2. DESCRIPTION OF THE PROPOSED PROJECT

2.1. Overview of the Proposed Project

The Poseidon and Grassridge Substations lie approximately 100 km apart (as the crow flies), and are separated by a varying landscape ranging from open agricultural areas in the north, through the mountainous Zuurberg down towards the coastal plateau. The existing 220 kV Transmission line traverses the existing Addo Elephant National Park (AENP) across its northern arm (for a distance of approximately 5 km), as well as the proposed Greater Addo National Park (GANP; for a total distance of approximately 20 km). This line has been present in the area since the 1970s.

The new Transmission line is proposed to be established within the existing Eskom servitude, and the existing 220 kV Transmission line will be 'recycled' through the construction of this proposed 400 kV Transmission line. In order to recycle the 220 kV Transmission line servitude, it will be required that the existing 220 kV towers be dismantled and removed, and new towers will be erected. Project activities, therefore, entail the following:

- the decommissioning and dismantling of the existing 220 kV Transmission line; and
- the construction of the new 400 kV Transmission line.

This proposed recycling of the 220 kV Transmission line servitude would require the switching off of the existing 220 kV line. As the existing Poseidon-Grassridge No 1 400 kV Transmission line cannot support the Greater Port Elizabeth area's electricity demand alone, and the reliance on only one Transmission line for supply could compromise the reliability of supply, it would be required that Eskom construct the new Poseidon-Grassridge No 2 400 kV Transmission line prior to the establishment of the third 400 kV line. The sequence of project activities will, therefore, be as follows:

- Digging and laying of new foundations for the new Poseidon-Grassridge No 2 400 kV line and the proposed Poseidon-Grassridge No 3 400 kV line (in parallel).
- Erection of towers and stringing of the new Poseidon-Grassridge No 2 400 kV Transmission line.
- Commissioning of the new Poseidon-Grassridge No 2 400 kV Transmission line.
- Decommissioning and dismantling of the existing Poseidon-Grassridge 220 kV Transmission line.

- Erection of towers and stringing of the proposed Poseidon-Grassridge No 3 400 kV Transmission line.
- Commissioning of the proposed Poseidon-Grassridge No 3 400 kV Transmission line.

2.1.1. Alternative Transmission Line Corridors

As the proposed 400 kV Transmission line is proposed to be constructed within the existing 220 kV Transmission line servitude, no alternative Transmission line corridors were investigated. However, site-specific alternative alignments were considered in sensitive areas (e.g. in the vicinity of the citrus farms in the Addo area).

2.1.2. Alternative Substation Sites

The extension to Grassridge Substation is required to be interconnected to the existing substation on the busbar in order to maintain the security of firm supply to customers, and to minimise the potential loss of supply. In order to ensure the reliability of supply to the Greater Port Elizabeth, it was therefore determined that the most appropriate position for the proposed substation extension is alongside the existing Grassridge Substation.

2.2. Technical Details of the Tower and Transmission Line Designs

All components of a Transmission line are interdependent, but are distinct in the roles which they fulfil. These components include towers, foundations, insulators and hardware, and conductors.

2.2.1. Towers

Transmission line conductors are strung on in-line (suspension) towers and bend (strain) towers. Suspension towers are typically less cumbersome structures, which are less steel-intensive than bend towers. This makes them less visually intrusive, and cheaper to construct than strain towers. Therefore, Transmission line routes are planned with as few bends as possible.

The two basic tower constructions which are planned to be used for the proposed 400 kV Transmission lines are:

- Self-supporting suspension/bend towers

- Cross-Rope Suspension (CRS) towers

Where feasible, the "cross-rope suspension" (CRS) tower (Figure 2.1 below) will be used. This tower type consists of two masts and four anchor cables. These towers have a reduced steel-component, and are, therefore, both less expensive and less visually intrusive than conventional self-supporting tower structures.

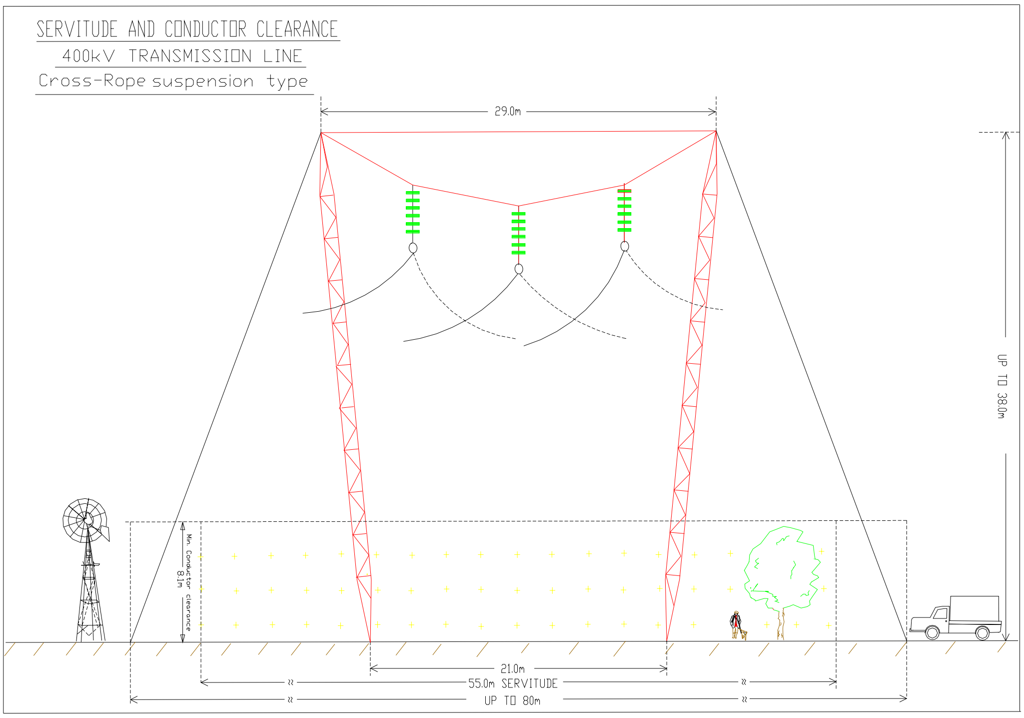

Figure 2.1: Diagrammatic representation of the cross-rope suspension tower

The CRS tower has limitations in that bends greater than 3° and steep surfaces will require that more stable "strain" or self-supporting towers be used (Figure 2.2 overleaf). These towers provide the stability required at bend points in the line. These towers are also used where slope angles or the topography requires a more stable tower design.

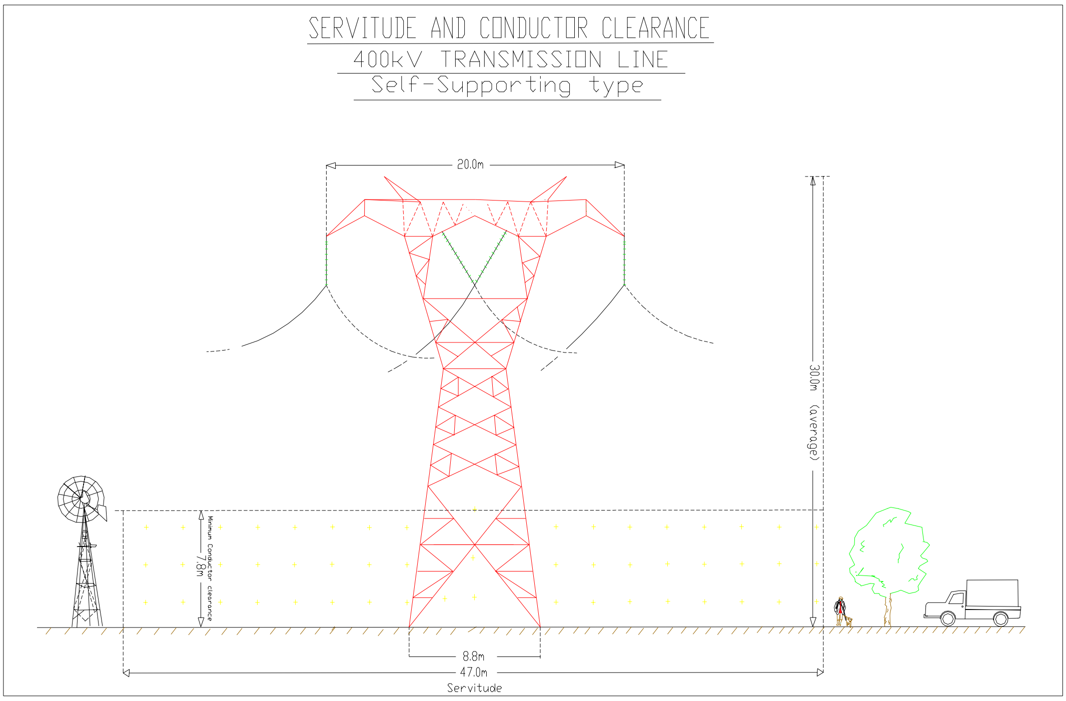

Figure 2.2: Diagrammatic representation of the self-supporting tower

2.2.2. Servitude Requirements

The servitude width for a 400 kV Transmission line is approximately 55 m, depending on the tower type which is to be used. Transmission lines running in parallel must have a minimum separation of 35 m. The minimum horizontal clearance to any building, structures, etc not forming part of the Transmission line must be 3,8 m (Figure 2.3), while the minimum horizontal clearance between the conductors and the ground is 8,1 m.

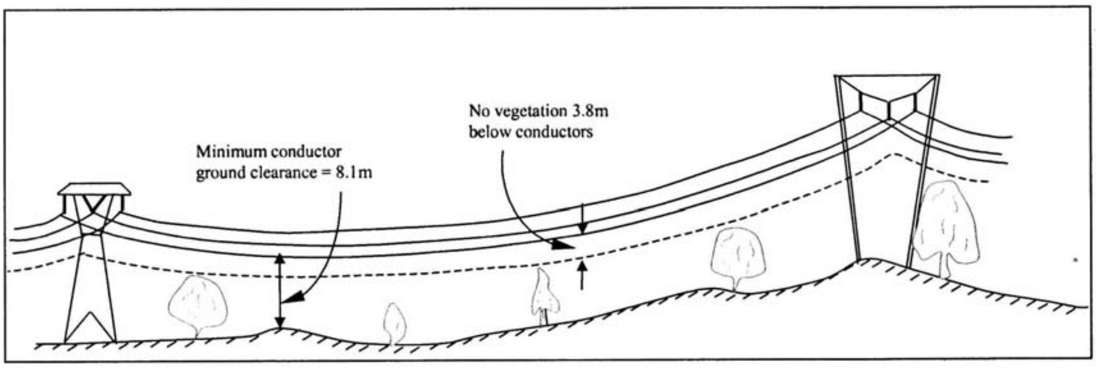

Figure 2.3: Servitude requirements in terms of vegetation clearing under conductors and minimum ground clearance

Use of CRS towers will require a widening of the existing 220 kV line servitude width (outside of the GANP area) in order to accommodate the 400 kV Transmission line towers.

The minimum distance of a 400 kV Transmission line running parallel to proclaimed public roads must be 100 m from the centre of the Transmission line servitude to the centre of the road servitude. Any main road located close to a Transmission line tower must have Armco barriers as protection.

The minimum distance between any part of a tree or shrub and any bare phase conductor of a 400 kV Transmission line must be 3,8 m, allowing for the possible sideways movement and swing of both the above-mentioned.

A maximum 8 m wide strip would be required to be cleared of all trees and shrubs down the centre of the Transmission line servitude for stringing purposes only. Any tree or shrub in other areas which will interfere with the operation and/or reliability of the Transmission line will be trimmed or completely cleared.

2.2.3. Foundations

The choice of foundation is influenced by the type of terrain encountered, as well as the underlying geotechnical conditions. Geotechnical requirements for all tower types are catered for by using various foundations systems, which are designed to withstand conditions varying from hard rock to waterlogged marshes. The main types of foundations include piles, pad-and-chimney, and anchors. The actual size and type of foundation to be installed will depend on the type of tower to be erected, and the actual sub-soil conditions. Strain towers require more extensive foundations for support than in-line suspension towers, which contributes to the construction expenses.

The construction of foundations is the slowest part of the line construction, and is typically started some time ahead of tower erection. Prior to filling of the foundations and tower erection, excavated foundations are covered in order to safe-guard unsuspecting animals and people from injury. The foundations also represent the biggest unknown in the cost and construction time, since access to the tower sites is required for earth-moving machinery and concrete.

All foundations are back-filled, stabilised through compaction, and capped with concrete at ground level.

2.2.4. Insulators and Hardware

The insulators and hardware are used to connect the conductors to the towers. The main types are glass, porcelain, and composite insulators.

Glass and porcelain have been used for many years, and are the most common. They are, however, heavy and susceptible to breakage by vandals, as well as contamination by pollution. Composite insulators have a glass-fibre core with silicon sheds for insulation. The composite insulators are light-weight and resistant to both vandalism and pollution. They are, however, more expensive than the more common glass insulators.

2.2.5. Conductors

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 electro-magnetic field 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.

2.2.6. Construction Process for Transmission Lines

Transmission lines are constructed in the following simplified sequence:

Step 1: Determination of technically feasible Transmission line alignment
Step 2: EIA input
Step 3: Negotiation of final route with affected landowners
Step 4: Survey of the route (by air)
Step 5: Determination of the conductor type
Step 6: Selection of best-suited conductor, towers, insulators, foundations
Step 7: Final design of line and placement of towers
Step 8: Issuing of tenders, and award of contract to construction companies
Step 9: Vegetation clearance and construction of access roads (where required)
Step 10: Tower pegging
Step 11: Construction of foundations
Step 12: Assembly and erection of towers

Step 13: Stringing of conductors

Step 14: Rehabilitation of disturbed area and protection of erosion sensitive areas

Step 15: Testing and commissioning

Step 16: Continued maintenance

Details of the construction process are presented for information in Appendix B.

- *Survey of the Route and Determination of Best-Suited Conductor, Towers, Insulators and Foundations:*
  After the acceptance of the proposed Transmission line corridor by the environmental authorities and negotiations with landowners, the final definition of the centre line for the Transmission lines and co-ordinates of each bend in the line will be determined. An aerial survey will then be undertaken in order to obtain an accurate profile of the area. Based on this, optimal tower sizes and positions are identified, together with ground information.

- *Vegetation Clearance:*
  With the approved profiles, the vegetation clearing of the centre line can take place, with the aid of a surveyor. Vegetation clearing will be undertaken in accordance with the minimum standards to be used for vegetation clearing for the construction of the proposed new Transmission lines as listed in Table 2.1 below (Eskom, 2000). In sensitive areas, it may be necessary to implement precautionary measures in order to ensure that particular plant species are not disturbed. The precise areas in which such measures may be required will be determined upon finalisation of the Transmission line route.

Table 2.1: Minimum standards to be used for vegetation clearing for the construction of a new Transmission line

Item	Standard	Follow up
Centre line of the proposed Transmission line	Clear to a maximum (depending on the tower type and voltage) of an 8 m wide strip of all vegetation along the centre line. Vegetation to be cut within 100 mm of 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 re-grow.

Item	Standard	Follow up
Access/service roads	Clear a maximum (depending on the tower type) 5 m wide strip for vehicle access within the maximum 8 m width, including de-stumping/cutting stumps to ground level, treating with a herbicide and re-compaction of soil.	Re-growth to be cut at ground level and treated with herbicide as necessary.
Proposed tower position and proposed support/stay wire position	Clear all vegetation within proposed tower position and within a maximum (depending on the tower type) radius of 5 m 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 the 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 line.	Selective trimming
Alien species within servitude area (outside of the 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.

Once the centre line has been cleared, the contractor's surveyor pegs every tower position and marks the crossing point with existing fences for new gate installation. Once the tower positions have been marked, the vegetation clearing team will return to every tower position and clear four strips (40 m x 40 m square for CRS towers and 20 m x 20 m for the self-supporting towers) for assembling and erection purposes.

- *Access/Service Roads:*

  Access/service roads will be required for the construction and maintenance phases. The existing access/service roads currently used for maintenance purposes on the existing 220 kV Transmission line will be utilised as far as possible in order to minimise disturbance to the area. Where new access roads are required to be constructed, and it is feasible to do so, this will be required to be negotiated with the individual landowners concerned. Where necessary for access to properties, gates are built at points where the centre line crosses any existing fence. This is undertaken in consultation with the landowners. Eskom locks are installed on such gates, and closed at all times.

- *Construction of Foundations:*
  Foundations will be mechanically excavated where access to the tower sites is readily available, and dug by hand where access is poor. The same will apply to the pouring of concrete required for the setting of the foundations. Open foundation excavations will be fenced/covered to prevent injury to people and/or animals.

- *Erection of Towers and Stringing of Conductors:*
  From the preliminary technical studies undertaken by Eskom, it has been determined that the CRS tower will be used for the majority of the in-line towers on the straight sections. In areas where space is limited (where other developments occurs close to one another, or where rocky outcrops occur), and those points where bends in the line are required, isolated self-supporting towers will be used.

- *Timing:*
  In most cases, the construction will begin at one end and progress towards the other. Construction of the proposed new Transmission lines will be undertaken over a maximum period of 24 months, and is anticipated to begin in early 2003. Construction of the Poseidon-Grassridge No 3 400 kV Transmission line is anticipated to be complete in late 2004.

- *Ongoing Maintenance:*
  The standard life-span of a Transmission tower and associated components is approximately 20 – 25 years. During this period, ongoing maintenance is performed.

2.3. Technical Details of Substations

2.3.1. Substation Infrastructure

A “mirror-image” of the existing Grassridge Substation is proposed to be constructed on the eastern side of the existing Grassridge Substation. This substation is proposed to be a 400/132 kV Transmission substation (Eskom, 2002), and is required to accommodate all new planned infrastructure, and to ensure reliability and robustness of the substation.

The proposed substation extension will contain four 500 MVA 400/132 kV transformers (Eskom, 2002), and is required to be interconnected to the existing Grassridge Substation. The total footprint area required for the extension to the substation is estimated at 49 ha (i.e. 400 m x 700 m).

2.3.2. Construction Process for Substations

The proposed extension to Grassridge Substation would be constructed in the following simplified sequence:

Step 1: Determination of technically feasible substation site
Step 2: EIA input
Step 3: Negotiation with affected landowners
Step 4: Survey of the site
Step 5: Design of substation
Step 6: Issuing of tenders and award of contract
Step 7: Vegetation clearance and construction of access roads (where required)
Step 8: Construction of terrace and foundations
Step 9: Assembly and erection of equipment
Step 10: Connection of conductors to equipment
Step 11: Rehabilitation of any disturbed areas and protection of erosion sensitive areas
Step 12: Testing and commissioning
Step 13: Continued maintenance

Details of the construction process are presented for information in Appendix B.

- *Timing:*
  Construction of the proposed extension to Grassridge Substation will be undertaken over a maximum period of 24 months, and is anticipated to begin in early 2003. Construction of the substation extension is anticipated to be complete in mid-2004.

- *Access/Service Roads:*
  Access/service roads are required by Eskom for the construction and maintenance phases. As far as possible, the existing access/service roads to the Grassridge Substation will be utilised.

- *On-going Maintenance:*

  The standard life-span of a substation and its associated components is approximately 25 years. During this period, on-going maintenance is performed, and components are replaced, which significantly extends the life-span beyond 25 years.