3. ALTERNATIVES

With full investigation and implementation of all options for optimisation of the existing infrastructure feeding the Grassridge Substation already being undertaken, Eskom continue to acknowledge the need for an additional Transmission line to supply the Greater Port Elizabeth area. The new Transmission line must, therefore, be available for operation at that time when the load growth and demand requires it, and is therefore largely dependant on economic growth, urban sprawl and the initiation of intensive industrial developments (such as the Coega IDZ). It is, however, necessary to pre-plan by comprehensively investigating appropriate routes, obtain necessary authorisations and secure servitude rights where required, to ensure the introduction of a new Transmission line into an area will be possible. The following alternatives for satisfying the need for additional electricity supply to the Greater Port Elizabeth area were investigated in terms of technical and environmental criteria.

3.1. The Do Nothing Option

Without an additional supply source of power to the Grassridge Substation, Eskom will be unable to meet load demand requirements or maintain existing reliability and quality of supply to the Greater Port Elizabeth area in the near future. In addition, local industry and new development plans for the area will be compromised. Current technical studies indicate that an insufficient firm capacity exists to even supply the existing load at the Grassridge Substation. The Do Nothing option is, therefore, rejected as a feasible option.

3.2. Demand Side Management

Demand Side Management (DSM) can generally be defined as the activities performed by the electricity supply utility, which are designed to produce the desired changes in the load shape through influencing customer usage of electricity and to reduce overall demand by more efficient use. These efforts are intended to produce a flat load duration curve to ensure the most efficient use of installed network capacity. By reducing peak-demand and shifting load from high load to low load periods, reductions in capital expenditure (for network capacity expansion) and operating costs can be achieved. Some of the basic tools are the price signals (such as time of use tariffs) given by the utility and direct load management. This option is practised to a certain extent, but is currently not considered feasible for expansion in this particular region.

Such management may become more feasible with the onset of other industries which are able to withstand an interruptible electricity supply being introduced into the Coega IDZ. This option relies heavily on such industries being tolerant to such variable energy supplies, and on agreement by these customers. Current technical studies indicate that, even with this load shedding, the current supply would remain insufficient to enable the remaining load to be supplied from the Grassridge Substation. As a result, firm supply cannot be provided at the Grassridge Substation by implementing demand-side management options alone.

3.3. New Generation Systems

3.3.1. Coal-Fired or Nuclear Generation Plant

A new coal-fired or nuclear generation plant could be commissioned close to the load centre. This option is not considered feasible, since Eskom has surplus generating capacity and is, therefore, reluctant to commit to a new capacity generation system while existing power stations are mothballed, thus not yielding a return on investment. A new power station would be required to be of a suitable power generation size (i.e. greater than 2 000MW) in order to make it economically feasible for Eskom to invest in such a plant. This is anticipated to exceed the need of the Greater Port Elizabeth area. An appropriate site would be required to be selected, and additional Transmission lines would be required to be built in order to connect the power station to the electricity grid to transmit the electricity. This would have a significant overall impact on the environment.

3.3.2. Nuclear Pebble-Bed Reactors

A future possible alternative is to establish a number of nuclear pebble-bed reactors close to the load centres. These units are sized small enough to be able to supply the required local load demand without the need to transmit excess electricity to other geographic areas. The development of this technology, however, is still in its infancy. A project is currently underway to establish a demonstration plant in the Western Cape Province, close to Koeberg Power Station. It is expected that it will take a number of years before this technology can be made commercially available at a competitive cost. The option of a nuclear pebble-bed reactor can, therefore, not meet the short- to medium-load requirements at the Grassridge Substation.

3.3.3. Wind-Generated Electricity

The use of wind-generated electricity may be a viable alternative within the "Windy City", but the amount and reliability of supply still requires confirmation through investigations. In addition, this alternative may not be desirable along the coastal belt due to the large tracts of land which would be required to establish a windmill-farm, and the significance of the negative visual impact associated with such a development.

3.4. Upgrade Existing Transmission Lines Through the Use of Bigger Conductors

An option exists to upgrade the existing Poseidon-Grassridge 220 kV Transmission line for 400 kV operation through the use of larger conductors. This option, therefore, involves the "recycling" of the existing 220 kV servitude. This option would result in the physical load on the existing towers increasing substantially, and the existing towers would, therefore, be required to be dismantled and replaced with new 400 kV towers. This would elevate the costs of the construction of the line. In addition, the dismantling of an existing Transmission line would be time consuming and destructive to the re-established environment, especially with regards to the removal of foundations, etc.

This alternate option is not considered feasible at this stage, as only two primary Transmission lines currently feed the Grassridge Substation. With the removal of one of these current lines of supply (i.e. the 220 kV line) during a decommissioning and re-construction phase, this would place the security of supply to the Grassridge Substation at considerable risk, which is not considered a viable option.

3.5. Construction of a New 400 kV Transmission Line to the Grassridge Substation

In taking a holistic view of the Transmission network supplying the Eastern Cape load centres, seventeen different expansion schemes in total were evaluated by Eskom over a 25-year period. The composition of the strengthening schemes studied ranged from extremely capital-intensive options which brought about large reductions in system energy losses, to more phased approaches that aimed to optimise the capacity of the existing Transmission Network. Of the seventeen schemes, five common schemes were evaluated with two strengthening solutions for the Eastern Cape System, and the Port Elizabeth area in particular being identified. These two strengthening solutions are described below, and schematically illustrated in Figure 3.1:

1) The construction of a 1st Dröerivier-Grassridge 400 kV line.
2) The construction of a 2nd Poseidon-Grassridge 400 kV line, to reinforce the supply to the Port Elizabeth area, together with the construction of a 1st Beta-Delphi 400 kV line (which would serve to reinforce the supply to the Greater Eastern Cape Region).

Figure 3.1: Schematic representation of the strengthening options for the Eskom Transmission network for the Greater Port Elizabeth area

3.5.1. Construction of a 1st Droërivier-Grassridge 400 kV Transmission Line

The 1st Droërivier-Grassridge 400 kV Transmission line route is approximately 380 km long (as the crow flies) between the Beaufort West Substation and the Grassridge Substation. This relatively long distance between the substations has implications on both the strength of the supply to the Greater Port Elizabeth area, as well as overall construction costs.

An Environmental Impact Assessment was undertaken for the Droërivier-Grassridge corridor alternative (Eskom, 1997). Technical disadvantages such as the diminishing power supply over distance were identified as problematic in the overall enhancement/strengthening of the Eastern Cape Region's supply.

Therefore, this option is not considered feasible, primarily from an economical and a technical viability perspective.

3.5.2. Construction of a 2nd Poseidon-Grassridge 400 kV Transmission Line

A 2nd 400 kV Transmission line between the Poseidon and Grassridge Substations is approximately 100 km in length, therefore approximately 200 km shorter than the Droërivier-Grassridge line. This route has been identified as being the most feasible option from a technical and economic perspective, the benefits of which include:

- This option provides future strengthening capabilities of the Transmission System to the Greater Port Elizabeth area and the Eastern Cape Region.
- The Poseidon Substation currently receives its power supply via the Hydra Substation, near De Aar (see Figure 3.1). Hydra Substation is a firm source of power, providing a more reliable supply for Grassridge Substation, and hence the Greater Port Elizabeth area.
- With the regional re-enforcement with the Beta-Delphi 400 kV line (i.e. between Bloemfontein and Queenstown), the future sustainability of power at Poseidon Substation is assured.
- Due to the length of this line (approximately 100 km) implementation can be achieved in the short term.
- This is the most cost-effective alternative considered for supplying the Eastern Cape Region, which is a benefit to both the end-consumer, as well as the supplier. This option presents potential substantial savings on servitude acquisition, due to registered servitude being available for use between these two substations.

This option has, therefore, been identified for more rigorous environmental investigations.

- *Poseidon-Grassridge 400 kV Transmission Line Alignment Alternatives:*

  In order to determine the most appropriate route for the establishment of a new 400 kV Transmission line between these two substations, environmental studies investigated a broader study area. The environmental studies were, therefore, able to assess the viability of two alternate corridors within this study area identified as feasible alternatives (see Figure 3.2).

* *Eskom's Existing Servitude Corridor (Corridor 1):*

  Eskom has a vacant registered servitude which extends for 85% of the distance between the two substations, and lies directly adjacent (to the west) to the existing 220 kV Poseidon-Grassridge Transmission line. Use of this route would require the acquisition of a new servitude (55 m in width) for a total of 15 km (for the portions of line closest to both the substations). The approximately 85 km of existing servitude would be required to be widened by a further 29 m in order to accommodate the 400 kV CRS tower design. These additional servitudes are required to be negotiated by Eskom, and are to be parallel to the existing 220 kV Transmission line servitude, where possible. This route traverses the existing AENP across its northern arm (for a distance of approximately 5 km), as well as the area earmarked for the GANP development. Unique solutions in terms of tower design will be required to accommodate the Transmission line within the restricted existing servitude through the National Park, as per the limitations imposed by the National Parks Act (No 57 of 1976).

* *Eastern Alternative Corridor (Corridor 2):*

  This route utilises approximately 50% of the alignment proposed for corridor 1, extending along Eskom's existing servitude between Poseidon Substation and the northern boundary of the area earmarked for the GANP development. This alternative would, therefore, also require a further 29 m parallel to the registered servitude for this northern section.

  At the juncture with the proposed GANP boundary, the route is proposed to divert to the east, and follow the eastern extremity of the GANP's border. This alignment follows the N10 and the GANP boundary in a southerly direction, over the Oliphants Kop Pass past Paterson, to the N10/N2 intersection. At this point, the route is proposed to follow the alignment of the N2 in a westerly direction, through Colchester, the Sundays River and Cannonvale, and traverse the northern boundary of the proposed Coega IDZ to the Grassridge Substation.

  The southern half of this alternative corridor would require Eskom to negotiate a new servitude (55 m in width) for the entire distance beyond the juncture with the northern boundary of the proposed GANP. The Transmission line will pass in close proximity to the towns of Paterson and Colchester (on the coastal belt). This alignment would form a completely new Transmission line corridor in this area.

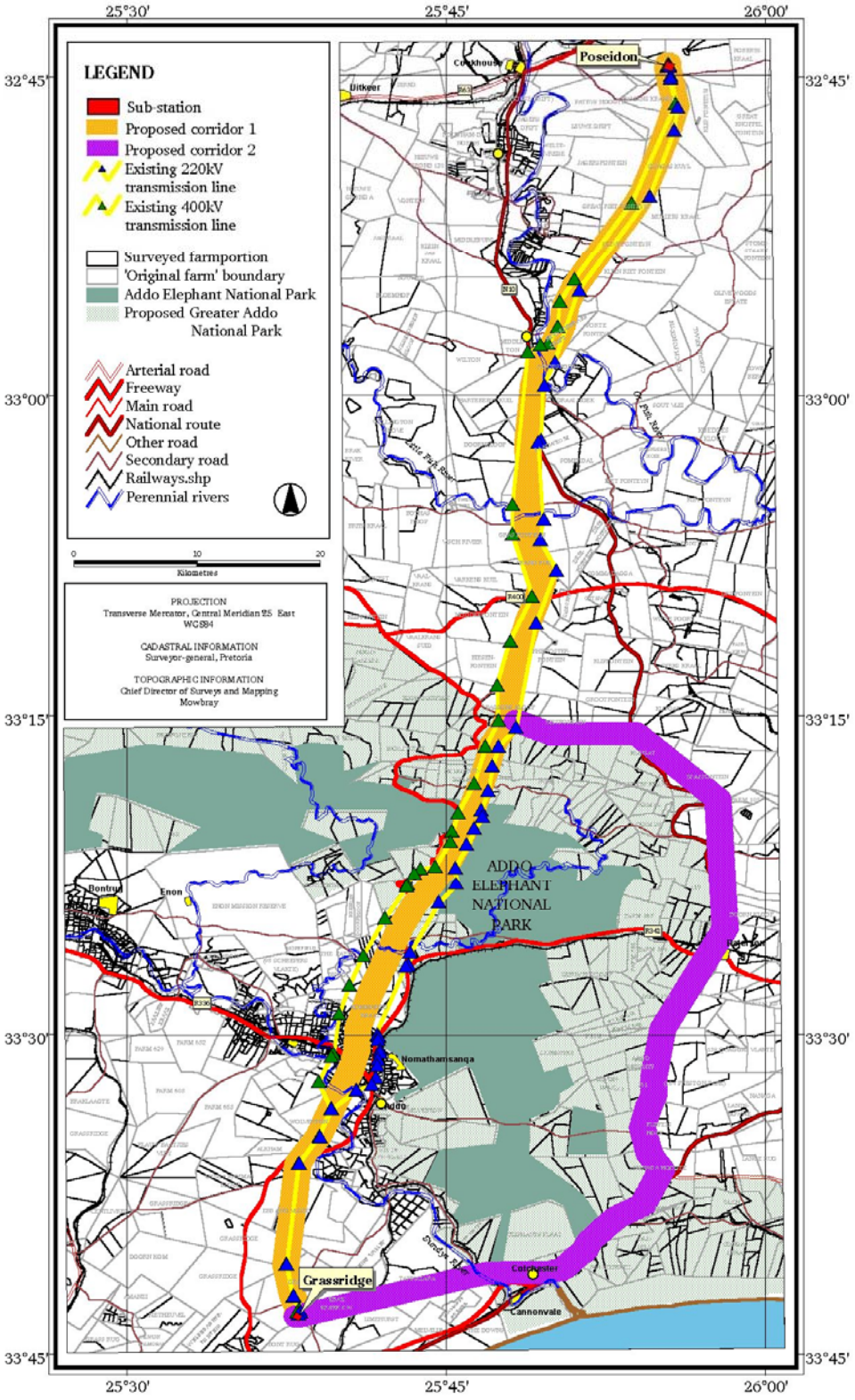

Figure 3.2: Map showing the two corridor alternatives considered

This route attempts to avoid traversing the existing AENP, however space constraints exist where the AENP meets the N2 and railway linear developments just north-east of Colchester. The corridor is unable to completely avoid crossing the area earmarked for the GANP development, as the Park planned to extend southwards down to the coastline.

Comparative construction costs for the 2 corridors have been estimated by Eskom's technical planners. The following are distinct differences between the two corridors, and will impact on the overall financial cost associated with the project:

* corridor 1 is approximately 30 km shorter than corridor 2.
* 85% of the total length of corridor 1 has a registered 26 m servitude which Eskom have rights to utilise.
* Approximately 20 km of the total length of corridor 1 cannot be widened, as per the National Parks Act, as it traverses the AENP (and the proposed GANP).
* 15% of the total length of corridor 1 has no registered servitude available, and this is required to be purchased.
* Approximately 33 % of the total length of corridor 2 has a registered 26 m servitude which Eskom have rights to utilise.
* The remaining 67% of the total length of corridor 2 has no registered servitude available, and this is required to be purchased.
* Approximately 20 km of the portion with no registered servitude will traverse the land planned for inclusion within the GANP, and will require special negotiations and permissions from Parliament as per the National Parks Act.
* Approximately 75% of the bends (use of strain towers) occurs within the southern half of both corridor 1 and 2. This is due to the nature of the topography within the Zuurberg area, and when quick changes of direction are required, e.g. within towns, etc.
* It is assumed that, on average, more bend towers will be required within corridor 2, as this corridor route is less direct and approximately 30 km longer.

It must be borne in mind that, without a definitive alignment, the number and placement of towers cannot be accurately determined. Therefore, the following table represents approximate costs to developer only.

Table 3.1: Approximate costs to developer associated with the construction of a new 400 kV Transmission line along corridor 1 and 2

	Estimated construction cost/km	**Estimated cost/km through National Park**	**Distances for purchasing servitudes**
Corridor 1 (approx. 100 km)	R510 000/km for ± 80 km = ***R40 800 000***	R542 000/km for ± 20 km = ***R10 840 000*** (increased number of towers due to reduced spans to match 200kV towers spacing)	55 m servitude for ± 15 km 29 m servitude for ± 65 km (ie widening of existing servitude) No widening of servitude for ± 20 km through National Park
	Total construction costs: ***R51 640 000***		Total: cannot be defined
Corridor 2 (approx. 130 km)	R546 000/km for ± 110 km (cost of additional bend towers factored in) = ***R60 060 000***	R546 000/km for ± 20 km (cost of additional bend towers factored in) = ***R10 920 000***.	55 m servitude for ± 88 km 29 m servitude for ± 42 km
	Total construction costs: ***R70 980 000***		Total: cannot be defined

The environmental feasibility of these two alignment alternatives is assessed within this Detailed Environmental Scoping Report.