7. VEGETATION

7.1. Vegetation Types within the Study Area

A wide range of vegetation types can be distinguished within the study area. These are briefly described below.

7.1.1. Bontveld

This vegetation type was recognised by Acocks (1988), and described as Veld type 7 (i.e. Eastern Province Thornveld). The bonteveld is located on soils of a generally poor quality, and occurs in regions with round-the-year rainfall. Rich fynbos elements are characteristic of this vegetation type. Agricultural potential within this vegetation type is limited due to the calcareous nature of the soils. Examples of this vegetation type are present in the southern section of the study area.

7.1.2. Valley Bushveld (Acocks Veld Type 23)

This veld type occurs within the southern and central sections of the study area. The Sundays River Scrub and Addo Bush variations of this veld type are endemic to this region, and contain many unique structures and floristic elements. This veld type has been divided into the following:

- *Mesic Succulent Thicket*

  The mesic succulent thicket comprises those thicket communities associated with moderate to higher rainfall areas, and is located on cooler, southern aspects. Leafy succulent species (e.g. *Portulacaria afra* and *Aloe* spp) are rare, and the woody component is dominated by *Scutia myrtina* (droogie), many *Rhus* species, *Sideroxylon inerme* (milkwood) and *Pteroxylon obliquum* (sneezewood). Some stem succulent taxa are present, for example *Euphorbia tetragona*.

- *Xeric Succulent Thicket*

  The xeric succulent is well conserved in the Eastern Cape, with numerous formal (AENP, Great Fish River complex) and informal (Shamwari Game Reserve, Schotia Game Reserve) conservation areas in existence. This vegetation type is sensitive to disturbance, and does not easily recover (Photogrpah 7.1).

Photograph 7.1: Xeric succulent is well conserved within the Eastern Cape, but does not recover well from disturbance. Within the AENP, elephants have long-term impacts on this vegetation type (Bannister, *et al*, 1987)

- *Tall Succulent Thicket*

  The tall succulent thicket is defined throughout the Eastern Cape region by the presence of canopy-emergent, stem succulents (*Euphorbia triangularis, Euphorbia tetragona*). This is a uniquely Eastern Cape growth form, and gives the countryside its distinctive appearance. This vegetation type is largely associated with existing conservation areas, particularly forests. Although not specifically threatened, it does contain habitat in which threatened taxa may occur (e.g. orchidaceae found on the trunks).

7.1.3. Afro-Montane Forest

The Afro-montane forest comprises tall evergreen trees with canopy heights of 10-14 m. The forest is relatively well protected in the AENP. Existing developments in the study area have had an impact on this vegetation, as it has been necessary to disrupt the canopy to undertake development activities.

7.1.4. Grassy Fynbos

This veld type, described by Acocks (1988) as False Fynbos (veld type 70), contains a large number of endangered, rare, threatened and endemic species. A list of all known endangered, rare and threatened vegetation species within the entire study area is provided in Appendix D.

7.1.5. Arid Savanna

The arid savanna is a unique structural vegetation type, associated with the arid, northern aspects on the sandstones in the central parts of the study area. The landscape is dominated by the single-stemmed woody shrubs (e.g. *Pappea capensis* and *Boscia oleoides*), with the understorey comprising grasses and dwarf shrubs of Karoo affinity. The woody component includes species such as *Nymania capensis*, *Eulcea undulata*, Grewia *robusta* and *Maytenus polyacantha*. This vegetation type is not formally conserved.

7.1.6. Grassy Dwarf Shrublands

The grassy dwarf shrublands comprise the large extent of rangeland in the central and northern parts of the study area. The dominant grass species are *Pentzia incana*, *Eragrostis lehmaniana*, and *Eragrostis curvula*. The dwarf shrublands are in good condition, with relatively low productivity. Although no rare or endangered taxa were observed during site investigations, some of the low-growing *Euphorbia* and *Gasteria* species could be encountered when during bush clearance activities during the construction phase.

7.1.7. Grassland

The grasslands of the area south of the Poseidon Substation are an important agricultural resource, as they support the livestock production systems of the Smaldeel. The erection and maintenance of Transmission lines have little impact on this vegetation.

7.2. Vegetation Characteristics within the Study Area

Using a Landsat TM image of the study area, vegetation indices were successfully utilised in the evaluation of vegetation conditions within the study area. A summary of the patterns for each index within the study area is provided below.

7.2.1. Normalised Difference Vegetation Index (NDVI)

The NDVI is a standard vegetation index prepared from the red and the near-infra red bands of the Landsat TM data (NIR - red/NIR + red). It provides an index of the amount of actively growing biomass at a site. It is highest in areas with high woody biomass (e.g. forests, succulent thicket and the riparian zone) and in late growing season crops (e.g. centre pivot irrigation lands). Low NDVIs are associated with areas of low biomass, such as stony, shallow soils, and degraded rangeland. The NDVI can be used to estimate the production potential of the natural rangelands. The NDVI is related to water use efficiency (Holm *et al* 2000, Tyson & Palmer 1996), and when used in conjunction with the mean annual rainfall (Figure 7.1), it is possible to predict the livestock carrying capacity (LSU/100ha) of land parcels in the region.

Throughout the study area, the NDVIs are parallel to the rainfall gradient (Figure 7.1), with the high values being associated with thicket and forests of the Zuurberg, and the low values occurring on arid rangelands of the northern sections.

Figure 7.1: Median annual rainfall (mm) for the region between the Grassridge and Poseidon Substations (Dent *et al* 1987)

7.2.2. Moving Standard Deviation Index (MSDI)

This index has been developed for evaluating the state of degradation of arid rangelands (Tanser & Palmer 1999), and high MSDI values are associated with severely degraded rural landscapes.

High MSDI is associated with all the transformed land (irrigation schemes, urban areas, roads, etc.) along the Sundays River (High MSDI reflected as blue in Figure 7.2). Natural vegetation in all areas within the study area is either disturbed by the intensive irrigation activities, or by urban areas and roads. Moving northwards, the MSDI is low over the Zuurberg range, with some high patches in the broken landscapes of the riparian zones of the Little Fish River (Figures 7.3 and 7.4). In the karroid dwarf shrublands (Figure 7.5), the MSDI is found to be low, suggesting well preserved forms of this vegetation and intact, functional landscapes.

7.2.3. Multi-Spectral Classification

The three band colour composite (Figures 7.6 to 7.10) provides a perspective of the pattern of the vegetation within the study area, and is an index of habitat diversity. When interpreting the 3-band colour composite, the bontveld (a combination of light green and purple; Figure 7.6) does not stand out as clearly as it does in the NDVI (Figure 7.11). The areas of higher woody biomass (bushclump) are purple in colour, and the low woody biomass (fynbos elements) are light green. Some unusual and rare patterns (dark green) occur below the existing Transmission lines in the bontveld. It is possible to define the physical boundaries of bontveld using NDVI, and within bontveld patchiness using the colour composite. In general, patchiness and habitat diversity in the bontveld is high relative to the adjacent succulent thicket (purple).

The Zuurberg range is topographically complex, and patches of tall succulent thicket and forest (dark red) occur in a mosaic with grassy fynbos (light green) (Figures 7.7 and 7.8). Once again, the high diversity of habitats in the area is clearly indicated by the multi-spectral classification.

Figure 7.2: Landsat TM MSDI for 1:50 000 Topo Series Sheet 3325DA, showing the existing Transmission lines and field sampling sites

Figure 7.3: Landsat TM MSDI for 1:50 000 Topo Series Sheet 3325BD, showing the existing Transmission lines and field sampling sites

Figure 7.4: Landsat TM MSDI for 1:50 000 Topo Series Sheet 3325BC, showing the existing Transmission lines and field sampling sites

Figure 7.5: Landsat TM MSDI for 1:50 000 Topo Series Sheet 3325BB, showing the existing Transmission lines and field sampling sites

Figure 7.6: Three band colour composite (Landsat TM) for 1:50 000 Topo Series Sheet 3325DA, showing the existing Transmission lines and field sampling sites

Figure 7.7: Three band colour composite (Landsat TM) for 1:50 000 Topo Series Sheet 3325BD, showing the existing Transmission lines and field sampling sites

Figure 7.8: Three band colour composite (Landsat TM) for 1:50 000 Topo Series Sheet 3325BC, showing the existing Transmission lines and field sampling sites

Figure 7.9: Three band colour composite (Landsat TM) for 1:50 000 Topo Series Sheet 3325BB, showing the existing Transmission lines and field sampling sites

Figure 7.10: Three band colour composite (Landsat TM) for 1:50 000 Topo Series Sheet 3225DD, showing the existing Transmission lines and field sampling sites

Figure 7.11: Landsat TM NDVI for 1:50 000 Topo Series Sheet 3325DA, showing the existing Transmission lines and field sampling sites. Dark green=high NDVI, yellow=low NDVI

7.3. Alien Vegetation

The remote sensing and field survey of the study area indicated that the natural vegetation that has not been cleared, is in a good condition. With the exception of some alien invasives (*Opuntia* spp.) in the Xeric Succulent Thicket, most rangeland is in moderate to good condition. The Moving Standard Deviation Index (Tanser & Palmer, 1999) indicates that large areas of the karroid dwarf shrublands and grasslands are in a healthy state, showing little evidence of disturbance, which could be attributed to over-stocking by domestic stock.

The following alien species were encountered during a brief survey of the study area, and are regarded as having a negative impact on the natural environment:

- *Opuntia ficus-indica* (prickly pear)
- *Opuntia aurantiaca* (jointed cactus)
- *Acacia mearnsii* (black wattle)
- *Acacia longifolia* (long-leaved wattle)
- *Acacia saligna* (Port Jackson willow)
- *Solanum mauritianum* (bugweed)
- *Lantana camara* (lantana)
- *Pinus pinaster* (cluster pine)
- *Eucalyptus* sp. (blue gums)

7.4. Potential Impacts

As the vegetation within the study area is fairly uniform, potential impacts associated with the construction and operation of the proposed Transmission line between the Poseidon Substation and the Grassridge Substation will not differ substantially between corridor 1 and 2.

7.4.1. Potential Impacts of the Transmission Line and Associated Infrastructure on Endangered, Rare and Threatened Flora in the Study Area

The construction of the proposed Transmission line and associated infrastructure could potentially impact on the endangered, rare and threatened floral species, which have been identified to potentially occur within the study area. Although this impact will be localised and confined to single individuals, it will be permanent, and therefore, will be significant.

However, with the implementation of appropriate mitigation measures, the majority of these impacts can be ameliorated.

- *Mitigation:*

  As it is likely that rare and endangered plant species may occur within the area along which the proposed Transmission line is to be constructed, a detailed survey of the preferred route, as well as all access roads and other structures should be undertaken by a qualified vegetation specialist prior to the commencement of construction activities.

  Where rare or endangered plants are identified within the proposed construction area, various mitigation measures can be implemented:

  * Many rare or endangered plant species can be successfully relocated to similar habitats. This should be undertaken in the winter months as far as possible.
  * Where it is not undesirable, or possible to successfully relocate rare or endangered plants (e.g. low-growing endemic geophytes such as *Euphorbia* and *Gasteria* species) due to sensitivities of the species with regards to habitat preferences, the specific location of each disturbance (tower construction, access road construction, clearing of servitude) should be undertaken under the supervision of a suitably qualified vegetation specialist. This will result in the avoidance of unnecessary disturbance to sensitive habitats.
  * In addition, where feasible, a slight shift in the position of the tower to avoid disturbance of rare or endangered species will result in an impact of low to no significance.

Table 7.1: Potential impacts of the proposed Transmission line on endangered, rare and threatened species

Extent	Duration	Intensity or Magnitude	Probability	Significance without Mitigation	Significance with Mitigation
Localised	Permanent	High	Definite	High	Low

7.4.2. Potential Impacts of Transmission Line and Associated Infrastructure on the Vegetation Structure in the Study Area

- *Afro-Montane Forest and Tall Succulent Thicket:*

  These vegetation types are associated with steeply sloping terrain, and are, therefore, extremely vulnerable to disturbance. Potential impacts associated with the construction of a Transmission line in these areas include increased water runoff and erosion.

- *Xeric Succulent Thicket:*

  The long-term impact of vegetation clearance within this vegetation type are clearly visible in other sites (e.g. national road clearing and other development features). Post-disturbance recovery is extremely slow, with the cut-lines for fences throughout the succulent thicket bearing evidence to the problems with mitigating disturbance effects. Edges of cut-lines are also more vulnerable to invasion by alien taxa. Therefore, extensive clearance of a Transmission line servitude in areas where this vegetation type occurs could potentially have a highly significant negative impact on the vegetation structure due to slow recovery periods.

- *Mitigation:*

  Standard practices implemented by Eskom (and included as part of all contracts; Eskom, 2000) include a number of mitigation measures which will result in the amelioration of the above potential impacts. These include:

  * the implementation of reasonable measures to prevent soil erosion at all times.
  * no clearance of sensitive and/or protected areas, provided that the vegetation poses no threat to the operation and reliability of the Transmission line. During construction, however, a 1 m "trace-line" may be required to be cut through the vegetation for stringing purposes only. In areas where no vehicle access is permitted, stringing will be undertaken by helicopter.
  * where no access roads are available (i.e. in sensitive and/or protected areas where no vegetation clearance is permitted), a helicopter will be used for the erection of towers and maintenance of the line during operation.
  * in all areas along the servitude, vegetation clearance will be minimised during construction and maintenance.
  * in the case of corridor 1, existing access roads to the existing Transmission line servitude could be used to minimise cut-lines and additional access roads.

Table 7.2: Potential impacts of the proposed Transmission line on vegetation structure

Extent	Duration	Intensity or Magnitude	Probability	Significance Without Mitigation	Significance With Mitigation
Localised	Medium-term	Moderate	Definite	High	Low

7.4.3. The Potential for Veld Fires to Occur in the Area and Nature of the Fire

Fires which impact on Transmission lines can be expected to occur in the following vegetation types found within the study area:

- *Grassy Mountain Fynbos:*

  In the grassy mountain fynbos, regular fires should maintain a grassy condition. The desired community is dominated by fire-adapted grasses and shrubs (e.g. *Themeda triandra, Erica sparse*) and if maintained in this low biomass state, will not pose a major fire hazard. However, another, less desirable form of the grassy mountain fynbos does exist, and is dominated by woody species such as *Cliffortia linearifolia* and *Elytropappus rhinocerotis*. This form, which develops in the absence of regular fire, and is common throughout the AENP, does pose a potential problem. Therefore, Eskom ensure that the area immediately below the line is kept clear of the intrusive indigenous shrub *Cliffortia* sp., and maintain the grassy fynbos in such a state that the risk of fire is minimal. Management of the servitude should include the regular (3-5 year) controlled burning of the grassy fynbos to reduce the woody fuel loads.

- *Grassland:*

  The grasslands of the Eastern Province Thornveld may experience fires after good rainfall years. However, these are infrequent, and are discouraged by the landowners, as the grazing is considered to be valuable.

- *Alien Invasives:*

  A more serious threat to the Transmission lines comes from fires in stands of woody alien species (e.g. *Acacia mearnsii, Acacia saligna, Acacia longifolia*), which are known to occur within the study area. Control of these species in close proximity to lines using appropriate vegetation clearance techniques and herbicide treatment is well developed by Eskom. This involves the clearance of exotic alien species from the servitude. These efforts reduce the possibility of high intensity fires occurring immediately below the line, and also have a positive influence on the composition and conservation value of the flora.

- *Mitigation:*

  Mitigation measures already implemented by Eskom (Eskom, 2000) include:

  * the regular (3-5 year) controlled burning of the grassy fynbos to reduce the woody fuel loads.
  * clearing of fire breaks around all towers and along all access routes.
  * a long-term commitment to the removal and control of all alien invasive species.

Table 7.3: Potential impacts of the proposed Transmission line on the occurrence and nature of fire

Extent	Duration	Intensity or Magnitude	Probability	Significance without Mitigation	Significance with Mitigation
Regional	Long-term	High	Definite	High	Low

7.4.4. Potential Impacts of Transmission Line and Associated Infrastructure on the Occurrence of Alien Species

The minimum standards implemented by Eskom during the construction of a new Transmission line include the clearance of all alien vegetation species within the servitude area. This is achieved through the use of appropriate cutting and treatment with herbicides. During the operation and maintenance of the Transmission line, regrowth is cut and treated with an appropriate herbicide in order to prevent recolonisation of the area by these species. Therefore, the potential impact associated with the construction of the proposed Transmission line in terms of alien vegetation species will be positive and will be of a long-term nature.

- *Mitigation Factors to Minimise Re-colonisation of Alien Vegetation:*

  Mitigation measures already implemented by Eskom (as discussed above) must be implemented to ensure that the potential impacts associated with alien invasive vegetation is ameliorated. In addition, post-fire herbicide treatment should be implemented, particularly for woody species.

Table 7.4: Potential impacts of the proposed Transmission line on the occurrence of alien invasive species

Extent	Duration	Intensity or Magnitude	Probability	Significance without Mitigation	Significance with Mitigation
Regional	Long-term	High	Definite	High (negative)	High (positive)

7.5. Conclusions and Recommendations

Although some impacts on vegetation can be anticipated as a result of the construction of the proposed new Transmission line, the majority of these can be ameliorated. These impacts are similar for both corridors 1 and 2, as the study area is fairly uniform in terms of vegetation. However, with regards to corridor 2, new access roads and other Transmission line infrastructure would be required to be constructed as this line does not follow existing Transmission line corridors (as does corridor 1). Construction of new access roads could entail impacts to special-status plant species from grading, including removal of plants and some loss of habitat. Therefore, impacts associated with corridor 2 are anticipated to be of a more significant nature and potentially more difficult to ameliorate through the implementation of mitigation measures.

In order to avoid or minimise the potential impacts to botanical resources described above, it is recommended that the following measures be implemented:

- For all tower locations, avoidance of any rare, endangered or protected plant or sensitive plant population must be the primary mitigation measure. The final Transmission line route must be surveyed by a qualified botanist in order to determine whether any rare, endangered or protected species, or sensitive plant populations occur within the proposed route, as well as the exact locations thereof.
- In sensitive areas, foundations should be excavated by hand and towers erected by helicopter, unless an acceptable access road exists adjacent to the tower location.
- No off-road vehicle travel should be permitted.
- Special status plants considered potentially salvageable should be removed for transplanting into other undisturbed areas.

These, as well as other appropriate management measures should be detailed within an Environmental Management Plan for construction, operation and maintenance of the Transmission line.