Self-supporting tower (**Figure 30**);

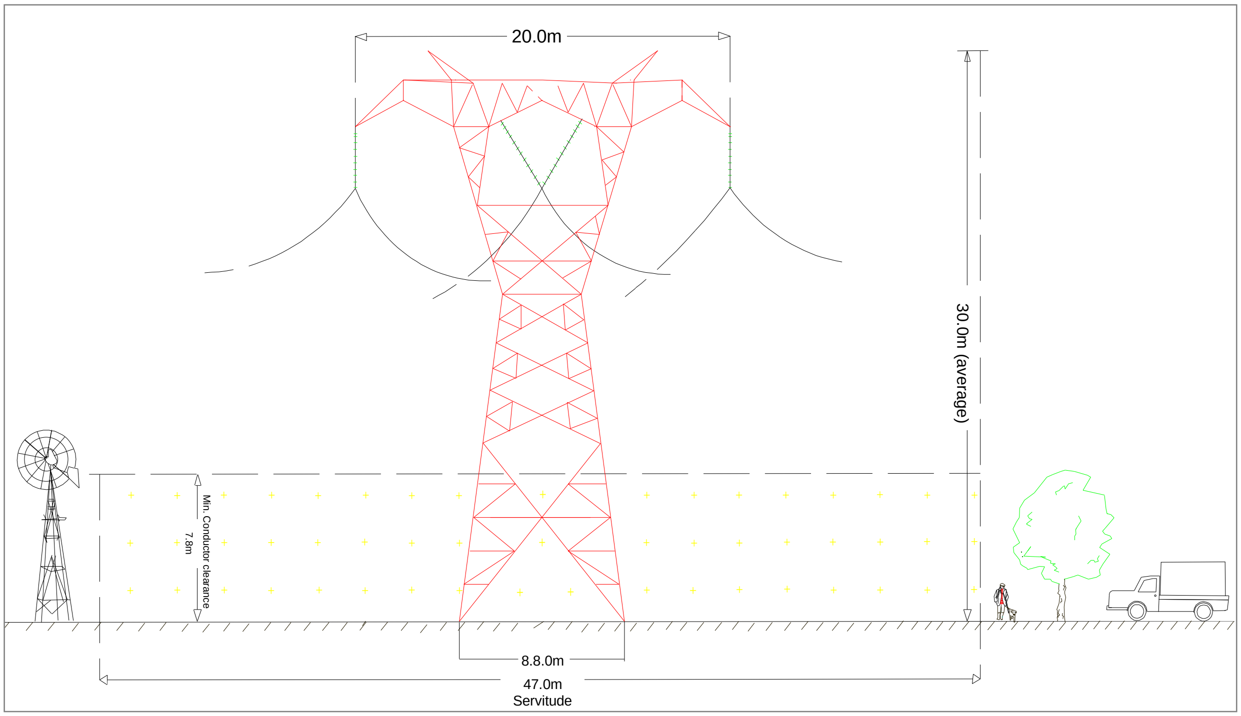

Figure 30: Self-supporting tower

- Guyed suspension tower (**Figure 31**); and

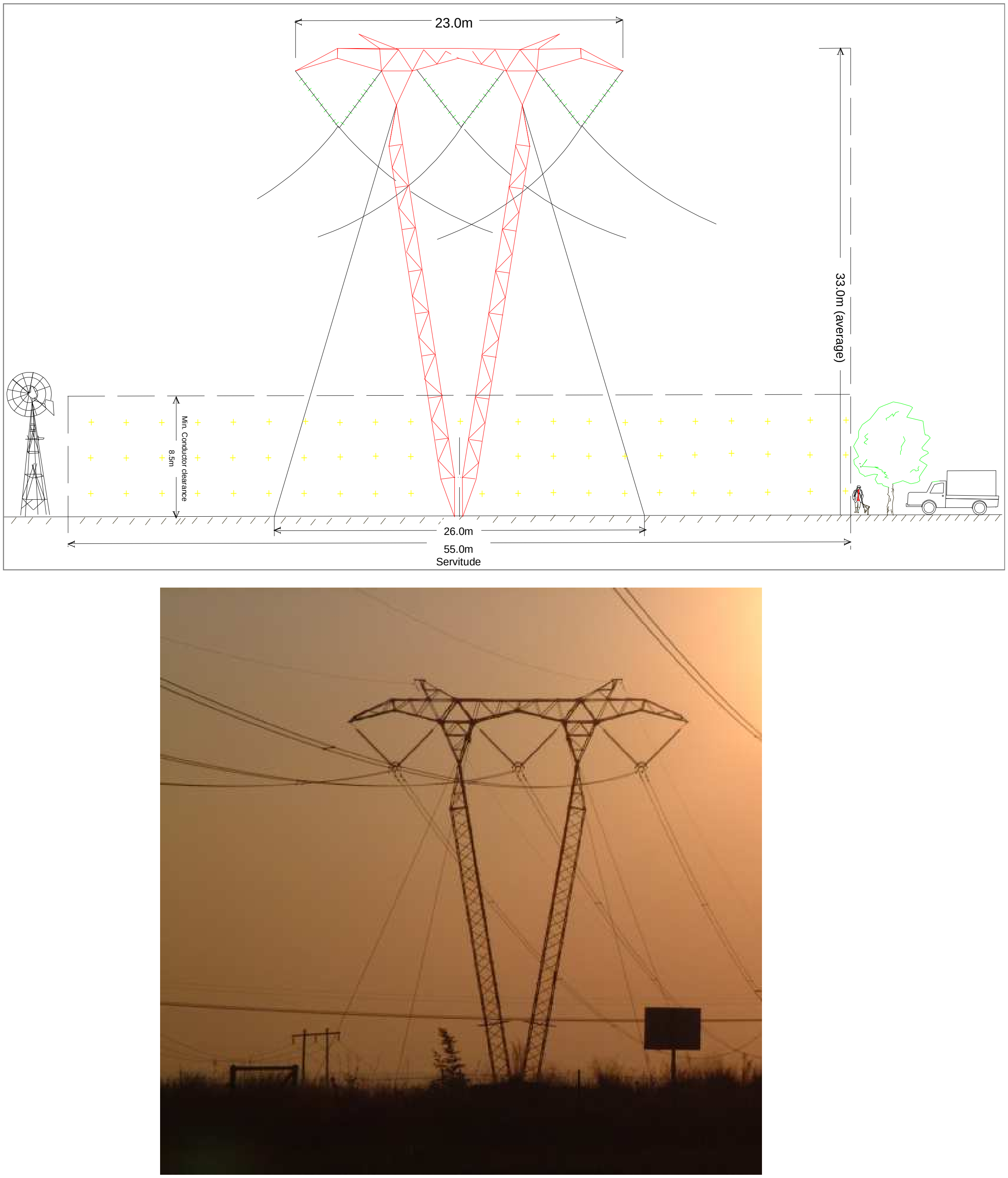

Figure 31: Guyed suspension tower

Strain or bend towers, which will be required at points where the line deviates at an angle of greater than 3 degrees or on difficult terrain.

8.6 Substations

An electrical substation is a subsidiary station of an electrical generation, transmission and distribution system where voltage is transformed from high to low (or the reverse) for distribution to users (e.g. domestic, commercial).

8.6.1 Dinaledi Substation

The Dinaledi Substation (see **Figures 32**) is situated approximately 8 km north east of Brits, on Portion 843 of the Farm Roodekopjes of Zwartkopjes 427 JQ. The substation is surrounded by vacant land and the small rural village of Rankotia lies approximately 350 m to the north-east.

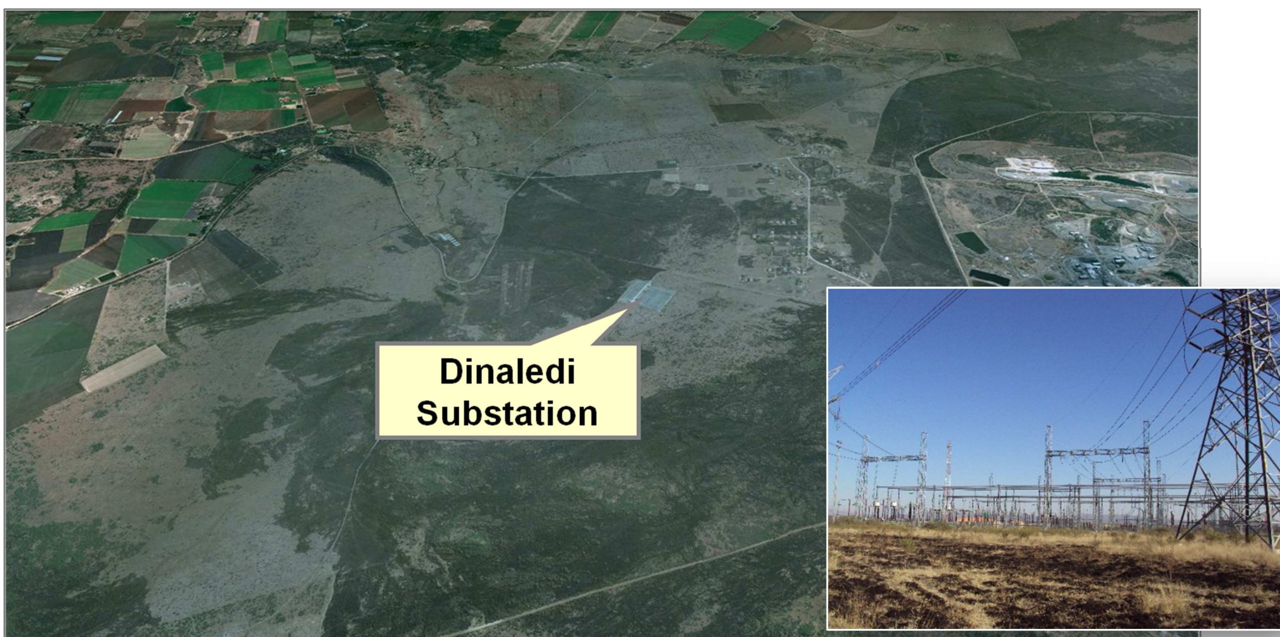

Figure 32: Dinaledi Substation (feeder bays shown in inserted photograph)

In order to accommodate the new Anderson-Dinaledi 400kV power line, two 400kV feeder bays need to be constructed at the Dinaledi Substation. The proposed civil works will be undertaken within the existing terrace and no earthworks are anticipated. The safety fences will be modified to enclose the new 400kV yard extension. Existing roads will be utilised. The storm water drainage system will be extended to accommodate the expansion. Operational lighting will be provided for the new 400kV yard extension.

8.6.2 Anderson Substation

The Anderson-Dinaledi 400kV power line will terminate at the proposed Anderson Substation. The proposed Anderson substation will be on Portions 82, 83 and 76 of Farms Schurveberg 488 JQ.

8.7 Project Life-cycle

The entire life cycle for a new transmission line includes the following primary phases:

- Feasibility phase - This includes selecting a suitable corridor for the route of the proposed transmission line following the execution of an EIA process. Servitude negotiations are also initiated during this phase.
- Planning and design phase - This phase, which is only undertaken should environmental authorisation be obtained, includes the following –
  - Aerial survey of the route;
  - Selection of the most appropriate structures;
  - Eskom and environmental specialists (e.g. ecologist, heritage) conduct a walk-down survey to determine the exact locations of the towers, based on sensitive environmental features and technical criteria.
  - Preparation of relevant planning documentation, including technical and design documentation.
- Construction phase – During the implementation of the project, the construction activities related to the installation of the necessary infrastructure and equipment is undertaken.
- Operational phase - This includes operational activities associated with the maintenance and control of the transmission line.
- Decommissioning - This phase will include measures for complying with regulatory requirements, rehabilitation and managing environmental impacts in order to render the affected area suitable for future desirable use.

The sub-sections to follow provide an overview of key activities during selected phases of the project life-cycle.

8.7.1 Construction

The construction period of the Anderson-Dinaledi transmission line will take approximately 24 months. It involves the following activities, which are most often undertaken sequentially and by different construction crews.

8.7.1.1 Vegetation Clearance

An 8 m-wide strip is generally required to be cleared of all trees and shrubs down the centre of a transmission power line servitude for stringing purposes only (see example in **Figure 33**). Any tree or shrub in other areas that will interfere with the operation and/or reliability of the transmission power line must be trimmed or completely cleared.

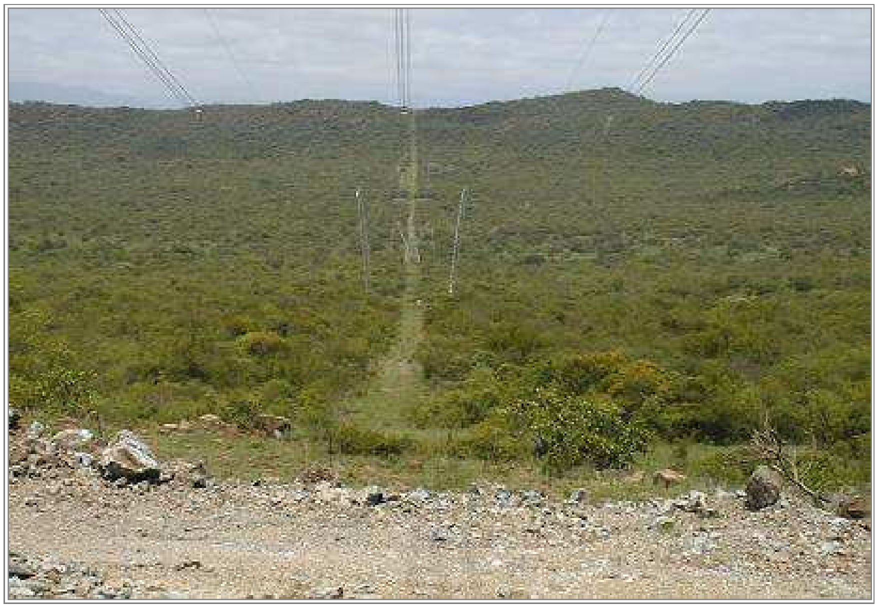

Figure 33: Vegetation clearance for stringing

The clearing of vegetation will take place in accordance with Eskom's minimum standards for the construction of new Transmission power lines, as listed below in **Table 12**.

Table 15: Minimum standards for vegetation clearing for new Transmission power line

Item	Standard	Follow up
Centre line of the proposed Transmission power line	Clear to a maximum (depending on tower type and voltage) of a 4-8 m wide strip of all vegetation along the centre line. Vegetation to be cut flush with the ground. Treat stumps with herbicide.	Re-growth shall be cut within 100 mm of the ground and treated with herbicide, as necessary.
Inaccessible valleys (trace line)	Clear a 1 m strip for access by foot only, for the pulling of a pilot wire by hand.	Vegetation not to be disturbed after initial clearing – vegetation to be allowed to regrow.
Access/service roads	Clear a maximum (depending on tower type) 6 m wide strip for vehicle access within the maximum 8 m width, including de-stumping/cutting stumps to ground	Re-growth to be cut at ground level and treated with herbicide as necessary.

	level, treating with a herbicide and re-compaction of soil.	
Proposed tower position and proposed support/stay wire position	Clear all vegetation within proposed tower position in an area of 20 x 20 m (self-supporting towers) and 40 x 40 m (compact cross-rope suspension towers) around the position, including de-stumping/cutting stumps to ground level, treating with a herbicide and re-compaction of soil. Allow controlled agricultural practices, where feasible.	Re-growth to be cut at ground level and treated with herbicide as necessary.
Indigenous vegetation within servitude area (outside of maximum 8 m strip)	Area outside of the maximum 8 m strip and within the servitude area, selective trimming or cutting down of those identified plants posing a threat to the integrity of the proposed Transmission power line.	Selective trimming
Alien species within servitude area (outside of maximum 8 m strip)	Area outside of the maximum 8 m strip and within the servitude area, remove all vegetation within servitude area and treat with appropriate herbicide.	Cut and treat with appropriate herbicide.

8.7.1.2 Tower pegging

Following the necessary access negotiations and arrangements with the affected landowners, a surveyor will pegs the central line and then set out the footprint of the development (i.e. transmission line and towers).

Through continual vehicular use, the surveying team will make the first basic track (access route) during their site work. If any flaws with a site are encountered (e.g. gully erosion) the site may need to be relocated.

8.7.1.3 Construction camp establishment

Note that the locations of the construction camps were not yet known during the preparation of the EIA Report, although it is anticipated that they will be located within the transmission line corridor investigated during the EIA. Contractors will negotiate the siting and erection of camps with landowners. These sites must strictly adhere to Eskom Transmission's 'Generic Environmental Management Plan – Line Construction'. In addition, the EMPr provides suitable mitigation measures to safeguard the environment from impacts associated with the construction camps.

The constructions camp is expected to be approximately 50m X 50m in size. The following areas / tasks may occur within a construction camp:

- Fuel storage and re-fuelling areas;
- Workshops and offices;

- Laydown areas;
- Portable ablution facilities and / or wash areas;
- Designated eating areas;
- Accommodation facilities for contractors;
- Security guardhouse / checkpoint;
- Hazardous chemical store;
- Vehicle, plant, equipment and material storage areas;
- Cement mixing areas; and
- Any other infrastructure required for the construction of the substation.

See **Figure 34** for examples of construction camps for Eskom transmission lines**.**

Figure 34: Examples of Construction camps

8.7.1.4 <u>Gate installation</u>

After tower pegging, gates will be installed at the most appropriate locations to allow for future access to the servitude. An example of an access gate for a 400 kV transmission line is shown in **Figure 35**.

Figure 35: Access gate for an Eskom transmission line

8.7.1.5 Access roads

Existing access roads will be utilised as far as possible. For the use of private roads, the requisite negotiations will be conducted with the affected landowners.
35). These roads will be constructed to a Type 6 gravel road that comprises the following:

- Widening to a final gravel carriageway width of 6 m on raised earthworks;
- Drainage is to be provided in the form of meadow drains (flat terrain) and "v" drains (steeper terrain). Some new culverts may be required;
- Fencing will be erected where required;
- The total width of carriageway and drainage ranges between about 14 m (flat terrain) and 16 m (rolling terrain); and
- Gravel will be obtained from the nearest existing borrow pit.

Suitable erosion control measures will be implemented at watercourse crossings. Examples include the construction of gabion structures to protect the watercourse (see **Figure 36**). Stormwater management measures will also be considered on steep gradients.

Figure 36: Access roads

At this stage it is not possible to identify which access roads will be affected by the project. However, the walk-down survey will identify sensitive environmental features that need to be avoided when creating these new roads and the final site specific EMPr will address the associated impacts.

8.7.1.6 Excavation for foundations

Excavations will be made for the foundations and anchors of the towers by a team of 10 to 15 people with equipment (i.e. drilling rig, generator) (see **Figure 37**). Foundation sizes are dependent on *inter alia* the tower type and soil conditions. For example, the minimum working area required for the erection of a self-supporting strain tower is 40 m by 40 m, and for a cross-rope suspension tower is 50 m by 50 m. The foundations are ultimately filled with concrete.

Contractors are required to safeguard excavations, which may include erecting a temporary wire fence around the excavations to protect the safety of people and animals.

Figure 37: Drilling rig and generator (top) and excavation activities (bottom)

8.7.1.7 Foundation of steelwork

Following the preparation of the excavations, a separate team will position the premade foundation structures into the holes. Thereafter these structures will be tied together for support (see **Figure 38**).

Figure 38: Foundation work

8.7.1.8 Concrete works

A new team will then undertake the concrete filling of the foundation. Concrete is sourced via a 'Ready-mix' truck which accesses the site. If the access roads do not permit use by such a heavy vehicle, concrete will be mixed on site. Once the excavations have been filled, the concrete requires approximately 28 days for curing.

8.7.1.9 Erection of steel structures

Approximately 1 month after the foundation has been poured the steelwork is usually delivered to the site via trucks. The tower will then be assembled on site by a team of approximately 50 people. See examples of steel delivery and assembly shown in **Figure 39**.

Figure 39: Delivery of steel (top) and assembly of tower (bottom)

A new team will then be responsible for the erection of the towers, with the use of a mobile 70-ton crane (see **Figure 40**).

Figure 40: Erection of towers

8.7.1.10 __Stringing of transmission cables__

Cable drums (see **Figure 41**), which carry approximately 2.5 km of cable, will then be delivered to the site. The conductors are made of aluminium with a steel core for strength. Power transfer is determined by the area of aluminium in the conductors. Conductors are used singularly, in pairs, or in bundles of three, four or six. The choice is determined by factors such as audible noise, corona, and electromagnetic field (EMF) mitigation. Many sizes of conductor are available, the choice being based on the initial and life-cycle costs of different combinations of size and bundles, as well as the required load to be transmitted.

Figure 41: Cable drums

Two cable drums, with a winch in the middle, are placed approximately 5 km apart along the route. A pilot cable, which is laid with a pilot tractor that drives along the route, is pulled up on to the pylons with the use of pulleys (see **Figure 42**). The line is generally strung in sections (from bend to bend). Once the tension has been exacted, the conductor cables are strung.

In mountainous regions, the pilot cables are flown in by helicopter or shot across valleys, to create the correct tension to pull through the conductor.

Tension is created, the conductors clamped at the tower and the excess cable cut off.

Figure 42: Stringing with pilot tractor (top) and pulleys (bottom)

8.7.1.11 Rehabilitation

Site reinstatement and rehabilitation are undertaken for each component of the construction phase, which include the following activities (amongst others):

- Removal of excess building material, spoil material and waste;
- Repairing any damage caused as part of the construction activities;
- Rehabilitating the areas affected by temporary access roads;
- Reinstating existing access roads; and
- Replacing topsoil and planting indigenous grass (where necessary).

8.7.1.12 Inaccessible Sites or Sensitive Areas

For a site that cannot be accessed by vehicle (e.g. kloofs) or where environmental sensitive features are encountered, the following approach is followed:

- Excavations for foundations are done by hand;
- Foundation structures, concrete filling and steel towers (pre-fabricated) are transported and delivered by helicopter; and
- Stringing is performed by helicopter.

This abovementioned approach is an expensive operation and not the preferred method of construction.

8.7.2 Operation and Maintenance

During operations, Eskom Transmission needs to reach the servitude via access roads to perform maintenance of the transmission line. Line inspections are undertaken on an average of 1 – 2 times per year, depending on the area.

Figure 43: Example of an access road used for maintenance

The servitude will need to be cleared occasionally to ensure that vegetation does not interfere with the operation of the line. This will be conducted in terms of Eskom's Transmission Vegetation Management Guideline, which will be included in the Environmental Management Programme (EMPr).

8.7.3 Decommissioning

GN No. R544 defines "decommissioning" as taking out of active service permanently or dismantling partly or wholly, or closure of a facility to the extent that it cannot be readily re-commissioned. Note that under the aforementioned notice, which represents Listing Notice 1 of the EIA Regulations (2010), the decommissioning of existing facilities or infrastructure for electricity transmission and distribution with a threshold of more than 132kV (which applies to this project) would need to undergo a Basic Assessment to seek authorisation in terms of NEMA.

Decommissioning of the Anderson-Dinaledi transmission line is not anticipated. However, should this be required in the future a decommissioning plan with suitable mitigation measures will need to be developed, including provision for the dismantling of the towers and the disposal or recycling of the material. This plan will also require a site-specific rehabilitation plan for the footprint of the project. All regulatory requirements will need to be complied with for the decommissioning phase.

8.8 Resources Required for Construction and Operation

This section briefly outlines the resources that will be required to execute the project.

8.8.1 <u>Water</u>

During the construction stage, the Contractor(s) will require water for potable use by construction workers and water will also be used in the construction of the foundations for the towers. The necessary negotiations will be undertaken with the landowners / local authorities that are traversed by the transmission line to obtain water from approved sources.

8.8.2 <u>Sanitation</u>

Sanitation services will be required for construction workers in the form of chemical toilets, which will be serviced at regular intervals by the supplier.

8.8.3 <u>Roads</u>

Refer to **Section 8.7.1.5** for a discussion on access roads.

8.8.4 <u>Waste</u>

Solid waste generated during the construction phase will be temporarily stored at suitable locations (e.g. at construction camps) and will be removed at regular intervals and disposed of at approved waste disposal sites within each of the local municipalities that are affected by the project. All the waste disposed of will be recorded.

Wastewater, which refers to any water adversely affected in quality through construction-related activities and human influence, will include the following:

- Sewage;
- Water used for washing purposes (e.g. equipment, staff); and
- Drainage over contaminated areas (e.g. cement batching / mixing areas, workshop, equipment storage areas).

Suitable measures will be implemented to manage all wastewater generated during the construction period.

8.8.5 <u>Electricity</u>

Electricity will be obtained from diesel generators or temporary electricity connections during the construction phase.

8.8.6 Construction Workers

It is anticipated that when construction activities are at it's peak, which is when the civil related construction activities are being undertaken, there should not be more than approximately 80 people on the site at any time. Employment will be effected either directly with the main contractor, or through sub-contractors. The appointed Contractor will mostly make use of skilled labour to install the power line. In those instances where casual labour is required, Eskom will request that such persons are sourced from local communities as far as possible. Apart from direct employment, local people and businesses will benefit through the supply of goods and services to the appointed contractors.

9 PROFILE OF THE RECEIVING ENVIRONMENT

The sub-sections below provide a general description of the status quo of the receiving environment in the project area. This serves to provide the context within which the EIA was conducted. The study area included a 1 km wide corridor for each of the alternative routes.

The profile of the receiving environment to follow also provides local and site-specific discussions on those environmental features investigated by the respective specialists. The reader is referred to **Section 12** for more elaborate explanations of the specialist studies and their findings.

This section allows for an appreciation of sensitive environmental features and possible receptors of the effects of the proposed project. The potential impacts to the receiving environment are discussed further in **Section 11**.

9.1 Geology

The geotechnical conditions are of particular importance for establishing the appropriate sites for the tower foundations. A general description of the geological conditions in the project area is provided below. The vegetation cover found within the 1km study corridors of the three powerline alternatives are provided in the table below **(Table 16 and figure 44)**. A description of the geology found within areas where these vegetation types occur are also provided in this table. The details provided in this table are based on the SANBI data.

Table 16: Vegetation Cover and Associated Geology

Vegetation Type	Geology Description
Andesite Mountain Bushveld	In terms of the SANBI data the area predominately consist of tholeitic basalt of the Klipriviersberg Group (Randian Ventersdorp Supergroup), also dark shale, micaceous sandstone and siltstone and thin coal seems of the Madzaringwe Formation [Karoo Supergroup, and andesite and conglomerate of the Pretoria Group (Vaalian Transvaal Supergroup)].
Gauteng Shale Mountain Bushveld	In terms of the SANBI data the area is dominated by shale and some coarser clastic sediments as well as significant andesite from the Pretoria Group (Transvaal Supergroup), all sedimentary rocks. A part of the area is underlain by Malmani dolomites of the Chuniespoort Group (Transvaal Supergroup). (Although dolomite is found in areas where this vegetation type occurs, no dolomite is found within the specific 1km study corridors of

Vegetation Type	Geology Description
	the alternative proposed powerline routes in terms of the Environmental Potential Atlas Data).
Gold Reef Mountain Bushveld	In terms of the SANBI data the area predominately consist of quartzites, conglomerates and some shale horizons of the Magaliesberg, Daspoort and Silverton Formations (Vaalian Pretoria Group), and the Hospital Hill, Turfontein and Government Subgroups (Randian Witwatersrand Supergroup).
Marikana Thornveld	In terms of the SANBI data most of the area is underlain by the mafic intrusive rocks of the Rustenburg Layered Suit of the Bushveld Igneous Complex. Rocks found in the area include gabbro, norite, pyroxenite and anorthosite. Shales and quartzites of the Pretoria Group (Transvaal Supergroup) also occurs on the area.
Moot Plains Bushveld	In terms of the SANBI data most of the area is underlain by clastic sediments and minor carbonatesand volcanic of the Pretoria Group (including the Silverton Formation) and some Malmani dolomites in the west of South Africa, all of the Transvaal Supergroup (Vaalian). Mafic Bushveld intrusive are also found.
Norite Koppies Bushveld	In terms of the SANBI data most of the area is mostly underlain by gabbro and norite with interlayered anorthosite of the Pyramid Gabbro-Norite, Rustenbrug Layered Suite, with a small area of the Rashoop Granophyre Suite (felsic igneous rocks), both of the Bushveld Complex (Vaalian). Large rock boulders and very shallow lithosols occur.

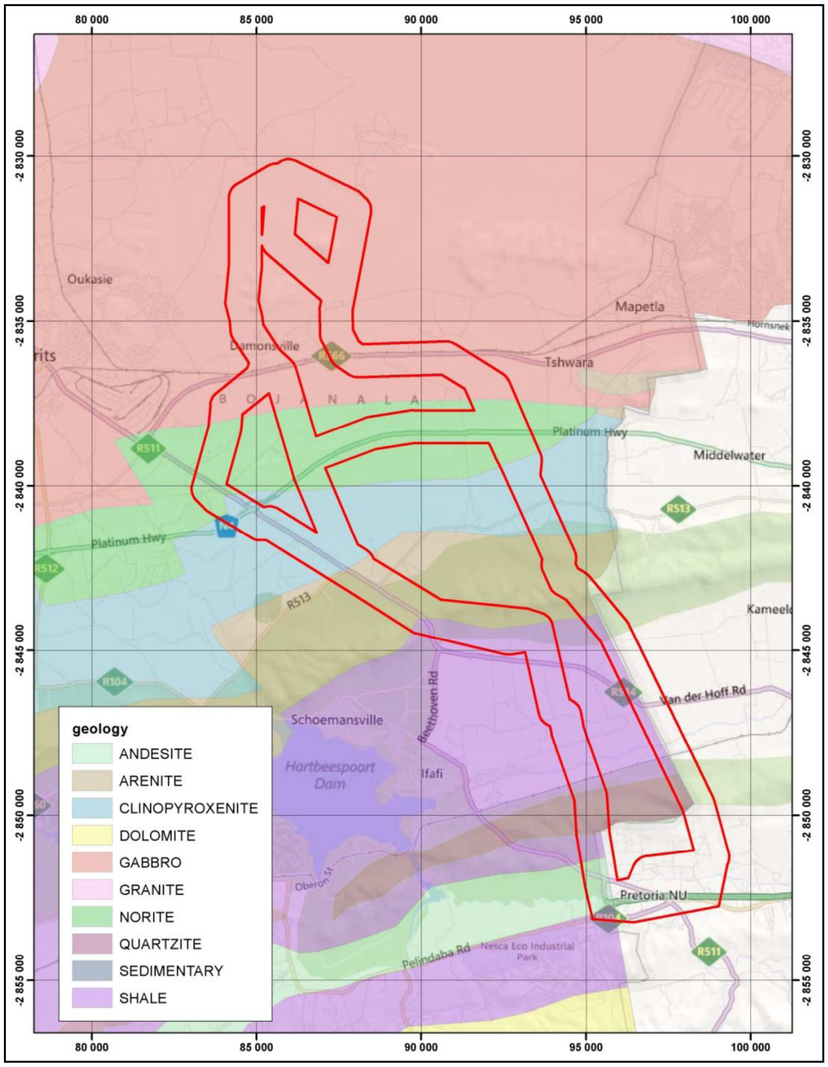

Figure 44: Map showing the geology within the proposed site

The proposed activity will be affected by the underlying geology of the area. As mentioned above the geological conditions of the site are of particular importance for establishing the appropriate sites for the tower foundations. Upon receipt of the EA and approval of a specific route by the DEA, a detailed geotechnical assessment will be undertaken to determin the exact locations of the tower site within the preferred route.

9.2 Topography

The North West Province has one of the most uniform terrains of all South African Provinces with altitudes ranging from between 920-1782 metres above mean sea level (mamsl). The eastern part of the province is mountainous and includes the scenic Magaliesberg, while the western and central parts of the province is characterised by gently undulating plains. The surface topography of the area within the Gauteng Province which the proposed eastern route alternative will traverse is described as a rugged landscape with hills and slopes of the Magaliesberg and the Witwatersberg. Approximately 20 ridges occur in the Tshwane (Pretoria) area, of which the most sensitive ridges include the Bronberge, The Magaliesberg, Daspoort, Meintjieskop, Tuine Bult Koppies and the Witwatersberg.

The proposed alternative powerline routes and associated 1km study area traverses the Magaliesberg as well as the Witwatersberg. In terms of the South African National Biodiversity Institute (SANBI) data, the vegetation cover in the study area is comprised of Andesite Mountain Bushveld, Gauteng Shale Mountain Bushveld, Gold Reef Mountain Bushveld, Marikana Thornveld, Moot Plains Bushveld, and Norite Koppies Bushveld. The landscape character associated with each of these vegetation types are tabled below **(Table 17)**:

Table 17: Vegetation Types and Associated Topography

Vegetation Type	Associated Landscape Character
Andesite Mountain Bushveld	Undulating landscape with hills and valleys.
Gauteng Shale Mountain Bushveld	Low broken ridges varying in steepness with high surface rock cover.
Gold Reef Mountain Bushveld	Rocky hills and ridges often west-east trending.
Marikana Thornveld	Valleys and slightly undulating plains with some low hills.
Moot Plains Bushveld	Plains and some low hills.
Norite Koppies Bushveld	Plains, koppies and noritic outcrops.

<u>Ridges (Phampe, 2012)</u>

The majority of the proposed transmission alternative routes incorporate an area that forms part of the Magaliesberg rocky ridge system that runs roughly in an east-west direction. The quartzite ridges of Gauteng are one of the most important natural assets in the northern provinces of South Africa. These ridges support a wide diversity of fauna and flora species, some of which are on the Red Data List, rare or endemic. Various other important ecological functions are fulfilled by ridges, particularly important is the recharging of groundwater. Wetlands and rivers along the ridges act as migratory corridors for mobile faunal species and provide essential habitat for pollinators. The ridges also provide a socio-cultural function in that they provide aesthetically pleasing environments that are valued by residents, tourists and recreational users (Pfab, 2001 cited in Phampe 2012).

Ridges are specialized by high spatial heterogeneity due to the range of differing aspects (north, south, east, west and variations thereof), slopes and altitudes resulting in differing soil characteristics (e.g. depth, moisture, temperature, drainage, nutrient content), light and hydrological conditions

(Samways & Hatton, 2000 cited in Phampe 2012). Moist cool aspects are more conducive to leaching of nutrients than warmer drier slopes (Lowrey & Wright, 1987 cited in Phampe 2012). Variations in aspect, soil drainage (Burnett *et al*., 1998 cited in Phampe 2012) and elevation/altitude (Primack, 1995 cited in Phampe 2012) have been found to be especially important predictors of biodiversity. All ridges in Gauteng have been classified into four classes (**Table 1 of the fauna and flora report – Appendix D1**) based on the percentage of the ridge that has been transformed (mainly through urbanization) using the 1994 CSIR/ARC Landcover data. The study area falls within Class 2 (Table 18) of the Gauteng ridges (Gauteng C-Plan 3.3), as indicated in **Figure 45.**

Table 18: Class 2 of the four classes of ridges in Gauteng Province and the percentage of transformation

Ridge type	% of Gauteng ridges	Policy
Class 2 (5-35% transformed) includes parts of Magaliesberg, World Heritage site, Klipriviersberg, Bronberg, Skurweberg	28%	(a) The consolidation of properties on Class 2 ridges is supported. (b) The subdivision of property on Class 2 ridges will not be permitted. Development activities and uses that have a high environmental impact on a Class 2 ridge will not be permitted. (d) Low impact development activities, such as tourism facilities, which comprise of an ecological footprint of 5% or less of the property, may be permitted. (The ecological footprint includes all areas directly impacted on by a development activity, including all paved surfaces, landscaping, and property access and service provision). (e) Low impact development activities on a ridge will not be supported where it is feasible to undertake the development on a portion of the property abutting the ridge.

Figure 45: Gauteng Ridges in relation to the proposed transmission line

According to the North West Department of Agriculture, Conservation, Environment and Rural Development (2009), hills and ridges are identified as sensitive habitats in the existing provincial Spatial Development Framework dataset. Class 2 ridges fall within the Dinaledi transmission line route alternatives as indicated in **Figure 46**.

Figure 46: North West hills and ridges (in blue) in relation to the proposed transmission line

The majority of the study area is considered to have a moderate landscape character sensitivity due to the relative undeveloped and high topographic variation of the landscape. High terrain variability occurs through most of the study area where a moderate VAC can be expected. Generally the vegetation varies from medium to low shrubs and trees covers which will provide visual screening for the proposed transmission line. As such, the landscape type, through which the transmission line crosses, can mitigate the severity of visual impact through topographical or vegetative screening.

9.3 Climate

9.3.1 Temperature

There are wide seasonal and daily variations in temperature in the North West Province. The summers are warm to very hot with average daily maximum temperatures of 32 ºC in January.

The winter days are sunny and temperate while the winter nights are cool to cold, with average daily minimum temperatures of 0.9 ºC in July. The far western part of the province is arid, with the central part of the province being semi-arid, and the eastern part of the province being predominantly temperate.

Although Gauteng is quite close to the equator, the temperatures are moderate because of the high altitude above sea level. The Tshwane are experiences average daily maximum temperate of 30°C during summer (January), and average daily maximum temperatures of 18.3°C during winter (June). The Tshwane region is the coldest during July when the mercury drops to 1.7°C on average during the night.

9.3.2 ***Precipitation***

The North West Province falls within a summer rainfall region, and rainfall often occurs in the form of late afternoon thundershowers. Rainfall in the province is highly variable both regionally and in time. The western part of the province which is classified as being arid receives less than 300mm of rain per annum, while the central semi-arid region receives 500mm of rain per annum. The eastern and south-eastern temperate part of the region receives over 600mm of rain per annum. Droughts and floods is a regular occurrence at a provincial and local scale. In most parts of the province, evaporation exceeds rainfall.

The Gauteng Province also falls within a summer rainfall region, and rainfall in this province occurs in the form of thunderstorms in the late afternoons from November to March. The average rainfall in the Tshwane area is 573-650mm per annum, with most rainfall occurring during summer. Rainfall in the Tshwane area is lowest during June (0mm) and highest in January (110mm).

9.3.3 ***Wind***

The predominant wind direction in the Tshwane area is north-northeast. Historical wind speed and wind direction information for the Tshwane area was obtained from "MyForecast". The annual average wind speed and direction of the area is tabled below.

Table 19: Average Wind Speed and Direction for the Pretoria (Tshwane Area)

Tshwane (Pretoria)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Average Windspeed (mph)	6	6	6	6	6	6	7	8	8	7	6	6
Average Wind Direction	NE	E	E	W	w	W	W	W	NE	NE	NE	NE

Historical wind data for the Hartbeespoort Dam area was obtained from Weather SA. Weather SA indicated that this wind information is the only available information for the study area. A wind rose is provided in Figure 47 which shows the average wind speed and direction in the Hartbeespoort Dam area from November 2009 to October 2010.

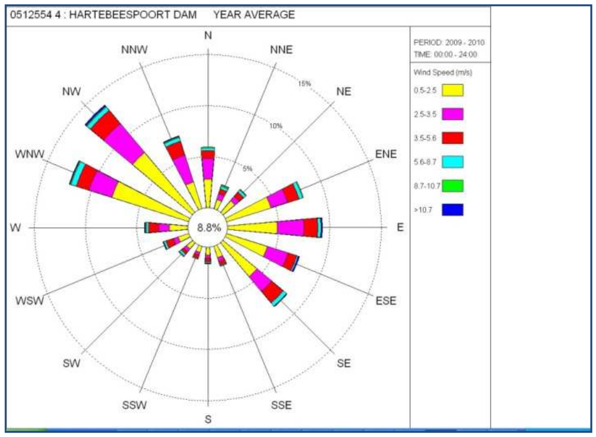

Figure 47: Wind Rose for Hartbeespoort Dam (November 2009-October 2010)

The predominant wind direction for this period as indicated on the wind rose is north-west and west-northwest. The average wind speed for this period was between 0.5-2.5m/s.

9.4 Soil and Land Capability

According to the North West Province State of the Environment Report the province in general is showing signs of increased land and soil degradation. Signs of degradation and desertification can be seen in all magisterial districts. The areas most severely affected are those areas that are communally managed. In terms of soil and land degradation, the province is ranked as the forth worst affected province in South Africa. Soil and land degradation in the province has numerous negative consequences for agriculture in the area, such as decreased productivity of the croplands. Water and wind erosion is the major contributors to soil degradation in the province.

In terms of the Gauteng State of the Environment Report, the Gauteng Province where ranked as the second least degraded province in South Africa. Gauteng has the lowest veld degradation index in South Africa (31 on a scale of 0-540) and the fourth lowest soil degradation index (113 on a scale of –97 to 650).

The map below indicates the dominant soils found within the proposed site as identified in the agricultural assessment (Index, 2012):

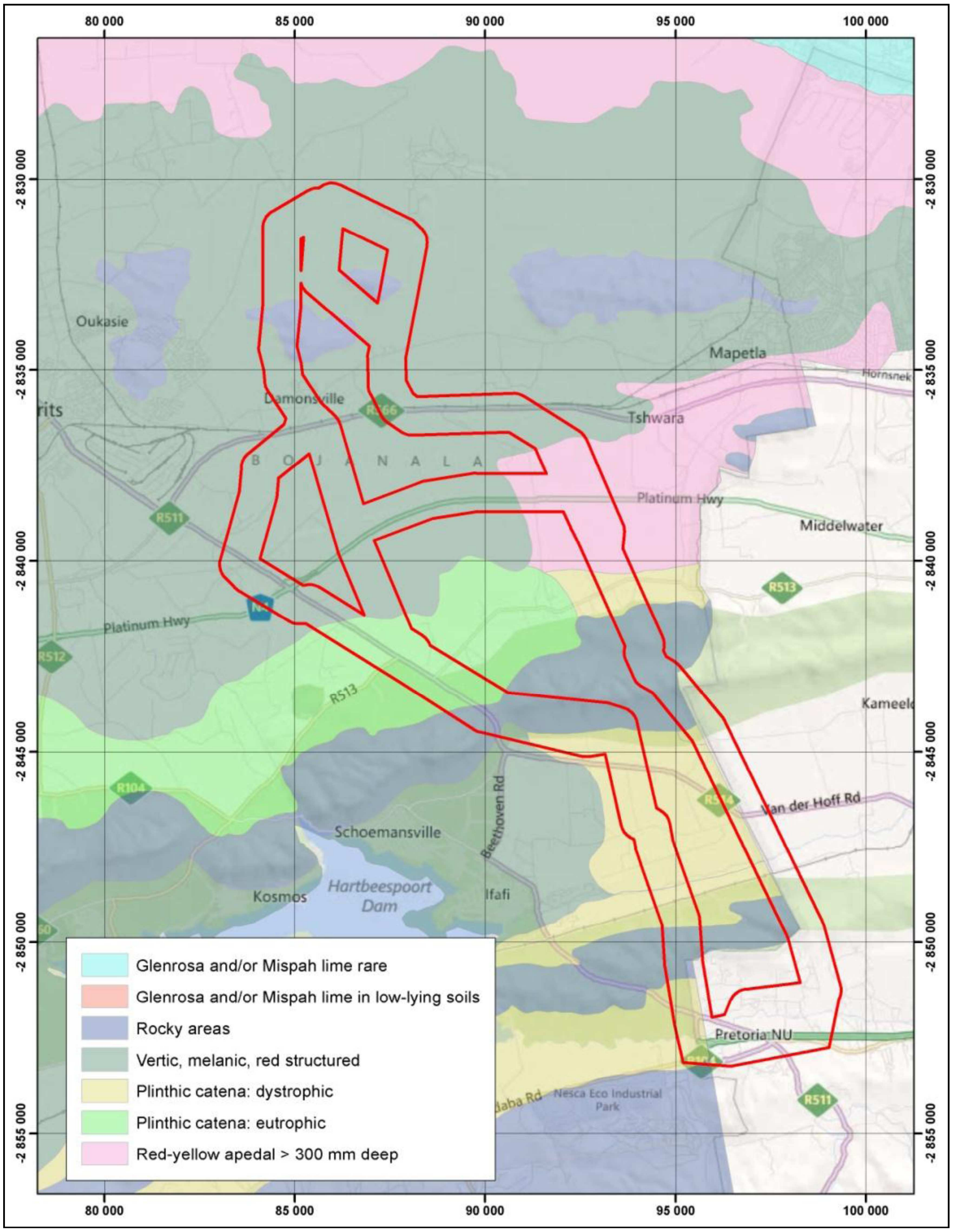

Figure 48: Soil Types for the proposed area

The following is a description of the soil types as identified as part of the desktop study undertaken by Index, 2012:

Red – yellow apedal soils and Plinthic Catena eutrophic soils

- The area just north and south of the Magaliesberg consists of predominantly deep reddish Hutton and Shortlands soil forms.
- The clay content varies greatly depending on the geology and topography. Stones and loose rock are common.
- Some land is serviced with irrigation by the canal from the Hartbeespoort and is considered as high potential land.

Rocky areas

- Predominantly the Magaliesberg and rocky ridges
- Mispah, Glenrosa and rock outcrops dominate

Vertic, melanic and red structured soil

a) These soils occur on most of the northern portion of the site

b) The dominant soils are Arcadia, Rensburg and Shortlands.

c) The canal supplies water to portions of this group, but it seems that much has been withdrawn for mining

d) Although some of the vertic soils have been irrigated in the past, the deteriorating water quality from Hartbeespoort is becoming problematic

Plinthic Catena dystrophic soils

- Consists mostly of Hutton soils, often rocky and difficult to cultivate
- They are normally dryland and with a low arable potential. Where that are irrigated, they are considered as moderate to high potential

9.5 Land Use

In terms of the North West Province State of the Environment Report, the North West Province is approximately 11,632,000 ha in extent. Land use in the North West Province mainly comprises of agriculture, mining, conservation, industrial, commercial, recreational and residential.

Approximately 9,421,920 ha (81%) of the total land area is considered as potential farming land. Of this total potential farming land, approximately 2,638,138 ha (28%) is potentially arable, approximately

4,334,083 ha (46%) is grazing land and approximately 603,002.9 ha (6,4%) is used for nature conservation. During 2001 the agricultural land use patterns included the following (Table 20);

Table 20: Land Use Patterns – North West Province (2001)

Agricultural Land Use Pattern	Approximate Area of Coverage
Field Crops	2,06 million ha
Horticultural crops	67 879 ha
Grazing land	2,97 million ha
Mixed farming	1,2 million ha

The land use patterns in the province are linked to ownership. Three main types of ownership occur within the province which includes, privately owned land, communal or tribal lands and state owner land. During 2001, most of the land in the Province was privately owned and the landowners where mainly committed to agriculture.

Livestock and cropping are the main agricultural activities undertaken in the eastern part of the province which is the higher rainfall area, whilst livestock and wildlife farming are prevalent in the western drier parts of the province. Three major irrigation schemes occur within the province which includes the Crocodlie, Vaal and Harts Rivers. The Vaalharts irrigation scheme is the largest scheme in the province. Details of this scheme are detailed below.

Table 21: Irrigation Schemes in the Vaal and Harts Rivers

Irrigation Scheme	Approximate Area of Coverage	Crops under Irrigation
Vaalharts irrigation area	43 700 ha	Wheat (36% of area) Maize (23% of area) Groundnut (22% of area)

Several smaller irrigation schemes also occur in the province which includes the Taung, Manyeding, Bodibe and Tlhaping-Tlharo schemes. The total area under irrigation by these smaller schemes is approximately 4,500 ha in extent. The total area under irrigation in the province is approximately 50,000 ha.

Mining forms a significant land use in the province, and several mining areas occur within the province. These mining areas are predominantly located within the Bushveld Complex which is described as a sill-like mineral-rich geological feature of approximately 50,000 km in extent.

Mining activities in the province mainly occur in the Rustenburg area and Southern Districts, and include the extraction of uranium, gold, iron, chrome, manganese, platinum, coal, granite, marble, slate, limestone, wonderstone, and andalusite. Stone crushing, clay and sand pits and quarries are also found in the province. Commercial, industrial, and residential land uses, as well as roads and dams are estimated to contribute to approximately 15% of the total land use.

In terms of the Gauteng State of the Environment Report, the land use in the area where the eastern route alternative traverse the Gauteng Province is mainly comprised of conservation, and unspecified land uses, with very small sections of cultivation (see figure 49).

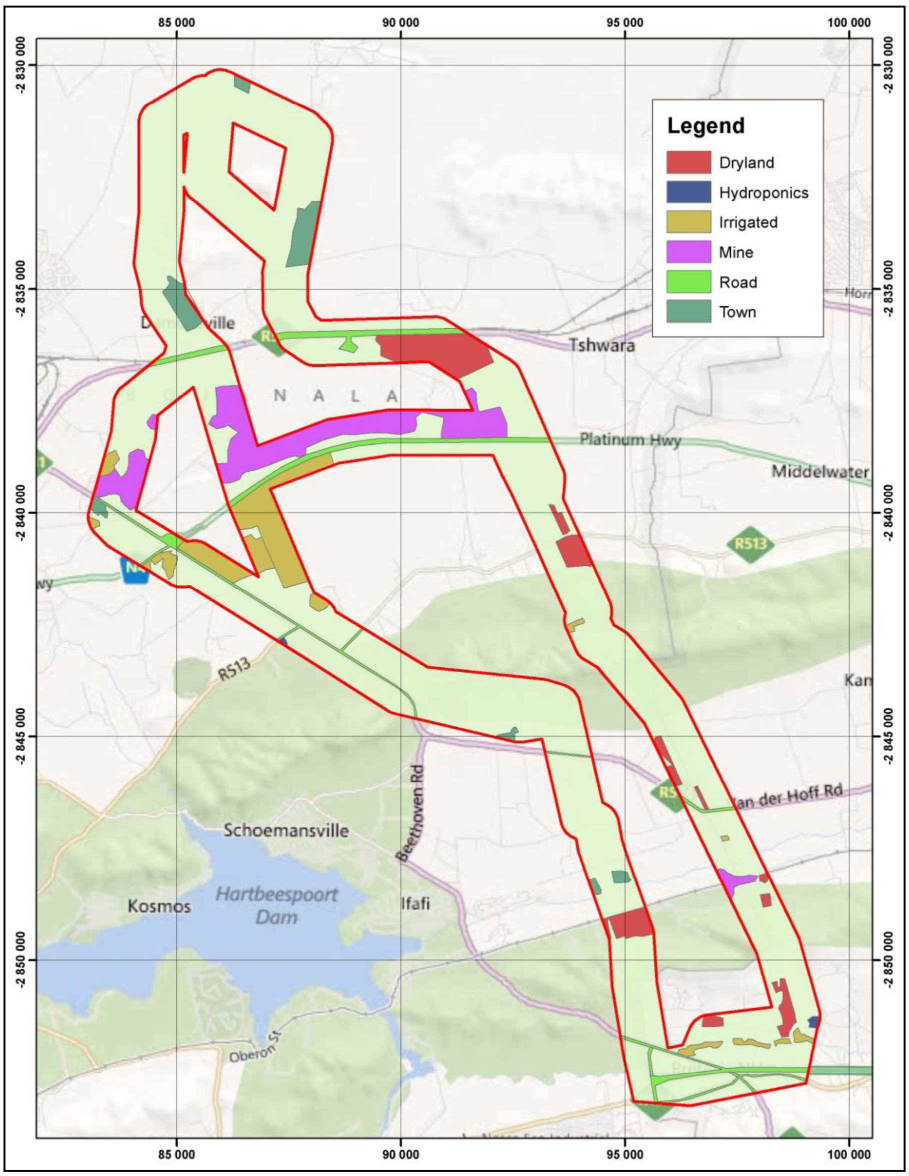

Figure 49: Map indicating the land use for the proposed routes