna	HIGH	<i>Local</i>	<u>Medium Term</u>	<i>It's going to happen</i>	High
	4	3	4	5	3.7

Cumulative

The operation of the power line will contribute to additional bird deaths through collisions, and retard population growth by through the impact to natural habitat. The cumulative impact of existing power lines and the additional impact during the operational phase of the Camden power line will not result in an increase to the impact rating as given above.

Mitigation Measures

Refer to mitigation measures documented in Section 10.1.

Residual Impact

Mitigation will ensure the reduction of risk but not likely affect the significance of impact.

Table 10-25: Residual Impact on Avi- Fauna (Alternative 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Residual impact on avi-fauna	HIGH	<i>Local Area</i>	<u>Medium Term</u>	<i>Very Likely</i>	Moderate
	4	3	4	4	2.9

10.2.5 Surface Water and Wetlands

Once the power lines are constructed there should be no further impact to surface water.

10.2.6 Visual

Once the power lines are strung as described in Section 10.1 above, this impact will remain and hence the impact assessment will remain as assessed during construction.

10.2.7 Cultural Heritage Environment

The will be NO IMPACT to the Cultural Heritage Environment as a result of operational activities associated with the Camden – Mbewu powerline.

10.2.8 Palaeontology

The will be NO IMPACT to the Paleontological Environment as a result of operational activities associated with the Camden – Mbewu powerline.

10.2.9 Social Environment

Initial Impact

The initial impacts of existing activities on the existing social fabric were not assessed.

Additional Impact

During the operational phase there will probably not be significant in-migration into the area, but the residual impact from the construction phase may remain.

Table 10-21 represents the social change processes that have been identified and the possible social impacts that may result because of these processes. It also identifies the stakeholder group that is most likely to be affected by the process. Please refer to the attached SIA specialist report in Appendix R.

Table 10-26: Summary of socio-economic impacts.

Social Change Process	Possible Social Impact	Affected stakeholder group
Change in land use	<ul style="list-style-type: none"> • Long term conflict about management of servitudes • Safety hazards • Communication and arrangements surrounding access to properties & management of servitude – can be positive or negative 	<ul style="list-style-type: none"> • Industry • Farmers • Vulnerable communities
Deviant social behaviour	<ul style="list-style-type: none"> • Acts of sabotage 	<ul style="list-style-type: none"> • Vulnerable communities • Farmers • Industry • Tourism • Surrounding towns

An assessment of the identified impacts is given below.

Finding	Magnitude	Duration	Scale	Probability	Significance
Management of Servitude	MODERATE	<u>MEDIUM TERM</u>	<i>Local</i>	<u>Will Occur</u>	High
	3	3	3	5	3
Safety Hazard	LOW	<u>MEDIUM TERM</u>	<i>Local</i>	<u>Unlikely</u>	Low
	2	3	3	2	1.06

Cumulative Impact

Potential cumulative impacts:

- Will be felt by landowners with more than one servitude on their farm i.e. additional people wanting to access the servitude; additional fire risk; and more opportunity for invader species to take over.
- In areas where people have had negative experiences with the management of servitudes their expectation will be to have similar experiences, should Eskom not improve their service the impact will be felt much more intensely.

Mitigation Measures

Refer to the mitigation measures described in the construction phase.

Residual Impact

With mitigation measures implemented the residual impact to the social environment as a result of operational activities is **probably** VERY LOW, affecting only the *local* environment, and acting in the long term. The impact will likely occur, and as such is categorised as a **Low** impact.

10.2.10 Economic Environment

Additional Impact

During the operational phase, such impacts as improved supply of electricity to the region and creation of additional employment for maintenance of the servitude are expected to take place. The most strategic among them is the improvement of the supply of electricity to the region that would enable it to continue growing. Employment creation during maintenance of the servitude will have a lower impact compared to the other impacts; however it will still provide additional income for predominantly poor households.

This MODERATE positive impact occurs at a *national* level and will be active in the long term. This impact will definitely occur if the project is approved, resulting in a **High positive impact**.

Cumulative Impact

In Cumulative terms the significance and magnitude of the operational impacts will score the same for all the alternatives. One could keep in mind that the alternative that would supply electricity to the largest number of households currently without electricity could be selected as the best alternative. However the distribution of the electricity from this line to the user is still to be determined in the future.

Mitigation Measures

None required.

Residual Impact

The residual impact remains as assessed above i.e. a **High positive impact**.

11 ALTERNATIVE SENSITIVITY ANALYSIS

This section provides a short sensitivity matrix, which compares the three different alternative corridors and their associated environmental sensitivities. Where an impact is rated between two thresholds, that is, low-moderate; moderate-high or high-very high the rating assigned to the description will lean towards the value assigned to that impact. (i.e. if ranked as 2.9 it will fall within the upper threshold that is the high category as indicated in the matrix below).

Considering the sensitivity information obtained from the various specialist reports, several route alternatives have potential impacts that are not acceptable. These alternatives are therefore excluded from the potential options for the power line and include:

- Route LH (heritage) and by association GH as well;
- Routes BK, KD and KC (wetlands, tourism, biodiversity); and
- Routes SBC and SDE (technical).

Furthermore the various route alternatives resulted in a large number of potential combinations of routes. When considering all the studies the combinations have been reduced to the following three alternatives:

- Alternative 1 – Routes AB, BC, CD, DE, EF2, FG, SGH, HI, IJ;
- Alternative 2 – Route AM, MN, SNO2, SIJ; and
- Alternative 3 – Route AP, PO, SIJ.

Each of these alternative routes is assessed against the environmental and social criteria in a sensitivity matrix shown in the table below. In order to ensure that the comparison is consistent, the ratings are given assuming the implementation of all the mitigation measures proposed in this report.

Table 11-1: Alternative Sensitivity Matrix.

Sensitivity	Alternative Corridor		
	Alternative 1	Alternative 2	Alternative 3
Topography	0	0	0
Soils and Agricultural Potential (Land Capability)	1	2	2
Terrestrial Ecology	1	1	2
Avi- Fauna	2	1	1

Sensitivity	Alternative Corridor		
	Alternative 1	Alternative 2	Alternative 3
Visual	1	2	2
Social Environment	1	2	2
Economic Environment	1	1	1
Cultural Heritage Environment	1	1	1
Palaeontology	1	1	0
Total Sensitivities	9	11	11

Low = 0	Moderate = 1	High = 2	Very High = 3
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On the basis of the matrix presented above, it is suggested that corridor Alternative 1 be utilised as the preferred alternative for the proposed powerline.

12 ENVIRONMENTAL MANAGEMENT PROGRAMME

12.1 Introduction

This section, Section 12, constitutes the EMPProg for the construction and operation of the Camden- Mbewu (Theta) powerline.

12.2 Purpose of this EMPProg

This EMPProg has been compiled in order to address the potential environmental impacts that the powerline of the above mentioned project could have on the surrounding environment. The EMPProg serves as the environmental specification to Eskom staff and outside contractors with regards to addressing environmental issues identified prior to the implementation of this project. It is the overall responsibility of the Project Manager and Contractor to ensure compliance with all the environmental specifications in this section as well as the relevant legislation.

This EMPProg should also ensure the sustainable management (to avoid and/or minimise environmental damage) of the environment whilst the construction is being undertaken. This EMPProg must be viewed as a contract document to which all Eskom employees and outside contractors involved in the proposed construction must be committed to.

Thus the aim of this EMPProg is to:

- Ensure that the team are familiar with the environmental procedures to be followed and comply with all the recommendations made within it;
- Ensure that a list of environmental representatives involved in the project are given to the construction team;
- Ensure that an environmental incident register is implemented and maintained to address environmental impacts;
- Ensure that the mitigatory measures are implemented to avoid and/or minimise the identified negative environmental impacts and to enhance the positive impact of the project on the environment; and
- Ensure that a monitoring programme is in place that tracks the effectiveness of the implemented mitigatory measures.

12.3 Objectives of the EMPProg

The EMPProg has a long-term objective to ensure that:

- Appropriate Environmental Management measures and requirements are implemented from the start of the project;

- Precautions against damage and claims arising from damage are taken timeously; and
- The completion date of the contract is not delayed due to problems with landowners arising during the course of construction.

12.4 Legal Context

A growing awareness of the environment and an increase in the number of environmental laws and regulations, present company management with a daunting task of monitoring, interpreting and implementing systems to produce a workable plan to comply with legal requirements.

The list below was compiled to ensure that the person responsible for the construction of powerline is aware of their legal responsibilities and liabilities. Complying with these laws and regulations will minimise the risks in terms of legal, financial (claims) and rehabilitation costs.

Non compliance to environmental law is a criminal offence and if prosecuted Eskom will be liable for any environmental damage incurred.

Table 12-1: Legal Requirements for this EMProg.

Act name	Act no	Notes/remarks
National Environmental Management Act	107 of 1998	List of activities and competent authorities identified in terms of Sections 24 and 24D
Conservation of Agricultural Resources Act	43 of 1983	Control of utilisation and protection of wetlands; soil conservation; control and prevention of veld fires; control of weeds and invader plants.
The National Environmental Management: Waste Act	59 of 2008	<ul style="list-style-type: none"> ◆ Waste management ◆ Application of waste disposal license
Fencing Act	31 of 1963	Prohibition of damage to a property owner's gates and fences <ul style="list-style-type: none"> ◆ <i>Climbing or crawling over or through fences without permission</i> ◆ <i>Closing gates</i>
Veld and Forest Fires Act	101 of 1998	Prevention of unauthorised veld and forest fires
Transvaal Nature Conservation Ordinance	12 of 1938	Endangered plants and wild animals. Protected fauna and flora
Occupational Health and Safety Act	85 of 1993	Prescribes health and safety measures necessary to adhere to for all construction workers
National Water Act	36 of 1998	All aspects relating to pollution of surface and ground water.

12.5 Eskom and Contractor Commitment

Eskom requires a commitment from the Eskom Project Manager and the Contractor on the following issues:

- To underwrite Eskom Transmission's Environmental Policy TRMPBAAX3 Rev 2 at all times;
- Ensure that environmental conditions that are applicable in transmission lines, and are stipulated in the Power Station Environmental Authorisation are implemented;
- Resolve problems and claims arising from damage immediately to ensure a smooth flow of operations;
- To implement this EMPProg for the benefit of all involved; and
- To preserve the natural environment by limiting destructive actions on site.

12.6 Reporting Structure

ECO: Environmental Control Officer

CM: Contract Manager (Eskom)

CECO: Contractor Environmental Control Officer (Dedicated person)

PM: Project Manager (Eskom)

EA: Environmental Advisor (Eskom)

EM: Environmental Manager (Eskom)

RA: Relevant Authority (DEA)

12.7 Responsibilities and Duties

Function	Name / Cell Number	Responsibility
Project Manager (PM) Eskom		Overall management of project and EMPProg implementation
Site Supervisor/ Contract Manager (CM) Eskom		Oversees site works, liaison with Contractor, PM and ECO
Environmental Control Officer (ECO) Eskom		Implementation of EMPProg and liaison between Eskom, Contractor and Landowners/stakeholders
Contractor (C)		Implementation and compliance with

		recommendations and conditions of the EMProg, Appoints dedicated person (CECO) to work with ECO
Contractor Environmental Control Officer (CECO)		Implementation of EMProg, landowner interaction, environmental control of site actions, re-mediation and rehabilitation work.
Environmental Advisor (Eskom)		Environmental advice and auditing

(Table to be completed upon Contract award)

12.7.1 Project Manager

The primary responsibility of the Project Manager is to ensure that the Contractor complies with the environmental specifications in this EMProg. In addition the Project Manager shall:

- Assume overall responsibility for the effective implementation and administration of the EMProg;
- Ensure that the EMProg is included in the Contractor's contract;
- Ensure that the EMProg is given to the applicable Construction Supervisor and the contractors;
- In conjunction with the Construction Supervisor; undertake regular inspections of the Contractor's site as well as the installation works in order to check for compliance with the EMProg in terms of the specifications outlined in this EMProg. Inspections shall take place at least once a week and copies of the monitoring checklist contained in the file;
- Keep a register of all incidents (spills, injuries, complaints, legal transgressions, etc) and other documentation related to the EMProg;
- Report to the Environmental Control Officer (ECO) any problems (or complaints) which cannot first be resolved in co-operation with the Contractor(s);
- Implement recommendations of possible audits; and
- Ensure that construction staff is trained in accordance with requirements of the EMProg.

12.7.2 Construction Contractor

The Contractor shall:

- Ensure that the environmental specifications of this document (including any revisions, additions or amendments) are effectively implemented. This includes the on-site implementation of steps to mitigate environmental impacts;
- Discuss implementation of and compliance with this document with staff at routine site meetings;
- Preserve the natural environment by limiting any destructive actions on site;

- Monitor environmental performance and conformance with the specifications contained in this document during site inspections;
- Report progress towards implementation of and non-conformances with this document at site meetings with the Project Manager;
- Ensure that suitable records are kept and that the appropriate documentation is available to the Project Manager;
- Advise the Project Manager of any incidents or emergencies on site, together with a record of action taken;
- Report and record all accidents and incidents resulting in injury or death;
- Take into consideration the legal rights of the individual Landowner, Communities and Eskom Regional staff;
- Ensure quality in all work done, technical and environmental;
- Resolve problems and claims arising from damage immediately to ensure a smooth flow of operations;
- Underwrite Eskom's Environmental Policy at all times, and
- Use this EMProg for the benefit of all involved.

12.8 Training

- The SHECO shall be appropriately trained in environmental management and shall possess the skills necessary to impart environmental management skills to all personnel involved in the construction, rehabilitation and operation of the corridor;
- Eskom, together with the Environmental and Safety Manager and the SHECO, shall ensure that the employees (including construction workers, engineers, and long-term employees) are adequately trained on the EMProg; and
- All employees shall have an induction presentation on environmental awareness. The cost, venue and logistics shall be for the Eskoms account;

Where possible, training must be conducted in the language of the employees. The induction and training shall, as a minimum, include the following:

- The importance of conformance with all EMProg and other environmental policies and procedures;
- The significant environmental impacts, actual or potential, of their work activities;
- The environmental benefits of improved personal performance;
- Their roles and responsibilities in achieving conformance with the EMProg and other environmental policies and procedures;

- The potential consequences of departure from specified operating procedures; and
- The mitigation measures required to be implemented when carrying out their work activities.

12.9 Commissioning of Tenders for the Project

- All tendering Contractors / Sub-contractors will be made aware of the contents of this EMProg and any penalties arising from non-compliance; and
- All appointed Contractors / Sub-contractors will be required to attend the EMProg training and induction as detailed in Section 12.8 above.

12.10 Environmental Authorisation

The construction of power lines can have a major impact on the environment. It is thus imperative that precautions be taken to ensure that environmental damage is minimised. This will take a concerted effort from the Contractor and proper planning is of the utmost importance.

The Environmental Control Officer (ECO) shall convey the contents of this EMProg and the conditions of the Record of Decision (Environmental Authorisation) from the DEAT and discuss the contents in detail with the Eskom Project Manager and Contractor at a pre-construction meeting. This formal induction training is a requirement of ISO 14001 and shall be done with all main and sub-contractors. Record of the training dates, people who attended and discussion points shall be kept by the ECO.

Most landowners / adjacent landowners will see the construction period as interference with their daily activities. Good relations with adjacent landowners need to be established and sustained. Landowners shall therefore be informed timeously of the construction programme, duration and all interference with their daily activities. This will help in the solving of problems and the prevention thereof. Lines of communication should always be open to ensure proper and timeous reaction to complaints. The contact numbers of the ECO and CECO shall be made available to adjacent landowners. The reputation of both the Contractor and Eskom Transmission is at stake and should be the drive for everybody involved to perform in excellence.

The Contractor (TRMSCAAC1 REV 3 section 4.1.2) shall take all the necessary precautions against damage. The Contractor shall ensure that the correct equipment for construction purposes is available at all times to ensure construction proceeds without unnecessary damage to the environment. Should alternative methods be used, it requires approval from site staff and the ECO must be informed to ensure environmental issues are addressed.

During the construction period at least three (3) Environmental Audits shall be conducted to determine compliance with the recommendations of the EIA, Environmental Authorisation

and EMProg together with this. These will include internal audits and external by the DEAT or the ISO14001 auditors or combined audits.

12.11 Environmental Management Measures

The management measures documented in each of the sub-sections below have been compiled using the following information:

- Impact Assessment and mitigation measures documented in the Draft EIR for the Camden- Mbewu (Theta) powerline.
- The standard EMProg utilised by Eskom: Transmission for the construction of power lines.

In addition to the abovementioned information sources, the EMProg will be updated to include the conditions documented in the Environmental Authorisation to be received upon approval of the EIA.

12.11.1 Construction Initiation

Table 12-2: Environmental Management Measures during construction Initiation.

Objectives		Pre-Construction Phase						
No	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
	<ul style="list-style-type: none"> • Ensure that all necessary legal obligations and contractual conditions have been met prior to the commencement with construction; • To ensure that all role players and stakeholders are aware of the pending construction activities and have received timeous notice; and • To ensure that power outages are avoided wherever possible during the construction phase. 							
1	Labour Issues	<p>Eskom must appoint a suitably qualified Environmental Officer (hereafter referred to as ECO) who would act on behalf of the applicant, on a daily basis, monitor project compliance with the conditions of environmental authorisation, environmental legislation and the recommendations of the revised EMPProg. This role will be fulfilled by the appointed ECO and CEEO.</p> <p>The ECO / CEEO must be appointed prior to the commencement of construction and pre-construction related activities and the authorities must be notified of such and appointment.</p>	Throughout Project	Daily	PM	EA	EM	C
			Throughout Project	Once off	PM	EA	EM	C / RA

		<p>The ECO / CECCO shall remain employed until all rehabilitation measures, as required for implementation due to construction damage, are completed and the site is handed over to Eskom by the contractor for operation;</p> <p>The ECO shall maintain the following on site:</p> <ul style="list-style-type: none"> • A daily site diary; • A non-conformance register; and • A public complaint registers. 	Throughout Project	Daily	PM	EA	EM	C
2	Initiation	<p>The authorised activity / activities may not commence within thirty (30) days of the date of signature of the authorisation;</p> <p>Should Eskom be notified by the minister of a suspension of the authorisation pending appeal procedures, Eskom may not commence with the activity / activities unless authorised by the minister in writing.</p> <p>Fourteen (14) days written notice must be given to the Department that the activity will commence. Commencement for the purposes of this condition includes site preparation. The notice must include a date on which it is anticipated that the activity will commence.</p>	Prior to authorisation	Once off	PM	PM SM	EM EA ECO	RA C
			Throughout Project	Throughout Project / as and when necessary	PM	PM SM	EM EA ECO	RA C
			Prior to commencement	Once - off	CECCO	PM SM	EA EM ECO	RA

	Fourteen (14) days written notice must be given to the Department that the operational phase of the activity will commence. A copy of the authorisation must be kept at the property where the activity will be undertaken. The authorisation must be produced to any authorised official of the Department who requests to see it and must be made available for inspection by any employee or agent of the holder of the authorisation who works or undertake work at the property. No work shall commence until permission is granted from the Environmental Advisor from Transmission Services and acceptance of this proposal and EMProg from DEA has been obtained. Obtain a signed agreement statement from the contractor indicating their willingness to comply to the EMProg.	14 days	Throughout	Prior to operation commencement	CECO	PM SM	EA EM ECO	EA	RA
				Monthly Inspection	CECO	SM	EA	EA	EM PM
				Once-off	SM C	PM	ECO	EA EM	EA EM
				Once - off	CECO C	SM	ECO	PM EA EM	PM EA EM
Construction Phase									
1	Construction Initiation	Ensure that the grid is considered throughout the construction phase.	Throughout construction	Throughout construction	C	SM	ECO	PM EA EM	PM EA EM

	Where any of the applicant's contact details change, including then name of the responsible person, the physical or postal address and/or telephonic details, the applicant must notify the Department as soon as the new details become known to the applicant;	Throughout construction	Throughout construction	SM	PM	ECO	EA EM RA
	The holder of the authorisation must notify the Department, in writing and within 24 hours, if conditions of the authorisation cannot be or is not adhered to. In all other cases, the holder of the authorisation must notify the Department, in writing, within 48 hours if a condition of the authorisation is not adhered to. Any notification in terms of this condition must be accompanied by reasons for the non-compliance; and	Prior to commencement	to commencement	CECO	SM	ECO EA	PM EM RA
	Non-compliance with a condition of this authorisation may result in criminal prosecution or other actions as per the National Environmental Management Act, 1998 and the regulations.	Throughout	Throughout	CECO	SM	ECO EA	PM EM RA
2	Labour Issues	Throughout	Throughout	C	SM	ECO EA	PM EM RA
Rehabilitation Phase							
None							
Operational Phase							
None							

12.11.2 Site Establishment and Demarcation

Table 12-3: Environmental Management Measures during site establishment and demarcation.

Objectives		Pre-Construction Phase						
No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
	<p>Project Area</p> <ul style="list-style-type: none"> • Ensure proper demarcation of the project area prior to construction; • Ensure timely notice and negotiation with stakeholders in the event that access is required for construction purposes; and • Ensure that all areas impacted during construction are rehabilitated to suitable levels. <p>Gate Installation</p> <ul style="list-style-type: none"> • Properly installed gates to allow access to the servitude; • Minimise damage to fences; and • Limit access to Eskom and Contractor personnel with gate keys. <p>Servicing Vehicles</p> <ul style="list-style-type: none"> • Prevention of pollution of the environment; and • Minimise chances of transgression of the acts controlling pollution. <p>Batching Plants</p> <ul style="list-style-type: none"> • To ensure all agreements with Landowners are adhered to; • Prevention of complaints from stakeholders; and • Successful rehabilitation of disturbed areas. <p>Wet Areas</p> <ul style="list-style-type: none"> • Avoid impact to wet areas. <p>Sanitation</p> <ul style="list-style-type: none"> • Ensure that proper sanitation is received. 	<p>No new gate construction is anticipated, however, if needed, the contractor must refer to the Fencing Act, Act no 31 of 1963.</p> <p>Gate installation shall be according to TRMSCAAC1 REV 3 section 4.5 and the drawing 0.00/10261 Rev 2 as stated in the specifications.</p> <p>All gates installed in electrified fencing</p>	<p>Not anticipated</p> <p>Not anticipated</p> <p>Not</p>	<p>Throughout Project</p> <p>Once -off</p> <p>Once -off</p>	<p>C CECO</p> <p>C CECO</p> <p>C</p>	<p>SM</p> <p>SM</p> <p>SM</p>	<p>ECO</p> <p>ECO</p> <p>ECO</p>	<p>EA EM PM</p> <p>EA EM PM</p> <p>EA</p>

	shall be re-electrified.	anticipated		CECO					EM PM
	The Environmental Control Officer shall approve gate positions.	Not anticipated	Once -off	C CECO	SM		ECO		EA EM PM
	All gate positions shall be three (3) metres off centre to allow for continued access when stringing takes place.	Not anticipated	Once -off	C CECO	SM		ECO		EA EM PM
2	Batching Plants The siting, if necessary, of batching plants shall be done in conjunction with the Eskom PM and the ECO. Refer to TRMSCAAC1 REV 3 section 4.8 for specifications regarding batching plants. Ensure all agreements reached with the Landowner are fulfilled.	Not anticipated	Once -off	C CECO	SM		ECO		EA EM PM
		Pre-Construction	Once off	C CECO	SM		ECO		EA EM PM
		Pre-Construction	Once -off	C CECO	SM		ECO		EA EM PM
3	Sanitation The Contractor shall install mobile chemical toilets on site (TRMSCAAC1 REV 3). The Contractor camp shall have the necessary ablution facilities with chemical toilets where such facilities are not available at commencement of construction. The Contractor will be responsible for the provision of and proper utilisation, maintenance and management of toilet, wash and waste facilities. Toilet facilities supplied by the contractor for the workers shall occur at a maximum ratio of 1 toilet per 15 workers. All temporary / portable toilets shall be secured to the ground to prevent them from toppling due to wind or any other cause.	Throughout construction	Weekly	C CECO	SM		ECO		EA EM PM
		Throughout construction	Daily	C CECO	SM		ECO		EA EM PM

		Prior to the establishment of the ablation facilities, the Site Manager must approve an appropriate location.	Pre-Construction	Once-off	C CECO	SM	ECO	EA EM PM
		The entrances to the ablation facilities shall be adequately screened from public view.	Pre-Construction	Once-off	C CECO	SM	ECO	EA EM PM
4	Site Establishment – Contractors camp, wastewater management , Shower facilities	The contractor's camp shall be sited so as to cause the least amount of disturbance to adjacent landowners. The contractor's camp shall be fenced and the contractor shall maintain in good order all fencing for the duration of the construction activities. Site establishment shall take place in an orderly manner and all amenities shall be installed at Camp sites before the main workforce move onto site. The Contractor shall supply a wastewater management system that will comply with legal requirements and be acceptable to Eskom. A septic tank system is recommended to ensure the best practice environmental solution. Where Eskom facilities are available the Contractor shall make use of such facilities where it is viable and negotiated with the Grid. Should shower facilities be provided for the use by staff staying on site, the following controls must be imposed: • Positioning of the shower, and specifically its discharge point, will be carried out to ensure that erosion and build up detergents does not occur;	Pre-Construction Throughout Construction	Once-off Weekly	C CECO	SM	ECO	EA EM PM
			Pre-construction	Monthly	C CECO	SM	ECO	EA EM PM
			Pre-Construction	Once-off	C CECO	SM	ECO	EA EM PM
			Pre-Construction	Once-off	C CECO	SM	ECO	EA EM PM
			Throughout Construction	Daily	C CECO	SM	ECO	EA EM PM

		<ul style="list-style-type: none"> All discharge from the shower and other washing facilities must pass through a suitable filter to reduce the load of detergents to the environment; Filtered water discharge may thereafter be released to the environment, but mechanisms will be investigated to ensure that the water is evenly dispersed so as to lead to "greening up" and / or swampy conditions in one limited area; Use of the shower facilities must be limited to staff or authorised persons only. 											
		<p>The cooking area will be positioned such that no vegetation is in close proximity thereto, including overhanging trees. An area around the cooking area will be cleared such that any escaping embers will not start an uncontrolled fire.</p>	Pre-Construction	Once-off	C CECO	SM	ECO				EA EM PM		
5	Eating Areas	Eating areas shall be designated and demarcated.	Pre-Construction	Once-off	C CECO	SM	ECO				EA EM PM		
		Sufficient bins shall be present in this area for all waste material.	Pre-Construction	Once-off	C CECO	SM	ECO				EA EM PM		
		Dish washing facilities shall be provided. These may be very basic, but a process must be put in place to ensure that wastewater is disposed of appropriately (see Site Establishment - showers).	Pre-Construction	Once-off	C CECO	SM	ECO				EA EM PM		
Construction Phase													
1	Gate Installation	All gates shall be fitted with locks and be kept locked at all times.	Throughout	Throughout	C CECO	SM	ECO				EA EM		

	and Control		When necessary	When necessary	When necessary	C CECO	SM	ECO	PM
		Gates shall only be left open on request of the Landowner if he accepts partial responsibility for such gates in writing. Claims arising from gates left open shall be investigated and settled in full by the Contractor. If any fencing interferes with the construction process, such fencing shall be deviated / protected until construction is completed.	When necessary	When necessary	When necessary	C CECO	SM	ECO	EA EM PM
2	Project Area	Construction activities are limited to the area as demarcated by EA / EM within the site identified for the construction of the Power Station. Any area outside the construction area, required to facilitate access, construction activities, construction camps or material storage areas, where necessary, shall be negotiated with the affected stakeholders and written agreements shall be obtained. All construction areas shall be cleared in accordance with the EA / EM Standard for Bush clearing ESKASABG3. Any extra space to be cleared outside the construction area shall be negotiated and approved by EA / EM. All areas marked as no go areas inside the substation parameters shall be treated with the utmost care and responsibility.	Throughout Project	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
3	Batching Plants	The batching plant area shall be operated in such a way as to prevent contaminated water to run off the site and polluting nearby streams or water bodies. To this effect diversion berms can be installed to direct all	Throughout Construction	Throughout Construction	Weekly	C CECO	SM	ECO	EA EM PM

4	Sanitation	<p>wastewater to a catchments area.</p> <p>Staff shall be sensitised to the fact that they should use these toilets at all times. The Contractor shall inform all site staff to make use of supplied ablution facilities and under no circumstances shall indiscriminate excretion and urinating be allowed other than in supplied facilities.</p> <p>No use of the veld shall be allowed, as this always creates problems with the landowners and may lead to claims for problems with stock diseases.</p> <p>Toilet paper is also a source of littering, and the Contractor shall be forced to clean up any litter.</p> <p>Ablution facilities must be maintained in a hygienic state and serviced regularly. Toilet paper will be provided.</p> <p>The Contractor will ensure that no spillage occurs when the toilets are cleaned or emptied and that a licensed provider removes the contents from the site.</p> <p>Disposal of such waste is only acceptable at a licensed waste disposal facility.</p>	Throughout Construction	Daily	C CECO	SM	ECO	EA EM PM
5	Site Establishment	<p>Open uncontrolled fires will be forbidden at the site camp. Rather "contained" cooking mechanisms will be used – e.g. gas stoves or an enclosed braai facility.</p> <p>Where possible and practical all maintenance of vehicles and equipment shall</p>	Throughout Construction	Daily	C CECO	SM	ECO	EA EM PM

		take place in the workshop area. Workshop areas shall be monitored for oil and fuel spills and such spills shall be cleaned and remediate to the satisfaction of the ECO.	Throughout Construction	Weekly	C CECO	SM	ECO	PM
		The Contractor shall be in possession of an emergency spill kit that must be complete and available at all times on site.	Throughout Construction	Weekly	C CECO	SM	ECO	EA EM PM
		No equipment shall be used which may cause irreparable damage to wet areas. The contractor shall use alternative methods of construction in such areas. Refer to TRMSCAAC1 REV 3 section 4.4.1 regarding access through seasonally wet areas.	Throughout Construction	Daily	C CECO	SM	ECO	EA EM PM
6	Eating areas	The feeding of, or leaving of food for animals, is strictly prohibited.	Throughout Construction	Monthly	C CECO	SM	ECO	EA EM PM
		No fires for the purpose of cooking or warming purposes will be permitted other than within designated areas, for instance, at the site camp.	Throughout Construction	Daily	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
1	Batching Plants	All areas used as batching areas must be rehabilitated once construction is completed. Should any claim be instituted against EA / EM, due to the actions of the Contractor at a batching plant site, EA / EM shall hold the Contractor fully responsible for the claim until such time that the Contractor can prove otherwise with the necessary documentation.	Once Construction is completed – during rehabilitation	Monthly	C CECO	SM	ECO	EA EM PM
2.	Site Decommissioning	All areas where site infrastructure or camp sites are established must be rehabilitated to their original state in which they were found.	Once Construction is	Monthly	C CECO	SM	ECO	EA EM PM

		rehabilita- tion						
Operational Phase								
1	Gate Control	Gates must be fitted with Eskom locks.	Permanent	Throughout	C CECO	SM	ECO	EA EM PM
		Such gates shall be clearly marked by painting the posts green.	After construction – once off	Once off	C CECO	SM	ECO	EA EM PM

12.11.3 Water Management (including Storm water, Water Sources, Wet Areas)

Table 12-4: Environmental Management Measures for Water Management.

Objectives
<p>Storm-water Management</p> <ul style="list-style-type: none"> Effectively control storm water runoff to ensure that impacts to surface water resources are controlled, and erosion is not present on site. <p>River Crossings</p> <ul style="list-style-type: none"> Minimise damage to river and stream embankments; No access roads through river and stream banks; No visible erosion scars on embankments once construction is completed; and Minimise erosion of embankments and subsequent siltation of rivers, streams and dams. <p>Wetlands</p> <ul style="list-style-type: none"> No construction activities within designated wetland areas as identified in the EIA; and No pollution or effluent is to come in contact with wetland areas.

No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
Pre-Construction Phase								
1	Water Sources	Should water be required from sources other than Eskom supply, a written agreement shall be reached between the Contractor and the stakeholder involved.	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM
		Should the Contractor be required to use water from a natural source, the Contractor shall supply a method statement to that effect and obtain the required permits. No construction shall take place in the wetland, streams and other river courses without the necessary water license from the Department of Water Affairs and Forestry;	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
Construction Phase								
1	Water Sources	Strict control shall be maintained and the ECO shall regularly inspect the abstraction point and methods used.	Throughout Project	Weekly	C CECO	SM	ECO	EA EM PM
2	Wetlands	No construction is to take place in wetland areas. Including no vehicular traffic in wet areas / wetlands.	Throughout Project	Weekly	C CECO	SM	ECO	EA EM PM
		Only existing roads through such areas may	Throughout	Monthly	C CECO	SM	ECO	EA EM PM

	be used with the approval of Eskom.	Project	Monthly	C CECO	SM	ECO	EA EM PM
	The contractor shall use alternative methods of construction in such areas. Refer to TRMSCAAC1 REV 3 section 4.4.1 regarding access through seasonally wet areas.	Throughout Project					
	Berms should be created not closer than 10m from identified wetland areas, so as to ensure that no construction material and/or waste flow into wetland systems.	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM
3	Dust control The dust control measures, such as watering, chemical stabilisation and the reduction of surface wind speed through the use of windbreaks and source enclosures must be put in place during construction activities. Emission control efficiencies of 50% can readily be achieved through the implementation of effective watering programme for unpaved roads and material handling points.	During construction	Monthly	C CECO	SM	ECO	EA EM PM
4	Storm water Management Storm water shall be channelled away from construction activities.	Prior to commencement of Construction	Once-off	C CECO	SM	ECO	EA EM PM

		All excavated and filled slopes and stockpiles must be of a stable angle and capable of accommodating normal expected flows.	Throughout Construction	Monthly	C CECO	SM	ECO	EA EM PM
		Stabilisation of cleared areas to prevent and control erosion will be actively managed. The method chosen (e.g. watering, planting, retaining structures, commercial anti-erosion compounds) will be selected according to specifics and ensure acceptable rehabilitation.	Throughout Construction	Monthly	C CECO	SM	ECO	EA EM PM
		Traffic and movement over stabilised areas will be restricted. Any damage to stabilised areas will be repaired and maintained to the satisfaction of the Site Manager.	Throughout Construction	Monthly	C CECO	SM	ECO	EA EM PM
		Where erosion and sedimentation occur, rectification will be carried out in accordance with details specified by the Site Manager.	Throughout Construction	Monthly	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
1	Storm water Management	Any runnels or erosion channels will be backfilled and compacted, and the areas restored to a proper condition.	Throughout Construction	Monthly	C CECO	SM	ECO	EA EM PM
Operational Phase								

None

12.11.4 Hazardous Substance Spills

Table 12-5: Environmental Management Measures for Hazardous Substance Spills

Objectives								
No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
<ul style="list-style-type: none"> To ensure that spills occurring during the construction phase a suitably managed to reduce potential impacts on the environment. 								
Pre-Construction Phase								
1	Hazardous Spills	Ensure that potential hazardous materials on site are identified and documented in a register.	Throughout Project	Once-off	C CECO	SM	ECO	EA EM PM
		Ensure that suitable spill kits and absorption materials are purchased prior to commencement with construction, and stored suitably in places where there is a high risk of hazardous spills occurring.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
Construction Phase								
1	Hazardous Spills	All contaminated soil / yard stone shall be removed and be placed in containers. Contaminated material can be taken to one	Throughout Project	When-necessary	C CECO	SM	ECO	EA EM PM

	central point where bio-remediation can be done.	Throughout Project	When-necessary	C CECO	SM	ECO	EA EM PM
	Smaller spills can be treated on site. (ESKASABTO)	Throughout Project	When-necessary	C CECO	SM	ECO	EA EM PM
	A specialist Contractor shall be used for the bio-remediation of contaminated soil where the required remediation material and expertise is not available on site.	Throughout Project	When-necessary	C CECO	SM	ECO	EA EM PM
	All spills of hazardous substances must be reported to the ECO and appointed Transmission Engineering Environmental Advisor (Tx Key Performance Indicator requirement).	Throughout Project	When-necessary	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase							
1	Hazardous Spills	Throughout Project	When-necessary	C CECO	SM	ECO	EA EM PM
Operational Phase							
None							

12.11.5 Delivery of Materials

Table 12-6: Environmental Management Measures for the delivery of materials.

Objectives		<ul style="list-style-type: none"> To ensure that all sub-contractors responsible for delivering materials to site operate in an environmentally friendly manner whilst on site; and To ensure that the activities related to material deliveries do not create an unnecessary impact on the environment. 						
No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
Pre-Construction Phase								
1	Heavy machinery	All drivers and operators must be appropriately licensed.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
Construction Phase								
1	Heavy machinery	No vehicles coming on sites must spill oil.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
		No construction equipment, vehicles or unauthorised personnel will be allowed onto areas that have been re-vegetated.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
1	Heavy Machinery	All areas where heavy machinery has access must be rehabilitated in terms of soil pollution.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM

Operational Phase								
No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
1	Heavy Machinery	No oil/ petrol spills / leaks may occur.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM

12.11.6 Building, Civil's and Structural Steel Work

Table 12-7: Environmental Management Measures for building, civil's and Structural Steel Work

Objective	<ul style="list-style-type: none"> To ensure that all construction related activities including civils, building erection, and structural steel work is undertaken in such a manner that it reduces unnecessary impact to the environment. 							
No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
Pre-Construction Phase								
None								
Construction Phase								
1	Excavate foundations	During excavations no oil leaks from heavy vehicles may occur. PPE must be used by all workers using hand tools during the excavations of foundations.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM

		Spoil must be evenly spread.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
2	Excavate earth moving materials	During the excavation of earth materials no oil leaks may occur from heavy vehicles.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
3	Mixing concrete	During the mixing of concrete, concrete dust is emanated. Workers mixing concrete must wear PPE. Cement bags must not become litter after use. They must be disposed of in bins/skips (see Waste Management).	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
4	Trenches	All workers using hand tools must make use of PPE. No spills may occur. All spills should be reinstated into foundations as backfill.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
5	Cast Blinding Layer	No concrete spills may occur. All spills should be reinstated into foundations as backfill.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM

6	Place Copper Earthing	All copper off-cuts must be collected for recycling purposes.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
7	Construct Cable	No concrete spills may occur. All spills should be reinstated into foundations as backfill.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
8	Place steelwork on foundations	All steel off-cuts must be collected for recycling purposes. During steel cutting and grinding, all old discs must be managed and must not become litter.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
9	Connect earthing to steelwork	During welding and brazing, all old welding rods must be managed and must not become litter.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
10	Reinstate yard stone	No oils spills may occur as a result of heavy vehicles. Workers with rakes must use PPE at all times.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM

Rehabilitation Phase							
1	De-establish contractors yard / store	All waste, garbage, surplus materials and oils spills to be cleared and site must be rehabilitated.	During Rehabilitation	Weekly	C CECO	SM	ECO EA EM PM
2	Final inspection	During site inspection the site is to be cleared and rehabilitated back to its original state.	During Rehabilitation	Weekly	C CECO	SM	ECO EA EM PM
Operational Phase							
1	Take over works	During site take / hand over the site must be accepted from the contractor and handed over.	Operations	Once - off	C CECO	SM	ECO EA EM PM

12.11.7 Circuit Breakers and Current Transformers

Table 12-8: Environmental Management Measures for Circuit Breakers and Current Transformers.

Objective	<ul style="list-style-type: none"> See deliveries, site establishment, and civils and structural steel work. 								
	No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
Pre-Construction Phase									

1	Supply and delivery of new circuit breakers and current transformers	All drivers and operators delivering new circuit breakers and current transformers must be licensed to obey all road and local by-laws.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM	
Construction Phase									
1	Establish contractor on site	(See Site Establishment).							
2	Install new cables, clamps and conductors	The crane operators must be licensed in accordance with the OHS Act.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM	
Rehabilitation Phase									
1	Clear site	The site must be cleared and rehabilitated so that there is no damage to the surrounding infrastructure.	Post construction	Weekly	C CECO	SM	ECO	EA EM PM	
		All personal must be suitably accredited to perform duties.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM	
		All cable cut offs must be collected and sent for recycling.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM	

		All waste, garbage, scrap and oil spill must be disposed of (see Waste Management). The site must be cleared and rehabilitated.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
2	Final Inspection	During site inspection the site is to be cleared and rehabilitated back to its original state.	On termination of construction	Weekly	C CECO	SM	ECO	EA EM PM
Operational Phase								
1	Take over works	During site take / hand over the site must be accepted from the contractor and handed over.	On termination of construction	Once-off	C CECO	SM	ECO	EA EM PM

12.11.8 Access Roads

Table 12-9: Environmental Management Measures for Access Roads.

<ul style="list-style-type: none"> • Minimise damage to existing access roads; • Minimise damage to environment due to construction and rehabilitation of new access roads; and • Minimise loss of topsoil and enhancement of erosion. 									
Objectives	No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
Pre-Construction Phase									

1	Access Roads	<p>If required, planning of access routes must be done in conjunction between the Contractor and Eskom.</p> <p>All agreements reached shall be documented in writing and no verbal agreements should be made.</p> <p>The condition of existing access / private roads to be used shall be documented with photographs.</p> <p>The Contractor shall properly mark all access roads.</p> <p>Markers shall show the direction of travel.</p> <p>Roads not to be used shall be marked with a "NO ENTRY" sign (refer also TRMSCAAC1 REV 3).</p> <p>Where required, speed limits shall be indicated and speed control measures applied on the roads.</p>	Once off	As necessary	C CECO	SM	ECO	EA EM PM
			Throughout Project	Throughout Project	C CECO	SM	ECO	EA EM PM
			Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM
			Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM
			Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM
			Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM
			Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM

		Water diversion berms shall be installed from the start of the contract in accordance with TRMSCAAC1 REV 3 Section 4.6.	Prior to construction	When necessary	C CECO	SM	ECO	EA EM PM
		Where berms are installed on severe slopes the outflow shall be suitably stone pitched to prevent erosion from starting at the base of the berm.	Prior to construction	When necessary	C CECO	SM	ECO	EA EM PM
		All structures shall be properly designed and drawings shall be available for reference purposes.	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM
		Permanently wet areas are shown on the profiles. No vehicular traffic shall be allowed in such areas. Only existing roads through such areas may be used with the approval of Eskom and the Landowner.	Throughout construction		C CECO	SM	ECO	EA EM PM
Construction Phase								
1	Access Roads	All speed limits shall be strictly adhered to at all times.	Throughout Project	Daily	C CECO	SM	ECO	EA EM PM
		Where new access roads are constructed, this must be done in accordance with TRMSCAAC1 REV 3 Section 4.4.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		These berms shall be maintained at all	Throughout	Monthly	C	SM	ECO	EA

	times.		inspection	CECO			EM PM
	No roads shall be constructed on slopes of more than 20% unless such roads follow contours.	Throughout construction	Monthly inspection	C CECO	SM	ECO	EA EM PM
	In such areas the Contractor shall only use existing roads or alternative methods of construction. The Contractor shall take such areas into consideration during the tender.	Throughout construction	Monthly inspection	C CECO	SM	ECO	EA EM PM
	The installation of concrete pipes and drifts, to facilitate access, shall be at the discretion of the Environmental Control Officer on site.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
	Any dangerous crossings shall be marked as such and where necessary, speed limits shall be enforced.	Throughout construction	Monthly inspection	C CECO	SM	ECO	EA EM PM
	All existing private access roads used for construction purposes, shall be maintained at all times to ensure that the local people have free access to and from their properties.	Throughout construction	Monthly inspection	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase							

1	Access Roads	Berms must be repaired at the end of the contract.	End of contract	Once off	C CECO	SM	ECO	EA EM PM
		Upon completion of the project all roads shall be repaired to their original state.	End of contract	Once off	C CECO	SM	ECO	EA EM PM
Operational Phase								
None.								

12.11.9 Waste Management

Table 12-10: Environmental Management Measures for waste management.

Objectives	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
		<ul style="list-style-type: none"> To keep the construction site and servitude neat and clean. Disposal of rubble and refuse in an appropriate manner Minimise litigation Minimise neighbour complaints No visible concrete spillage on the servitude 						
Pre-Construction Phase								
1	Refuse and Rubble Removal	A method statement is required from the Contractor that includes the layout of the camp, management of ablation facilities and waste management.	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM

Removal	and at a designated place.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
	All packaging material shall be removed from site and disposed of and not burned on site.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
	No landfill may be used without the consent from the Landowner.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
	Should a landfill be used for biodegradable materials only, the rubble shall be compacted and at least 1m of soil shall cover the waste material.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
	No hazardous material, e.g. oil or diesel fuel shall be disposed of in any unregistered waste site.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
	No material shall be left on site that may harm man or animals.	Throughout Project	Weekly inspection	C CECO	SM	ECO	EA EM PM
	Any broken insulators shall be removed and all shards picked up.	Throughout Project	Daily	C CECO	SM	ECO	EA EM PM
	Broken, damaged and unused nuts, bolts and washers shall be picked up and removed from site.	Throughout Project	Daily	C CECO	SM	ECO	EA EM PM

		provided in sufficient quantity on the site.	Throughout Project	Weekly	C CECO	SM	ECO	EA EM PM
		Waste will be removed during off-peak traffic periods to minimise impacts on local traffic patterns.	Throughout Project	Weekly	C CECO	SM	ECO	EA EM PM
		All waste generated during construction and operation of the facility must be removed and disposed of at a waste facility permitted in terms of Section 20 of the Environmental Conservation Act, 1989 (Act 73 of 1989).	Throughout Project	Weekly	C CECO	SM	ECO	EA EM PM
		Littering by the employees of the Contractor shall not be allowed (TRMSCAAC1 REV 3 section 4.1.2).	Throughout Project	Daily	C CECO	SM	ECO	EA EM PM
		All potentially hazardous and non-degradable waste shall be collected and removed to a registered waste site.	Throughout Project	Weekly	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
1	Refuse and Rubble Removal	Same as construction phase.						
Operational Phase								
1	Refuse and Rubble	Same as construction phase.						

	Removal
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12.11.10 Fire Prevention

Table 12-11: Environmental Management Measures for Fire Prevention.

Objectives								
No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
<ul style="list-style-type: none"> • No veld fires started by the Contractor's work force. • No claims from Landowners for damages due to veld fires. • No litigation. 								
Pre-Construction Phase								
1	Fire Prevention	The Contractor shall have fire-fighting equipment available on all vehicles working on site, especially during the winter months.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		The Contractor will document a fire reduction management plan. The plan will identify sources of fire hazard, and appropriate management measures to reduce the identified risk. The relevant authority will be notified of such potential fire hazards.	Prior to commencement of construction	Monthly	C CECO	SM	ECO	EA EM PM
Construction Phase								

1	Fire Prevention	<p>Preferentially no fires will be lit on the site, if however required, fires must be limited to use for cooking and heating use only within a designated area. This area will be a suitable distance from fuel sources. A fire will be constantly monitored while present.</p> <p>In terms of the Atmospheric Pollution Prevention (APPA), burning is not permitted for waste disposal.</p> <p>Suitable precautions will be taken (e.g. suitable fire extinguisher, welding curtains) when working with welding or grinding equipment near potential sources of combustion.</p> <p>All fire control mechanisms (fire fighting equipment) will be routinely inspected by a qualified investigator for efficacy thereof and be approved by local fire services. Such mechanisms will be present and accessible at all times.</p> <p>All staff on site will be made aware of general fire prevention and control methods, and the name of the responsible person to</p>	Throughout Project	Daily	C CECO	SM	ECO	EA EM PM
			Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
			Throughout Project	Daily	C CECO	SM	ECO	EA EM PM
			Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
			Throughout Project	Once-off	C CECO	SM	ECO	EA EM PM

		alert to the presence of a fire.							
		The Contractor will advise the relevant authority of a fire outside of a demarcated area as soon as it starts and will not wait until he can no longer control it.	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM	
Rehabilitation Phase									
1	Fire Prevention	None.							
Operational Phase									
1	Fire Prevention	None.							

12.11.11 Designated Storage Areas

Table 12-12: Environmental Management Measures for Designated Storage Areas.

Objective	<ul style="list-style-type: none"> To ensure that cognisance is taken of proper storage of dangerous goods and hazardous materials so as to avoid accidents, spillage, and impacts to the environment. 							
No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
Pre-Construction Phase								

1	Workshop, equipment maintenance and storage	Where possible and practical all maintenance of vehicles and equipment shall take place in the workshop area, on a paved or concrete lined surface. All hazardous substances shall be stored in suitable containers and storage areas shall be banded. This includes all carbon substances like fuel and oil as well as herbicides and battery acid. A register shall be kept on all substances and be available for inspection at all times.	During construction	Monthly	C CECO	SM	ECO	EA EM PM
Construction Phase								
1	Workshop, equipment maintenance and storage	Servicing of vehicles within Power Station perimeters is strictly prohibited. Only emergency repairs shall be allowed on site and a drip tray shall be used to prevent oil spills. In the event of a breakdown within the substation perimeter, any oil spills shall be cleaned up immediately and appropriate environmental investigations undertaken and recorded.	Throughout Project	Throughout Project	C CECO	SM	ECO	EA EM PM
			Throughout Project	Daily	C CECO	SM	ECO	EA EM PM
			Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM

	<p>The following shall apply:</p> <ul style="list-style-type: none"> • All contaminated soil shall be removed and be placed in containers. Contaminated soil can be taken to one central point at the Contractors campsite where bio-remediation can be done; • Smaller spills can be treated on site; • A specialist Contractor shall be used for the bio-remediation of contaminated soil; • The area around the fuel storage drum at the Contractor's campsite shall also be re-mediated upon completion of the contract; and • All oil spills must be reported to ECO immediately. 	<p>Throughout Project</p>	<p>Monthly</p>	<p>C CECO</p>	<p>SM</p>	<p>ECO</p>	<p>EA EM PM</p>
	<p>Under no circumstances shall such waste be buried on site indiscriminately.</p>	<p>Throughout Project</p>	<p>Throughout Project</p>	<p>C CECO</p>	<p>SM</p>	<p>ECO</p>	<p>EA EM PM</p>
	<p>No maintenance or repair of construction vehicles or machinery will occur on site during the construction phase. Maintenance of equipment and vehicles will be performed off-site at a suitably designed workshop.</p>	<p>Throughout Project</p>	<p>Monthly</p>	<p>C CECO</p>	<p>SM</p>	<p>ECO</p>	<p>EA EM PM</p>

2	Materials use, handling and storage	oils sipping into the ground. The Contractor will ensure that delivery drivers are informed of all procedures and restrictions required by this document. Such drivers will be supervised during off-loading, by a person knowledgeable of the requirements.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
		Materials will be appropriately secured to ensure safe passage between destinations. Loose loads (e.g. sand, stone chip, fine vegetation, refuse, paper and cement) will be covered.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		The Contractor will be responsible for any clean-up resulting from the failure by his employees or suppliers to properly secure transported materials.	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM
		All material lay-down areas and stockpiles will be subject to the Site Manager's approval.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
		Imported fill / soil / sand materials will be free of weeds, litter and contaminants.	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM

	Areas shall be monitored for spills and any spills shall be contained, cleaned and rehabilitated immediately.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
	Any leaking containers shall be repaired or removed from site.	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase							
1	Servicing of Vehicles	None.					
Operational Phase							
1	Servicing of Vehicles	None.					

12.11.12 Tower Positions

Table 12-13: Environmental Management Measures for Tower Positioning.

Objectives	<ul style="list-style-type: none"> • Minimise damage to topsoil and environment at tower positions • Successful rehabilitation of all damaged areas • Prevention of erosion and no visible erosion scars three months after completion of the contract 							
No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
Pre-Construction Phase								

1	Tower positioning	Refer to TRMSCAAC1 REV 3 SECTION 4.4.5 for specifications concerning tower sites on slopes.	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM
Construction Phase								
1	Tower Positioning	Disturbance of topsoil on tower sites with severe slopes shall be minimised at all costs.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		At any tower sites where conventional foundations are installed, the Contractor shall remove the topsoil separately and store it for later use during rehabilitation of such tower sites.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
		During backfilling operations, the Contractor shall take care not to dump the topsoil in the bottom of the foundation and then put spoil on top of that.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
		In accordance with the Conservation of Agricultural Resources Act, No 43 of 1983, slopes in excess of 2% must be contoured and slopes in excess of 12% must be terraced.	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM
		Contour banks shall be spaced according to the slope on tower sites. The type of soil	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM

Rehabilitation Phase									
1	Tower Positioning	shall also be taken into consideration.							
		Re-seeding shall be done on disturbed areas as directed by the Environmental Control Officer.	Post construction	When necessary	When necessary	C CECO	SM	ECO	EA EM PM
		Other methods of rehabilitation of tower sites may also be used at the discretion of the Environmental Control Officer, e.g. stone pitching, logging, etc.	When necessary	When necessary	When necessary	C CECO	SM	ECO	EA EM PM
		A mixture of seed can be used provided the mixture is carefully selected to ensure the following: <ul style="list-style-type: none"> • Annual and perennial plants are chosen; • Pioneer species are included; • All the plants shall not be edible; • Species chosen will grow in the area without many problems; 	Throughout Project	When necessary	When necessary	C CECO	SM	ECO	EA EM PM

		<ul style="list-style-type: none"> • Root systems must have a binding effect on the soil; and • The final product should not cause an ecological imbalance in the area. 								
		<p>To get the best results in a specific area, it is a good idea to consult with a vegetation specialist or the local extension officer of the Dept of Agriculture. Seed distributors can also give valuable advice as to the mixtures and amount of seed necessary to seed a certain area. Re-seeding, as well as fencing in of badly damaged areas, will always be at the discretion of the Environmental Control Officer, unless specifically requested by a Landowner.</p>	Post construction	When necessary	C CECO	SM	ECO	EA EM PM		
Operational Phase										
1	Tower Positioning	None.								

12.11.13 Claims from Damages

Table 12-14: Environmental Management Measures for Claims from Damages.

Objective	Mitigation Measures						
No.	Activity	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
Pre-Construction Phase							
1	Claims from Damages	None.					
Construction Phase							
1	Claims from Damages	All damage to Eskom property shall be recorded immediately.	Throughout construction	When necessary	C CECO	SM ECO	EA EM PM
		The Environmental Control Officer should also keep a photographic record of such damage.	When necessary	When necessary	C CECO	SM ECO	EA EM PM
		The date, time of damage, type of damage and reason for the damage shall be recorded in full to ensure the responsible party is held	Throughout construction	When necessary	C CECO	SM ECO	EA EM PM

	liable.		Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM	
	All claims for damage should be directed to the Environmental Control Officer for appraisal.		Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM	
	The Contractor shall be held liable for all unnecessary damage to Eskom property.		Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM	
	A register shall be kept of all complaints from Landowners.		Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM	
	All claims shall be handled immediately to ensure timeous rectification / payment.		Throughout construction						
Rehabilitation Phase									
1	Claims from Damages	None.							
Operational Phase									
1	Claims from Damages	None.							

12.11.14 Erosion, Donga and River Crossings

Table 12-15: Environmental Management Measures for Erosion, Donga and River Crossings.

Objectives								
	<ul style="list-style-type: none"> Minimise erosion damage on donga crossings and embankments. There should be no visible damage caused by construction activities. Minimise impeding the natural flow of water Minimise initiation of erosion through donga embankments 							
No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
Pre-Construction Phase								
1	Erosion and donga Crossings	Crossing of dongas and eroded areas shall be thoroughly planned in accordance with TRMSCAAC1 REV 3 Section 4.4.1.	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM
		All structures shall be properly designed and drawings shall be available for reference purposes.	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM
2	River Crossings	Existing drifts and bridges may be used if the Landowner gives his consent. Such structures shall then be thoroughly examined for strength and durability before they are used.	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM
		New drifts and bridges shall only be constructed with the approval of Eskom and the Landowner and at the discretion of the	Prior to construction	Monthly	C CECO	SM	ECO	EA EM PM

	Environmental Control Officer.	tion							
	All structures constructed for access purposes shall be properly designed and drawings of such structures shall be available for record purposes.	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM		
Construction Phase									
1	Erosion and Donga Crossings Water diversion berms shall be installed at donga crossings to ensure runoff water on the servitude does not run into dongas and cause an erosion hazard. Suitable erosion containment structures shall be constructed at donga crossings where required and viable. No unplanned / improperly planned cutting of donga embankments is allowed as this leads to erosion and degradation of the environment.	Throughout construction	Monthly	C			EA EM PM		
2	River Crossings No roads shall be cut through river and stream banks as this may lead to erosion causing siltation of streams and downstream	Prior to construction	Throughout	C CECO	SM	ECO	EA EM PM		

		dams.					
Rehabilitation Phase							
1	Erosion and Donga Crossings	None.					
Operational Phase							
1	Erosion and Donga Crossings	None.					

12.11.15 Flora Management (including Vegetation Clearing, General, and Herbicides)

Table 12-16: Environmental Management Measures for Flora Management.

Objective	<ul style="list-style-type: none"> • Minimise damage to vegetation by only clearing 8m vegetation along the centre of the servitude for access purposes. • Keep servitude as natural looking as possible. • No vegetation interfering with structures and statutory safety requirements upon completion of the contract. • Minimise possibility of erosion due to removal of vegetation by not de-stumping vegetation on river and stream embankments. • Minimise removal of plant material on river and stream embankments. • Eradication of alien invader and densifier species that cause a fire hazard. • No visible herbicide damage to the vegetation along the servitude one year after completion of the contract due to incorrect herbicide use. • No litigation due to unauthorised removal of vegetation.
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No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
Pre-Construction Phase								
1	Vegetation Clearing	Vegetation clearing shall be done in accordance with ESKASABG3 REV 0 (Standard for bush clearance and maintenance within overhead power line servitudes) and the Vegetation Management Guideline.	Prior to construction	Monthly	C CECO	SM	ECO	EA EM PM
		The removal of all economically valuable trees or vegetation shall be negotiated with the Landowner before such vegetation is removed.	Prior to construction	When necessary	C CECO	SM	ECO	EA EM PM
		The Contractor will remove plants containing any diseases and /or pests from the site.	Prior to construction	Weekly	C CECO	SM	ECO	EA EM PM
Construction Phase								
1	Vegetation Clearing	Only an 8m strip may be cleared flush with the ground to allow vehicular passage during construction.	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		The removal of indigenous plant material from the site or surrounding and adjacent	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM

	land will not be allowed.	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM		
	No scalping shall be allowed on any part of the servitude road unless absolutely necessary.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM		
	All trees and vegetation cleared from the site shall be cut into manageable lengths and neatly stacked at regular intervals along the line.	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM		
	No vegetation shall be pushed into heaps or left lying all over the servitude.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM		
	Vegetation clearing on tower sites must be kept to a minimum.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM		
	Big trees with large root systems shall be cut manually and removed, as the use of a bulldozer will cause major damage to the soil when the root systems are removed.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM		
	Stumps shall be treated with herbicide.	Throughout construction							

	left under the line.	tion	When necessary	C CECO	SM	ECO	EA EM PM		
	Dense vegetation under the line which could cause a fire hazard, particularly in the middle third of the span in the vicinity of the lowest point of the conductors, will be considered as a separate case.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM		
	With permission of the landowner, the total servitude under the line and up to 5m outside the outer phases can be cleared.	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM		
	Protected or endangered species of plants shall not be removed unless they are interfering with a structure.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM		
	Where such species have to be removed due to interference with a structure, the necessary permission and permits shall be obtained from Provincial Nature Conservation.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM		
	All protected species not to be removed must be clearly marked and such areas	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM		

	fenced off if required.	tion	necessary				
	The use of herbicides shall only be allowed after a proper investigation into the necessity, the type to be used, the long-term effects and the effectiveness of the agent. Eskom's approval for the use of herbicides is mandatory (Contact Dr. Eugene van Rensburg—Vegetation Management).	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
	Application shall be under the direct supervision of a qualified technician. All surplus herbicide shall be disposed of in accordance with the supplier's specifications.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
	Upon completion of the stringing operations and before handover, the servitude must be inspected and all vegetation interfering with the safe operation of the line shall be removed / cut down.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
	All alien vegetation in the total servitude and densifiers creating a fire hazard shall be cleared and treated with herbicides. (Refer to	Throughout construction	Weekly	C CECO	SM	ECO	EA EM PM

	<p>the Vegetation Management Guideline attached).</p> <ul style="list-style-type: none"> • The application shall be according to set specifications and under supervision of a qualified technician. • The possibility of leaching into the surrounding environment shall be properly investigated and only environmentally friendly herbicides shall be used. 	tion					
	<p>It is recommended that a contractor for vegetation clearing should comply with the following parameters:</p> <ul style="list-style-type: none"> • The contractor must have the necessary knowledge to be able to identify protected species as well as species not to be interfering with; • The operation of the line due to their height and growth rate; 	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM

		<ul style="list-style-type: none"> The contractor must also be able to identify declared weeds and alien species that can be totally eradicated; and The contractor must be in possession of a valid herbicide applicators license. 						
2	Harvesting of Medicinal Plants	<p>The removal of protected vegetation and medicinal plants during construction must be done in consultation with the provincial environmental authorities, and the appropriate post-construction rehabilitation measures must be implemented in cooperation with the provincial environmental authorities.</p>	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		<p>The removal of protected vegetation and medicinal plants during construction must be done in consultation with the provincial environmental authorities, and the appropriate post-construction rehabilitation measures must be implemented in cooperation with the provincial environmental authorities.</p>	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM

	environmental authorities.		Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
	Should Medicinal Plants be found on site, these plants will be demarcated and cordoned off.	Throughout construction	When necessary					
	Once demarcated, they will be removed and translocated to an established nursery. The plants shall be removed by a certified Nursery with experience in the handling and translocation of plants. The South African National Biodiversity Institute (SANBI) shall be contacted for assistance should a certified nursery not be available.	Throughout construction	Throughout construction					
3	Protection of Indigenous Vegetation	Removal of indigenous plant material from the site or surrounding and adjacent land will not be allowed;	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		Only indigenous vegetation is to be used in any landscaping which may be undertaken;	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
4	Search and Rescue of Endangered Plant Species	Should Protected or Endangered Plant Species be found on site they will be demarcated and cordoned off. An Ecological Management Plan will be compiled and submitted to DEAT for approval. The Ecological Management Plan will include the	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM

	stored at a licensed facility.	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
	<ul style="list-style-type: none"> In situ conservation of Protected and Endangered Plant Species is preferable to ex situ conservation. Thus, should the plant species not "interfere" with the construction of a structure, the area surrounding the plant species shall be declared a "no-go" area as outlined in the Ecological Management Plan; and The area surrounding the plant species shall be declared a "No-go" area and a buffer zone will be applied as outlined in the Ecological Management Plan; 						
5	<p>Alien Plant Control and Monitoring</p> <p>The Developer will be responsible for controlling all alien invasive species, as per the requirements of the Conservation of Agricultural Resources Act (CARA), during the contract and vegetation establishment period;</p> <p>All exotic trees will be identified and marked;</p> <p>Alien invasive plant material will be preferentially removed in entirety through mechanical means (e.g. chainsaw, bulldozer,</p>	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM

		<p>hand-pulling of smaller specimens);</p> <p>The exotic trees must be cut down leaving the stumps behind to ensure that soil erosion is prevented;</p> <p>The trees can be chipped on site and the chips seeded with indigenous vegetation and spread over the site to allow for re-growth and to reduce erosion potential;</p> <p>Immediately after being cut, a herbicide solution must be applied to the exotic trees to ensure no further growth. The person applying the herbicide must have read and understood the instructions. Care must be taken that there is no spillage of solution in the wetland and that the correct protective equipment must be used;</p> <p>If plants are not removed in entirety but cut-back and systematically treated with approved herbicides, then remaining plant will be monitored for re-growth / re-establishment;</p> <p>Herbicides used must be approved by authorities and as per the supplier's specifications;</p>	<p>tion</p> <p>Throughout construction</p>	<p>Throughout</p>	<p>C CECO</p>	<p>SM</p>	<p>ECO</p>	<p>EA EM PM</p>
			<p>After being cut – immediately</p>	<p>Throughout</p>	<p>C CECO</p>	<p>SM</p>	<p>ECO</p>	<p>EA EM PM</p>
			<p>Throughout construction</p>	<p>Monthly</p>	<p>C CECO</p>	<p>SM</p>	<p>ECO</p>	<p>EA EM PM</p>
			<p>When necessary</p>	<p>Once-off</p>	<p>C CECO</p>	<p>SM</p>	<p>ECO</p>	<p>EA EM PM</p>

		Alien invasive plant material will not be stockpiled. All such material removed will be removed from the site and dumped at an approved disposal site;	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		If during the establishment period any noxious or excessive weed growth occurs, such vegetation will be removed; and	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		It is the developer's responsibility to implement a monitoring programme that will be instituted to ensure that re-growth of alien invasive plants species does not occur, or that such re-growth is controlled.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
1	Traffic on rehabilitated areas.	If disturbed areas are left to rehabilitate naturally, they must be frequently monitored and interventions put in place immediately should it become necessary. Special attention must be given to the potential for soil erosion and the associated environmental degradation. It is also essential to undertake alien vegetation control and management.	Post construction	Monthly	C CECO	SM	ECO	EA EM PM
		No construction equipment, vehicles or unauthorised personnel will be allowed onto areas that have been re-vegetated	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM

			tion							
	Only persons / equipment required for maintenance thereof will be allowed to operate on such areas.		Throughout construction	Throughout	C CECO	SM	ECO		EA EM PM	
2	Plant Material	All plant material used on site will be obtained from an approved nursery;	Post construction	Throughout	C CECO	SM	ECO		EA EM PM	
	The Contractor will remove plants containing any diseases and/or pests from the site;		Throughout construction	Throughout	C CECO	SM	ECO		EA EM PM	
	Propagation of suitable indigenous vegetation that is quick to establish such as grasses, should be encouraged in areas where vegetation has been removed		Throughout construction	Throughout	C CECO	SM	ECO		EA EM PM	
	On planting, there will be sufficient topsoil around each plant to prevent desiccation of the root system. Where plants are stored on site prior to planting they will be maintained to ensure that the root systems remain moist; and		Throughout construction	Throughout	C CECO	SM	ECO		EA EM PM	
	Each plant brought onto site will be handled and packed in an approved manner for that species or variety, and that all necessary		Throughout construction	Throughout	C CECO	SM	ECO		EA EM PM	

3	<p>Reseeding of Disturbed Areas</p>	<p>precautions are taken to ensure that the plants arrive on the site in a proper condition for successful growth (e.g. good plant specimens chosen, disease and/or pest free, potting material weed free, plants covered during transportation, containers in good condition);</p> <p>All reseeded activities will be undertaken at the end of the dry season (middle to end September) to ensure optimal conditions for germination and rapid vegetation establishment;</p> <p>The seed mix will be approved by the ECO prior to seeding;</p> <p>Seeds should be covered by use of an agricultural roller or similar mechanism;</p> <p>Inspect rehabilitated area at three monthly intervals during the first and second growing season to determine the efficacy of rehabilitation measures; and</p> <p>Take appropriate remedial action where vegetation establishment has not been</p>	<p>tion</p> <p>Throughout construction</p>	<p>Wet Season</p>	<p>C CECO</p>	<p>SM</p>	<p>ECO</p>	<p>EA EM PM</p>
			<p>Throughout construction</p>	<p>Wet Season once-off</p>	<p>C CECO</p>	<p>SM</p>	<p>ECO</p>	<p>EA EM PM</p>
			<p>Throughout construction</p>	<p>Throughout</p>	<p>C CECO</p>	<p>SM</p>	<p>ECO</p>	<p>EA EM PM</p>
			<p>Throughout construction</p>		<p>C CECO</p>	<p>SM</p>	<p>ECO</p>	<p>EA EM PM</p>
			<p>Throughout construction</p>		<p>C CECO</p>	<p>SM</p>	<p>ECO</p>	<p>EA EM PM</p>

		successful or erosion is evident within the first two growing seasons.	tion						
4	Alien Plant Control and Monitoring	Alien plant control will be conducted as described in Section 5.14, for a period of two years after the rehabilitation phase is completed.	Throughout construction		C CECO		SM	ECO	EA EM PM
5	Soil and Land Capability	All excess building material and rubble must be collected and disposed of at a suitably registered landfill site.	Throughout construction		C CECO		SM	ECO	EA EM PM
		Soils must be ripped to refusal or a minimum of 300mm prior to seeding.	Throughout construction		C CECO		SM	ECO	EA EM PM
		All areas must be profiled to tie in with adjacent terrain. Where necessary suitable soil must be imported obtain a suitable profile.	Throughout construction		C CECO		SM	ECO	EA EM PM
		Suitable erosion control measures must be installed in areas where erosion may occur;	Throughout construction		C CECO		SM	ECO	EA EM PM
		Apply a suitable mixture of N:P:K fertiliser prior to seeding;	Throughout construction		C CECO		SM	ECO	EA EM PM

		Harrow the disturbed areas after spreading the topsoil and fertilizer uniformly;	Throughout construction	C CECO	SM	ECO	EA EM PM
		Rehabilitated and profiled areas must be inspected for erosion every three months for the first two years. Additional measures must be implemented to remediate erosion where it is observed.	Throughout construction	C CECO	SM	ECO	EA EM PM
Operational Phase							
1	Vegetation Clearing	None					

12.11.16 Fauna Management

Table 12-17: Environmental Management Measures for Fauna Management.

Objectives	<ul style="list-style-type: none"> • Minimise disruption of farming activities (No stock losses where construction is underway); • Minimise disturbance of animals; • Minimise interruption of breeding patterns of birds; and • No litigation concerning stock losses and animal deaths. 							
No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
Pre-Construction Phase								

1	Planning	Construction planning must be undertaken prior to construction to ensure that it does not conflict with breeding seasons.	Once off	C CECO	SM	ECO	EA EM PM
		The breeding sites of raptors and other wild bird species shall be taken into consideration during the planning of the construction programme.	Once off	C CECO	SM	ECO	EA EM PM
		<i>There are many instances where protected and endangered species of birds are nesting on our transmission towers without causing any problems to the flow of electricity or network stability. These birds are highly territorial and some have been using the same nests for many years, i.e. Black Eagle (Witkruisarend). They are guarded jealously by the landowners and are monitored by many groups involved with ensuring their continued existence, including Nature Conservation officials at National and Provincial level. It is therefore imperative that the breeding sites of these birds are kept intact and that the breeding pairs are not disturbed especially where there are young</i>	When necessary	C CECO	SM	ECO	EA EM PM

		<i>nestlings.</i>								
		The Contractor shall take all the necessary precautions and it is recommended that sites on parallel existing lines be noted, i.e. tower numbers. This information must then be given to the avian specialist via the Environmental Advisor so that the necessary action can be taken timeously.	Throughout the project	Weekly inspections.	C CECO	SM	ECO	EA EM PM		
2	Fencing	Ensure that suitable fencing is erected prior to the commencement of construction to ensure that live stock does not wonder into dangerous areas.	Throughout the project	Weekly inspections.	C CECO	SM	ECO	EA EM PM		
Construction Phase										
1	Construction	The Contractor's workforce will have to be very careful not to disturb the animals as this may lead to fatalities which will give rise to claims from the Landowners.	Throughout the project	Throughout	C CECO	SM	ECO	EA EM PM		
		The Contractor shall under no circumstances interfere with livestock without the Landowner being present. This includes the moving of livestock where they interfere with	Throughout the project	Throughout	C CECO	SM	ECO	EA EM PM		

	construction activities.	Throughout the project	When necessary	C CECO	SM	ECO	EA EM PM
	Should the Contractors workforce obtain any livestock for eating purposes, they must be in possession of a written note from the Landowner.	Throughout the project	When necessary	C CECO	SM	ECO	EA EM PM
	Should any new sites or nests be found, during the construction process, that was not known or have been noted before, each site shall be assessed for merit and the necessary precautions be taken to ensure the least disturbance.	Throughout the project	When necessary	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase							
1	Construction	Same as construction phase.					
Operational Phase							
1	Construction	Same as construction phase.					

12.11.17 Interaction with adjacent landowners

Table 12-18: Environmental Management Measures for Interaction with Adjacent Land Owners

Objectives		<ul style="list-style-type: none"> Maintain good relations with Landowners; No delays in the project due to Landowner interference; and Landowner signs final release form. 						
No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
Pre-Construction Phase								
1	Interaction with Land Owners	<p>All negotiations for any reason shall be between Eskom, the landowners and the Contractor.</p> <p>No verbal agreements shall be made. All agreements shall be recorded properly and all parties shall co-sign the documentation. It is proposed that a photographic record of access roads be kept.</p> <p>It is required that the Contractor will supply one person to be the liaison officer (CECO) for the entire contract, and that this person shall be available to investigate all problems arising on the work sites concerning adjacent landowners (TRMSCAAC1 REV 3).</p>	When necessary	Throughout	C CECO	SM	ECO	EA EM PM
			Throughout the project	When necessary	C CECO	SM	ECO	EA EM PM
			Throughout project	Ongoing.	C CECO	SM	ECO	EA EM PM
Construction Phase								

1	Interaction with Land Owners	<p>The construction process will use the services of the Power Station Environmental Monitoring / Management Committee (EMC) for communication with the land owners.</p>	Throughout the project	Monthly	C CECO	SM	ECO	EA EM PM
		<p>Any claims instituted by the Landowners shall be investigated and treated promptly. Unnecessary delays should be avoided at all costs.</p>	Throughout the project	When necessary	C CECO	SM	ECO	EA EM PM
		<p>Landowners shall always be kept informed about any changes to the construction programme should they be involved. If Eskom's Environmental Control Officer is not on site the Contractor's Environmental Control Officer should keep the Landowners informed.</p>	Throughout the project	Monthly	C CECO	SM	ECO	EA EM PM
		<p>The contact numbers of the Contractor's ECO officer and the Eskom ECO shall be made available to the Landowners.</p>	Throughout the project	Once-off	C CECO	SM	ECO	EA EM PM
		<p>All contact with the Landowners shall be courteous at all times.</p>	Throughout the project	Throughout	C CECO	SM	ECO	EA EM PM
		<p>The rights of the Landowners shall be respected at all times and all staff shall be sensitised to the effect that we are working</p>	Throughout the project	Throughout	C CECO	SM	ECO	EA EM PM

		on private property.							
Rehabilitation Phase									
1	Interaction with Land Owners	Same as for construction phase above.							
Operational Phase									
1	Interaction with Land Owners	The rights of the Landowners shall be respected at all times and all staff shall be sensitised to the effect that we are working on private property.	Throughout the project	Throughout	C CECO	SM	ECO	EA EM PM	

12.11.18 Noise / Working Hours

Table 12-19: Environmental Management Measures for Noise Management.

Objective	<ul style="list-style-type: none"> To ensure that noise is managed in such a manner that no complaints are received. 							
No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
Pre-Construction Phase								
None								

Construction Phase								
1	Noise	In order to prevent noise impacts resulting from construction activities, working hours are to be limited to weekdays between 7h00 to 17h00.	Throughout the project	Throughout	C CECO	SM	ECO	EA EM PM
		If certain construction requires work outside of these hours, all adjacent landowners have to be informed prior to any construction outside of the specified hours commencing.	When necessary	Once – off, if necessary	C CECO	SM	ECO	EA EM PM
		If there are complaints about low frequency noise after the refurbishment, Eskom would have to get a noise expert to do measurements and recommend mitigation.	When necessary	If necessary				
Rehabilitation Phase								
1	Noise	Same as Construction Phase.						
Operational Phase								
1	Noise	Same as Construction Phase						

12.11.19 Infrastructure

Table 12-20: Environmental Management Measures for Infrastructure.

Objectives		<ul style="list-style-type: none"> Ensure that existing infrastructure is taken into account during planning and project execution to eliminate impacts to existing infrastructure; and To avoid claims and litigation. 						
No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
Pre-Construction Phase								
1	Planning	Demarcate all existing infrastructure on site layout plans. Document condition of existing infrastructure prior to construction.	One day	Monthly Inspections	C CECO	SM	ECO	EA EM PM
Construction Phase								
1	Construction activities	All existing private access roads used for construction purposes, shall be maintained at all times to ensure that the local people have free access to and from their properties. Speed limits shall be enforced in such areas and all drivers shall be sensitised to this effect.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
1	Re-instate all roads and infrastructure	Upon completion of the project all roads and infrastructure shall be repaired to their	Post construc-	Once-off	C CECO	SM	ECO	EA EM PM

	original state.	tion				
Operational Phase						
1	Re-instate all roads and infrastructure	Same as rehabilitation phase.				

12.11.20 Archaeology

Table 12-21: Environmental Management Measures for Archaeology.

Objective	<ul style="list-style-type: none"> • Protection of archaeological sites and land considered to be of cultural value; • Protection of known sites against vandalism, destruction and theft; and • The preservation and appropriate management of new archaeological finds should these be discovered during construction. 							
No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
Pre-Construction Phase								
1	Planning	Ensure all known sites of cultural, archaeological, and historical significance are demarcated on the site layout plan, and marked as no-go areas.	Throughout Project	Weekly Inspection	C CECO	SM	ECO	EA EM PM
Construction Phase								
1	Emergency	Should any heritage resources be exposed during excavation for the purpose of	When	Throughout	C CECO	SM	ECO	EA EM

Response	<p>construction, construction in the vicinity of the finding must be stopped.</p> <p>Should any heritage resources be exposed during excavation or be found on site, a registered heritage specialist must be called to site for inspection.</p> <p>Should any heritage resources be exposed during excavation or be found on site, the relevant heritage resource agency must be informed about the finding;</p> <p>Under no circumstances may any heritage material be destroyed or removed from site;</p> <p>Should remains and/or artefacts be discovered on the site during earthworks, all work will cease in the area affected and the Contractor will immediately inform the Construction Manager.</p> <p>Should any remains be found on site that is potentially human remains, the South African Police Service should also be contacted.</p>	necessary	<p>Throughout</p> <p>When necessary</p> <p>Throughout Project</p> <p>Throughout Project</p> <p>Throughout Project</p>	<p>C CECO</p> <p>C CECO</p> <p>C CECO</p> <p>C CECO</p> <p>C CECO</p> <p>C CECO</p>	<p>SM</p> <p>SM</p> <p>SM</p> <p>SM</p> <p>SM</p> <p>SM</p>	<p>ECO</p> <p>ECO</p> <p>ECO</p> <p>ECO</p> <p>ECO</p> <p>ECO</p>	<p>PM</p> <p>EA EM PM</p> <p>EA EM PM</p> <p>EA EM PM</p> <p>EA EM PM</p> <p>EA EM PM</p> <p>EA EM PM</p>
Rehabilitation Phase							
	Same as construction phase.						

Operational Phase	
	Same as construction phase.

12.11.21 Residential Property

Table 12-22: Environmental Management Measures for Management of residential property

Objectives	<ul style="list-style-type: none"> Control actions and activities in close proximity to inhabited areas; No complaints from Landowners; No damage to private property. 							
No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
Pre-Construction Phase								
1	Planning	All private residences will be demarcated on a site layout plan prior to construction phase commencing.	One day	Weekly Inspections	C CECO	SM	ECO	EA EM PM
Construction Phase								
1	Construction execution	The Contractor shall under no circumstances interfere with the property of adjacent landowners. If water is required, the Contractor shall negotiate with the relevant Landowner and a written agreement shall be drawn up	Throughout project	Weekly Inspections	C CECO	SM	ECO	EA EM PM

		(TRMSCAAC1 REV 3 section 4.8).							
Rehabilitation Phase									
1	Rehabilitation execution	Same as construction phase.							
Operational Phase									
1	Maintenance of the power line	Same as construction phase.							

12.12 General Requirements during Construction

- Proper and continuous liaison between Eskom, the contractor and Landowners to ensure everyone is informed at all times.
- A physical access plan shall be compiled and the contractor shall adhere to this plan at all times. Proper planning when the physical access plan is drawn up by the Environmental Control Officer in conjunction with the Contractor shall be necessary to ensure access to all construction areas within the route corridor parameter.
- The adjacent landowners shall be informed of the starting date of construction as well as the phases in which the construction shall take place.
- The Contractor must adhere to all conditions of contract, including the Environmental Management Plan.
- Proper planning of the construction process to allow for disruptions due to rain and very wet conditions.
- Where existing private roads are in a bad state of repair, such roads' condition shall be documented before they are used for construction purposes. If necessary, some repairs should be done to prevent damage to equipment and plant.
- All manmade structures shall be protected against damage at all times and any damage shall be rectified immediately.
- Proper site management and regular monitoring of site works.
- Proper documentation and record keeping of all complaints and actions taken.
- Regular site inspections and good control over the construction process throughout the construction period.
- Appointment of an Environmental Control Officer on behalf of the Contractor to implement this EMProg as well as deal with all Landowner related matters.
- Environmental Audits to be carried out during and upon completion of construction (at least three for the project).
- The Contractor shall not be released from site until all Landowners have signed off the release documentation to the satisfaction of the Eskom Environmental Control Officer.

12.13 Scheduling of Management Measures

The construction programme, showing the upfront management measures, and regular audit schedule is represented in Table 12-23. It should be noted that the majority of the management measures are incident and control based. Therefore they will not occur in a management schedule but will rather occur in day to day operations. Where such measures occur these will be inspected during the audit activities provided for in the schedule.

12.14 Site Documentation / Monitoring / Reporting

The standard Eskom site documentation shall be used to keep records on site, in addition all non-compliances to the environmental authorisation will be reported to the Director: Environmental Impact Evaluation within 48 hours. All documents shall be kept on site and be available for monitoring and auditing purposes. Site inspections by an Environmental Audit Team may require access to this documentation for auditing purposes. The documentation shall be signed by all parties to ensure that such documents are legitimate. Regular monitoring of all site works by the Environmental Control Officer is imperative to ensure that all problems encountered are solved punctually and amicably. When the Environmental Control Officer is not available, the Contract Manager/Site Supervisor shall keep abreast of all works to ensure no problems arise. The following checklist shall be used as an environmental performance monitoring tool.

Table 12-23: Checklist for monitoring environmental performance on site.

Person responsible for this deviation is:
Name:
Designation:
Reporting of environmental performance, problems and priorities are as follows:

Environmental monitoring of the deviation is according to the following schedule:

The following negative environmental impacts have been identified at the site:

Environmental Problem	Location

In order to solve (mitigate) the above identified negative environmental impacts, the following plan of action is to be implemented:

Problem	Solution	Date to be Completed

12.15 Environmental Contact Persons

- Lucia Chauke (Senior Environmental Advisor – Eskom Transmission)

Tel: 011 800 4427

12.16 Emergency Numbers

- Eskom Control 0800 037566
- Police 10111

12.17 Oil Spill Contact Numbers

To be provided

13 CONCLUSION AND WAY FORWARD

Eskom appointed Zitholele Consulting to undertake the EIA for the proposed Camden-Mbewu (Theta) 765kV power line. This Impact Assessment study has been undertaken with the aim of investigating potential impacts both positive and negative on the biophysical and social environment and identifying issues, concerns and queries from I&APs.

13.1 Impact summary

The environmental impacts for each of the components for the proposed power line route alternatives have been summarised in Section 12. The following broad conclusions can be drawn from the impact assessment.

- Sections of the current baseline environment in the study area are highly impacted by existing agricultural activities in the area, such as Flora and Soils;
- The sensitive biophysical environmental features along the various alternatives include endangered vegetation, animals, wetlands and surface water bodies;
- Sensitive socio-economic features include the tourism industry around Wakkerstroom and Utrecht, the plantations near Piet Retief and Paul Pietersburg, the sugar cane plantations near Empangeni and the traditional rural settlements in the KZN tribal lands;
- During the Construction Phase the impacts will range from LOW to HIGH. The most significant impacts will be to Flora, Avi-fauna; Social and Economics. Mitigation measures employed will adequately reduce the significance of impacts that may be sustained by the construction activities.
- During the operational phase negative impacts sustained will be in the LOW to MODERATE range. The most significant impact will be to Avi-fauna, Surface Water, and Visual. The economic impacts from the development will be a HIGH positive impact.
- Cumulative negative impacts to the physical environment are nominal, and with proper mitigation it is possible to minimise impacts.

13.2 Environmental assessment practitioner opinion on preferred alternative

As discussed in this report the three main route alternatives have various potential impacts but when considering all the biophysical and socio-economic criteria discussed in this report, Alternative 1 is the preferred alternative as summarised in Section 11.

The EAP has no objection with the construction and operation of the 765kV Camden-Mbewu power line by means of the Alternative 1 alignment, provided that the Environmental Management Plan and the associated mitigation measures are implemented throughout construction and operation of the power line.

The way forward recommended by this study is as follows:

- This Draft EIAR will be on public review from 6th May 2011 to 17th June 2011. I&APs are being encouraged to forward any comments and issues on to the Zitholele public participation team.
- Once comments have been received they will be captured in Version 3 of the Issues and Response Report (CRR) and incorporated into the Final EIAR;
- The Final EIAR and EMProg will be submitted to the Department of Environmental Affairs (DEA) for approval;
- Once the DEA has reached a decision, an Environmental Authorisation will be issued;
- Upon receipt of the Environmental Authorisation, Zitholele will notify all I&APs on the stakeholder database of the DEA's decision by means of advertisements and letters;
- The Eskom negotiation process with affected stakeholders will then commence.

End

