7 DESCRIPTION OF THE BASELINE ENVIRONMENT

7.1 Introduction

According to section 28(e) of the NEMA Regulations, this section includes a description of the baseline environment that may be affected by the activity and the manner in which the biophysical, social, economic and cultural aspects of the environment may be affected by the proposed activity.

7.2 Study Area in Regional Context

7.2.1 Locality

The study area falls within the Western Cape Province between Blouberg and Atlantis. The distance of towns from the Koeberg Power Station is: Blouberg = 17,2km, Atlantis = 12,6km, Melkbosstrand = 5,5km and Duinefontein = 2, 2 Km. The R27 (provincial road) is located just south of Koeberg.

The regional location of the proposed project is indicated in **Figure 7.1**. Refer to **Figure 7.2** for detailed information of the study area.

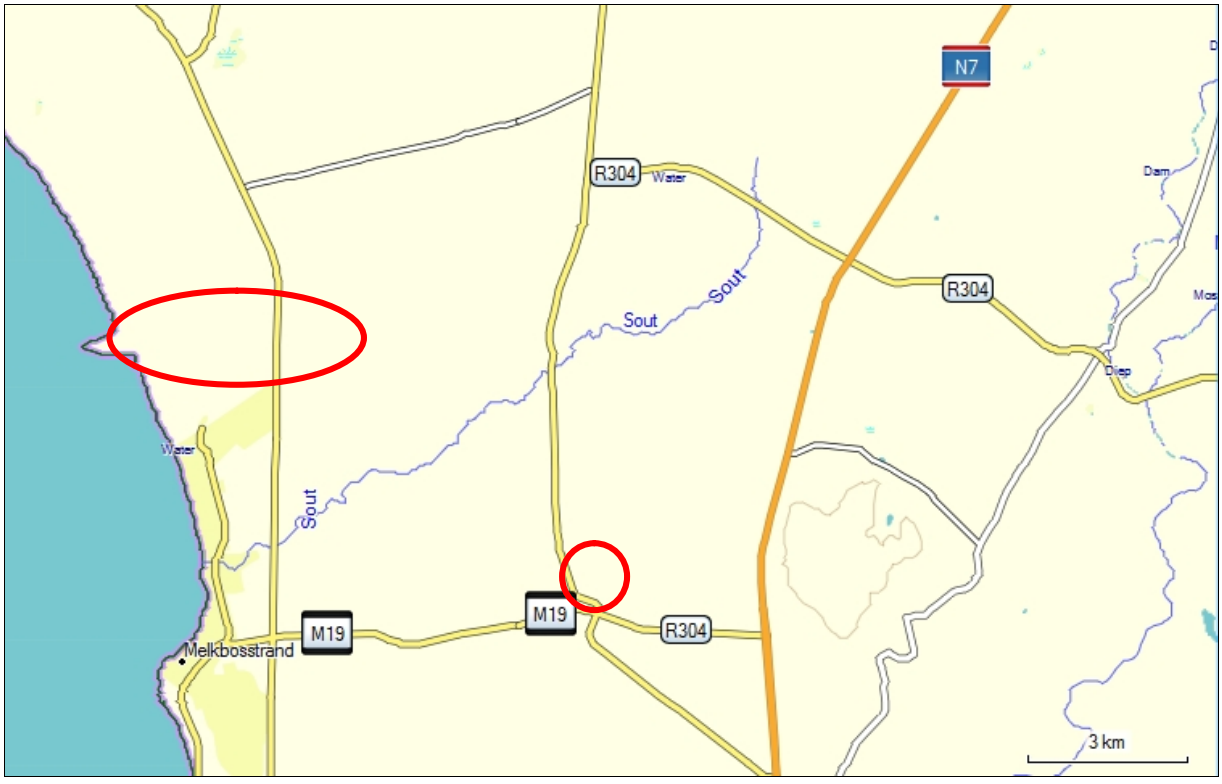

Figure 7.1: The location of the study area within the City of Cape Town Metropolitan Municipality

7.2.2 Study Area

The study area falls within the City of Cape Town Metropolitan Municipality in the area adjacent to the existing Koeberg Nuclear Power Station (KNPS) (Koeberg) near Melkbosstrand, 30 km north of Cape Town on the West Coast. The area is bounded to the north by the West Coast District Municipality, to the north east by Cape Winelands District Municipality, to the south east by the Overberg District Municipality and to the south and west by the Atlantic Ocean.

Due to the fact that the alternatives 1- 4 is close to Koeberg and alternative 5 at the existing Sterrekus Substation it is shown as two red circles to indicate the alternatives in the study area (**Figure 7.1**). A list of the farm portions is included in **Table 7.1. Figure 7.2** shows the location of the proposed alternatives within the study area.

- **Alternative 1** – Located at the north-east corner of the KNPS for the 400kV yard and the southern part of the parking area south of the incoming 400kVlines for the 132kV yard.
- **Alternative 2** – The area at the south eastern corner of the KNPS where part of the PBMR was planned.
- **Alternative 3** – The area on the corner of the main access road just east of the road to the conservation offices and north of the main access road south of the incoming 400 kV lines.
- **Alternative 4** – Offsite option to the east of the R27 on the farm Brakke Fontein 32.
- **Alternative 5** – Offsite option, just east of the R304 next to the existing Sterrekus (Omega) Substation.

Table 7.1. A list of the farm portions within the study area.

Ptn	Farm name	SG code
R	Duynefontyn 34	C01600000000003400000
0	Groot Oliphantskop 81	C01600000000008100000
1	Brakke Fontein 32	C01600000000003200001
2	Kleine Zoute Rivier 1063	C01600000000106300002
3	Kleine Zoute Rivier 1063	C01600000000106300003
4	Kleine Zoute Rivier 1063	C01600000000106300004
18	Kleine Zoute Rivier 1063	C01600000000106300018
23	Kleine Zoute Rivier 1063	C01600000000106300023
0	Kleine Zoute Rivier 84	C01600000000008400000
1	Kleine Zoute Rivier 1063	C01600000000106300001

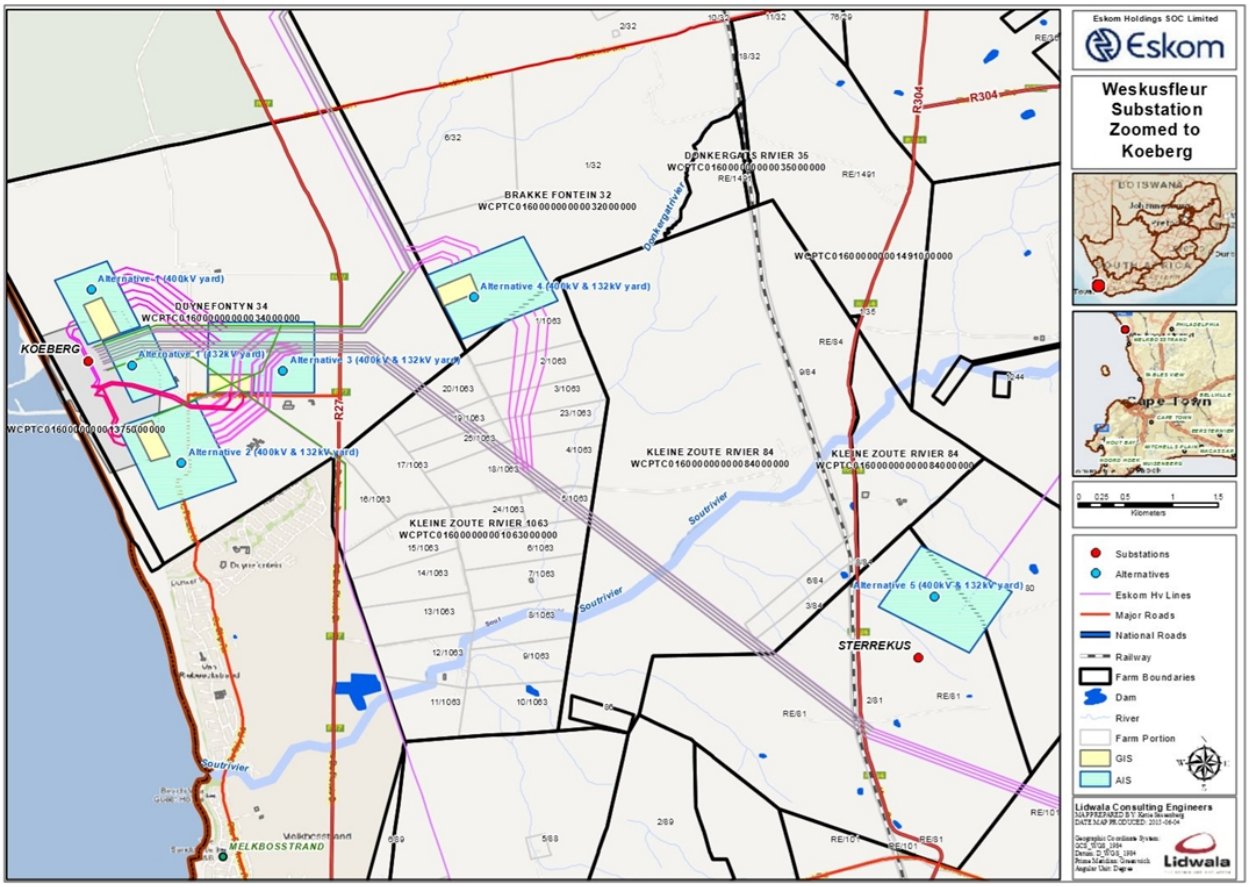

Figure 7.2: Proposed Alternatives within the Study Area (Note that the extent of the AIS on the map is larger than required at 950 x 750 m, the actual required size is 760 x 550 m)

Figure 7.3: Alternative 1 with the reactor units in the background. View facing south. Blouberg Hill and Table Mountain can be seen in the distance

Figure 7.4: Alternative 2. View of the proposed site facing west.

Figure 7.5: Alternative 3. View of the proposed site facing north.

Figure 7.6: Alternative 4. View of the proposed site facing north west. Note the very dense vegetation cover.

Figure 7.7: Alternative 5. View west depicting gums in the background, the Sterrekus Substation and agricultural in foreground.

7.3 Description of the Baseline Environment

7.3.1 Topography

Alternative 1:
The study area slope is generally flat with a gradient of approximately 1.0%-1.5%. The area earmarked for the proposed substation development occurs at heights varying between 19m and 24m above mean sea- level. The proposed development footprint would be cut into the above slope. No natural surface drainage features are evident in the area and much of the surface runoff would seep into the underlying gravels and migrate down gradient beneath the surface.
Alternative 2:
The study area slope is generally flat with a gradient of approximately 1.2%. The area earmarked for the proposed substation development occurs at heights varying between 10m and 15m above mean sea- level. The proposed development footprint would be cut into the above slope. No natural surface drainage features are evident in the area and much of the surface runoff would seep into the underlying dune sand and migrate down gradient beneath the surface.
Alternative 3:
The study area slope is generally flat with a gradient of approximately 1.5%. The area earmarked for the proposed substation development occurs at heights varying between 20m and 23m above mean sea- level. The proposed development footprint would be cut into the above slope. No natural surface drainage features are evident in the area and much of the surface runoff would seep into the underlying dune sand and migrate down gradient beneath the surface.
Alternative 4:
The study area slopes is generally flat, with a gradient of approximately 0.9%. The area earmarked for the proposed substation development occurs at heights varying between 36m and 38m above mean sea- level. The proposed development footprint would be cut into the above slope. No natural surface drainage features are evident in the area and much of the surface runoff would seep into the underlying dune sand and migrate down gradient beneath the surface. The loose nature of the surface sands makes vehicular access outside of the existing roads almost impossible without four wheel drive capability.
Alternative 5:
The study area slope is generally flat, with a gradient of approximately 3%. The area earmarked for the proposed substation development occurs at heights varying between 90m and 95m above mean sea- level. The proposed development footprint would cut into the above slope.

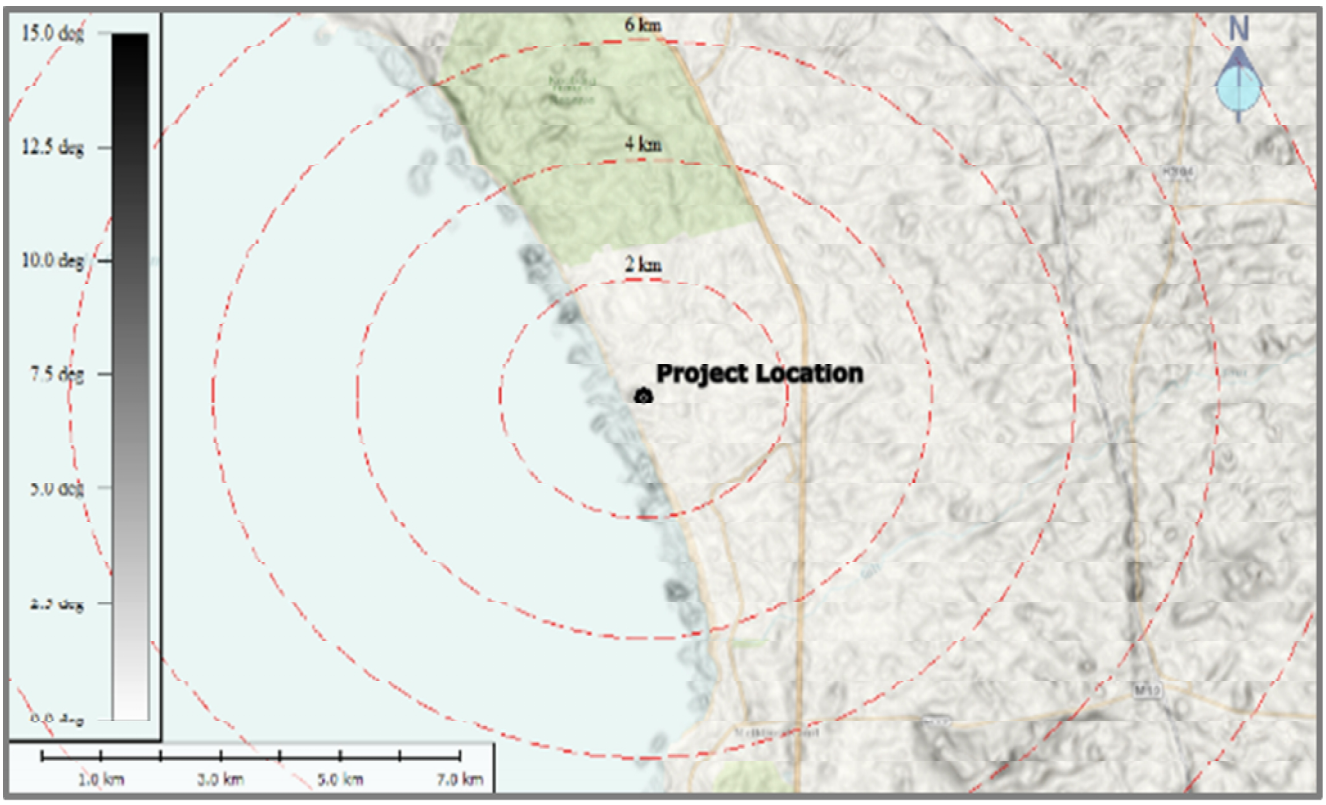

Figure 7.8: Surrounding areas slope gradient map overlay onto street map

7.3.2 Climate

The area has a temperate, Mediterranean-type climate with about 75% of the annual rainfall occurring in the winter months between April and September. Rainfall is cyclonic due to cold fronts moving in from the South Atlantic Ocean. The cold Benguela current inhibits cloud development. The average annual rainfall measured at the Koeberg Nuclear Power Station is 375 mm/a.

Summers are hot and dry with an average temperature of 28°C between January and March. Winter months are cold and wet with an average temperature of 17°C during July. Wind which is a characteristic feature of the West Coast can often be very strong.

Fog is a regular occurrence along the West Coast during the summer months and can drift as far as 3 km inland. The moisture supplied by the fog compensates for the relatively poor rainfall during the summer months.

The long-term averages and extremes measured from 1980 to 2012 at the Koeberg Meteorological Station is shown in **Table 7.2**.

Table 7.2: The long-term averages and extremes measured from 1980 to 2012 (*Source: Koeberg Meteorological Station)*.

Koeberg Meteorological Station

Long-Term Averages and Extremes @ 10m agl. - Average period = 1980 to 2012

Month	Temperatures (°C)					Rainfall (mm) @ 1.2m							Wind				
	Avg.	Extreme Max.	Year	Extreme Min.	Year	Avg.	Highest	Year	Lowest	Year	Highest 24hrs	Year	Avg. m/s	Gust Dir.	Max. Gust m/s	Max Gust km/hr	Year
January	19.6	38.1	2004	10.5	1982	9.4	67.6	1981	0.0	1999	57.4	1981	5.0	NNW	27.7	99.7	2008
February	19.8	38.0	2005	9.0	1980	7.8	42.0	1996	0.0	2000	26.4	1996	4.7	NNW	24.3	87.5	2008
March	18.8	36.6	2004	9.0	1989	11.9	51.0	1989	0.0	2001	33.8	1988	4.3	NNW	23.4	84.2	1993
April	16.9	36.6	2012	5.5	1995	32.9	105.4	1990	2.8	2000	62.0	1993	3.7	S	37.1	133.6	1993
May	15.1	33.6	1986	5.7	1995	46.6	98.2	1987	1.3	2004	49.3	1993	3.5	WSW	39.8	139.7	1987
June	13.5	31.4	1985	4.1	1988	67.3	157.4	1994	25.8	1984	58.2	1996	3.7	E	34.4	123.8	1994
July	13.0	29.0	1980	2.8	1995	64.8	162.4	2001	22.8	2005	59.4	1985	3.9	WSW	30.6	110.2	2000
August	13.2	32.0	1985	2.2	1981	54.1	134.4	1987	13.8	1991	57.6	1987	4.0	WSW	31.2	112.3	2008
September	14.3	38.2	2005	2.3	1989	33.9	75.0	1984	2.5	1993	34.6	1999	4.2	WSW	30.6	110.2	1991
October	15.8	37.2	1985	5.4	1990	18.8	114.8	2004	0.6	1993	50.4	2004	4.5	NNW	26.5	95.4	1992
November	17.2	36.3	1988	6.3	1998	16.3	67.8	2009	0.4	2003	35.7	2008	4.8	SSE	27.8	100.1	1991
December	18.8	37.4	2002	9.6	1988	12.2	32.8	1984	0.3	2005	17.0	1984	4.8	ESE	36.9	132.8	2002

7.3.3 Geology

According to the available geological maps, 1:250 000 Geological Series 3318 CAPETOWN map the regional geology of the sites comprise of light grey calcified dune sand and calcrete (**Ql**) on Alternative 1 & 2 and becoming white to light grey calcareous sand(**Qw**) bordering to **Qs** on Alternative 3 ; light grey to pale-red quartzose sand and dune sand(**Qs**) on Alternative 4 & 5.

According to the Council for Geoscience (CGS) **Figure 7.9** below all sites are underlain by Aeolian dune sand which are up to several depths of metres. From the author's experience, this layer could be up to +- 35m below the surface. Below this layer (>35m), clayeys soils with low to medium potential of expansiveness may be expected but this will have no effect on the proposed development as the horizon depth and thickness contribute towards determining the amount of surface movement (expansion and contraction).

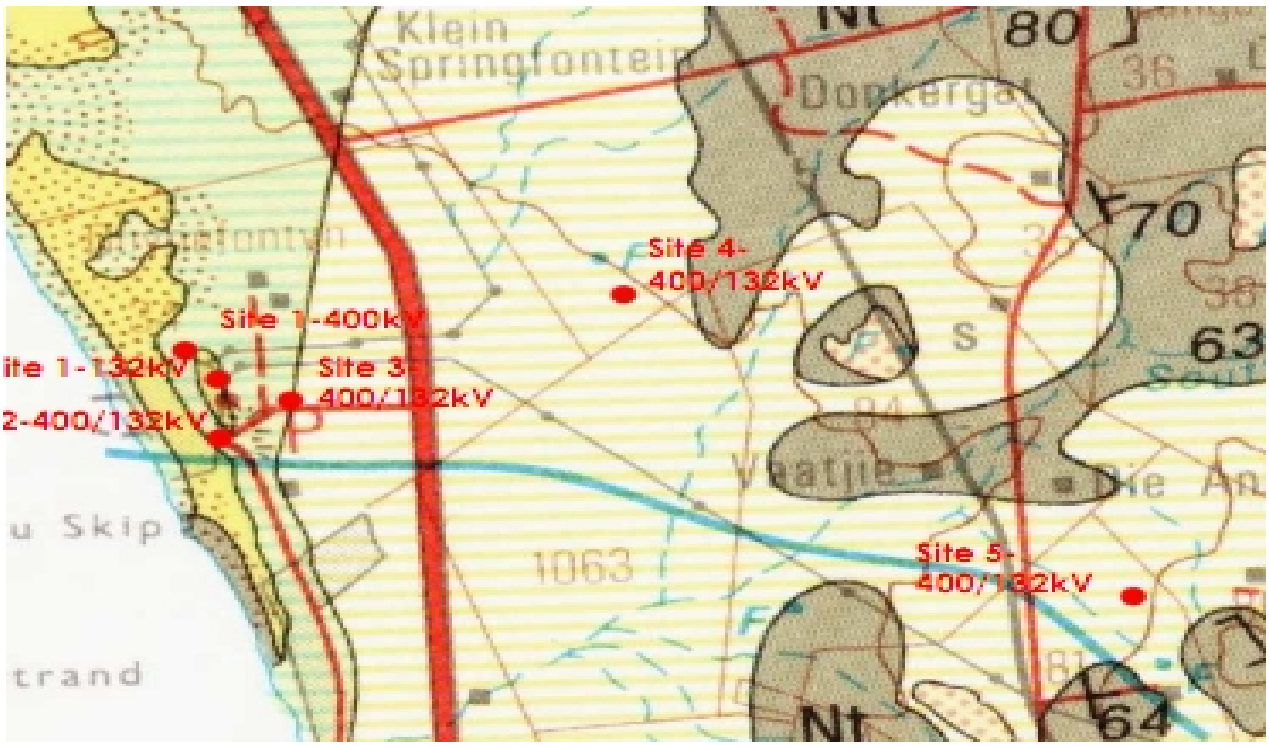

Figure 7.9: Regional Geology – Koeberg Substation

7.3.4 Natural Vegetation

The proposed Weskusfleur Substation is located in within the Cape Flats Dune Strandveld and Atlantis Sand Fynbos vegetation types which are classified as Endangered and Critically Endangered (**Figure 7.10)**. A large number of listed flora occur in the area and these species are likely to be impacted on by any development within the natural vegetation of the site.

National Vegetation Types

According to the national vegetation map (Mucina & Rutherford 2006), the alternatives around the power station (*Alternatives 1,2* and *3*) all fall within the Cape Flats Dune Strandveld Vegetation type. This vegetation type has an extent of 138 km^2 and occurs in several discontinuous patches on dune fields of the Western Cape. The largest patch

spans the south coast of False Bay and penetrates deep into the Cape Flats as a broad wedge as far north as Bellville, the other patch spans Silverstroomstrand and Table Bay and includes the Atlantis dune plume, the third region is a series of small patches covering coastal dune pockets on the Cape Peninsula, while the last patch is on Robben Island.

Alternative 4 occurs on Atlantis Sand Fynbos which has a total extent of 433 km^2 and occurs from Rondeberg to Blouberg on the West Coast coastal flats; along the Groen River on the eastern side of the Dassenberg-Darling Hills through Riverlands to the area between Atlantis and Kalbaskraal, as well as between Klipheuwel and the Paardeberg with outliers west of the Berg River east and north of Riebeek-Kasteel between Hermon Heuningberg. Atlantis Sand Fynbos is associated with moderately undulating to flat sand plains with dense, moderately tall, ericoid shrubland dotted with emergent, tall sclerophyllous shrubs and an open short restiod stratum. Restioid and proteoid fynbos are dominant, with asteraceous fynbos and patches of ericaceous fynbos in seepages.

Alternative 5 occurs in Cape Flats Sand Fynbos, which has an extent of 539 km^2 and occurs on the Cape Flats from Blouberg and Koeberg Hills west of the Tygerberg Hills to Lankeside and Pelican Park in the south near False Bay, from Bellville and Durbanville to Klapmuts and Joostenburg Hill in the east, and the southwest of the Bottelary Hills to Macassar and Firgrove in the south. Cape Flats Sand Fynbos is associated with moderately flat and undulating plains, with dense moderately tall, ericoid shrub land containing scattered emergent tall shrubs. Proteiod and restioid Fynbos are dominant, with asteraceous and ericoid Fynbos occurring in drier and wetter areas, respectively.

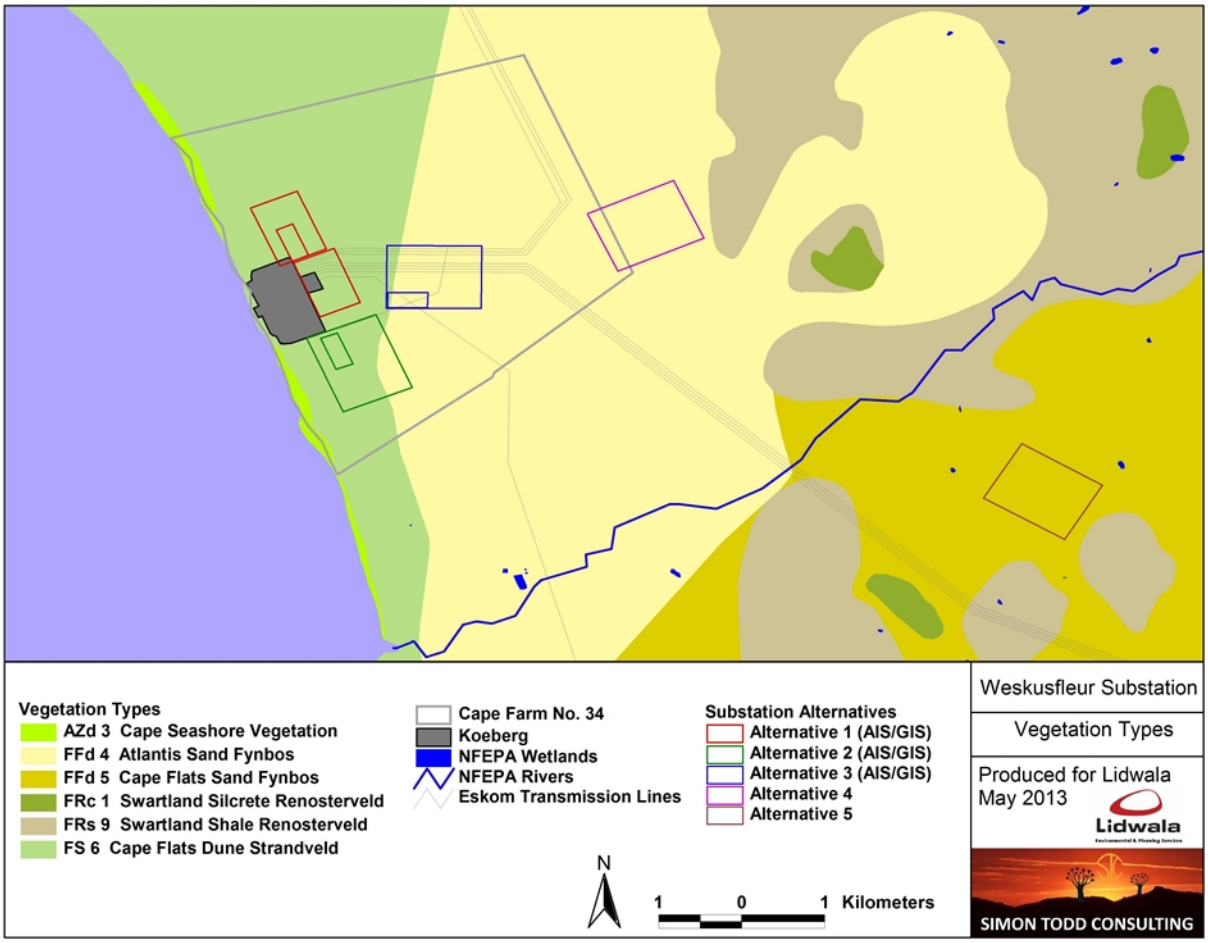

Figure 7.10: Broad-scale overview of the vegetation in and around the proposed Weskusfleur site alternatives. The vegetation map is an extract of the national vegetation map as produced by Mucina & Rutherford (2006), and also includes rivers delineated by the National Freshwater Ecosystem Priority Areas assessment (Nel et al. 2011) (Note that the extent of the AIS on the map is larger than required at 950 x 750 m, the actual required size is 760 x 550 m)

Threatened Ecosystems

Figure 7.11 Below illustrates the conservation and remaining extent of the different vegetation types within the study area. *Alternatives 1* and *2* are within the Cape Flats Dune Strandveld, which is classified as Threatened. An estimated 43% of the original extent remains and only 6% is currently conserved. A total of 66 Red Data plant species and 1 endemic plant species are known from the vegetation type. The high number, of species of conservation concern known from this vegetation type suggest that such species are likely to be present in most existing remnants of Cape Flats Dune Strandveld. Although the GIS for *Alternatives 1* and *2* are largely within the disturbed area adjacent to the power station, the AIS is too large to be accommodated within this area and both options impinge significantly on the adjacent natural vegetation. *Alternatives 3* and *4* lie within areas that have are intact Atlantis Sand Fynbos. This vegetation type is classified as Critically Endangered. An estimated 51% of this vegetation type remains and only 6%

is currently conserved. A total of 84 endemic species and 6 vegetation-type endemic species are known from this vegetation type. The high conservation status and large number of listed species known from this vegetation type indicate that any further loss and transformation of this vegetation type is highly undesirable. *Alternative 5* lies within an area of Cape Flats Sand Fynbos and on the edge of an area of Swartland Shale Renosterveld. Both these vegetation types are classified as Critically Endangered, but there are no intact remnants within the immediate vicinity of the Sterrekus substation and proposed Alternative 5 site.

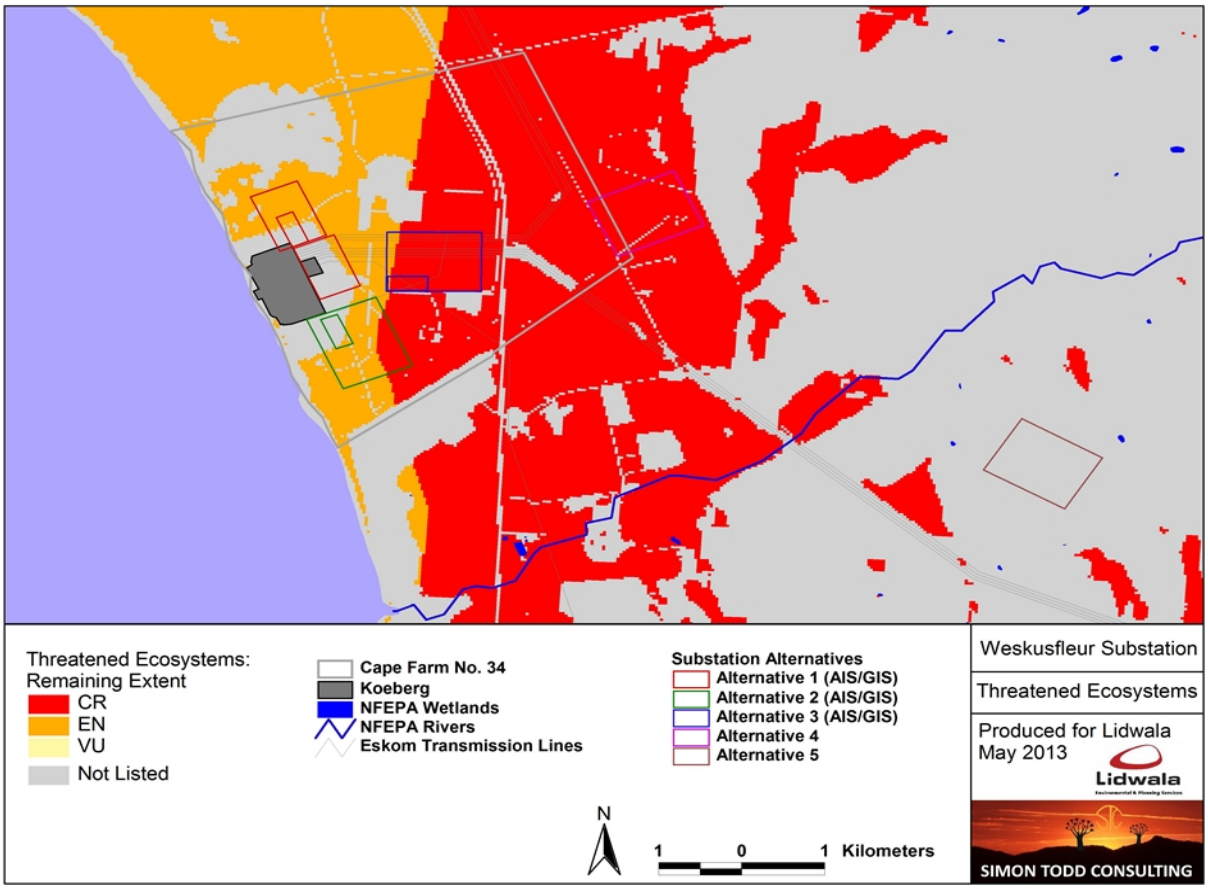

Figure 7.11.: Remaining extent of threatened ecosystems within the study area as mapped by SANBI (2011): Threatened Ecosystems in South Africa: Descriptions and Maps (Note that the extent of the AIS on the map is larger than required at 950 x 750 m, the actual required size is 760 x 550 m).

Listed and Protected Plant Species

According to the SANBI SIBIS database, 823 plant species have been recorded from the quarter degree square 3318CB. This includes 122 species of conservation concern, which highlights the botanical sensitivity of the study area. The listed species are dominated by species within the Proteaceae (22) Iridaceae (18), Mesembryanthemaceae (18), Fabaceae (12), Asteraceae (10) and Rutaceae (8). In terms of some of the previous studies that have been conducted at Koeberg, Low (2008) recorded 252 plant species for the whole of Koeberg, while Boucher (2010) recorded 166 species from 5 sites within Koeberg. Low

listed 22 species of conservation concern in his list while Boucher observed 11. At this point it is safe to assume that few if any listed species are likely to be encountered at *Alternatives 1 GIS*, *2 GIS* and *5*, while it is highly likely that some listed species will occur within the other Alternatives which impact intact vegetation. During the preliminary site visits, no listed species were observed at *Alternative 4*, while the listed species *Leucospermum hypophyllocarpodendron* subsp. *canaliculatum* was observed to be common at *Alternative 3*. *Alternative 4* was very heavily invaded by alien acacia and little indigenous vegetation remained across most of the site. It is however worth noting that the area under the power line in this area contained several listed species, despite being moved regularly. The important factor here being that alien acacia are cleared from under the power lines, allowing the persistence of a proportion of the original fynbos diversity.

Table 7.3. Numbers of the species within the different conservation status categories as indicated below, data derived from the SANBI SIBIS database. Species not evaluated are largely alien species.

Status/ IUCN Red List Category	No. Species
Critically Endangered (CR)	**15**
Endangered (EN)	**35**
Vulnerable (VU)	**47**
Near Threatened (NT)	**20**
Threatened	**1**
Critically Rare	**2**
Rare	**0**
Declining	**4**
Data Deficient - Insufficient Information (DDD)	**0**
Data Deficient - Taxonomically Problematic (DDT)	**11**
Least Concern	**528**
Not Evaluated	**162**
Total	**823**

Critical Biodiversity Areas & Braod-Scale Ecological Processes

The site lies within the planning domain of the Cape Town City Biodiversity Network (**Figure 7.13**), which was developed by the City of Cape Town (Holmes, Stipinovich & Purves 2012) on an iterative basis since 2001. Although a large proportion of the Koeberg property has been proclaimed as part of the Koeberg Private Nature Reserve (**Figure 7.12**), the area around the power station itself is not part of the reserve and consequently, none of the *alternatives 1 -3* actually fall within the Nature Reserve itself. In addition, Eskom is yet to sign a binding stewardship agreement for the site or commit any parts of the Koeberg property to formal conservation. *Alternative 4* is very heavily invaded by alien acacias to the clear detriment of biodiversity.

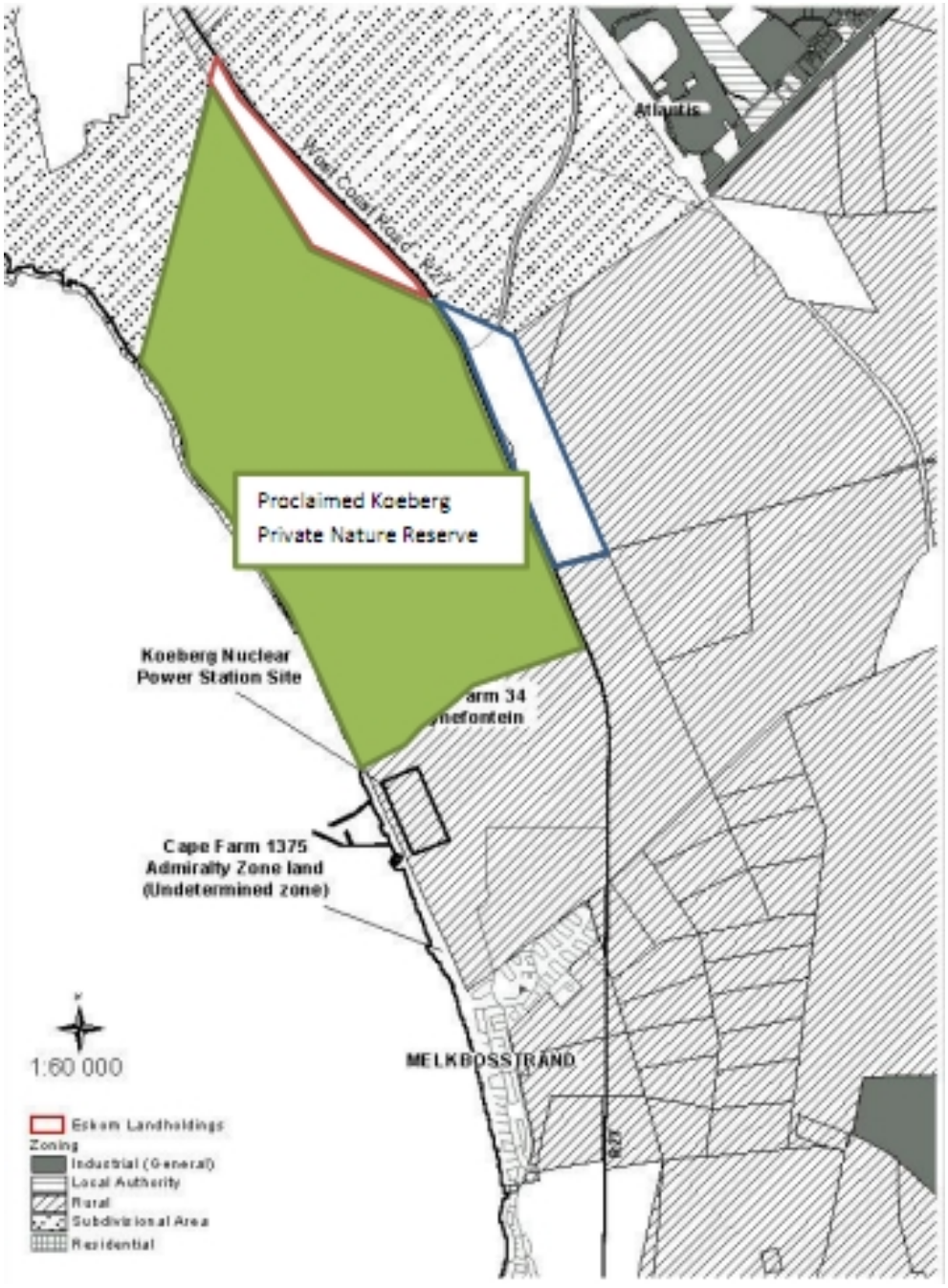

Figure 7.12: Locality Koeberg Private Nature Reserve *(Source: MLH Architects)*

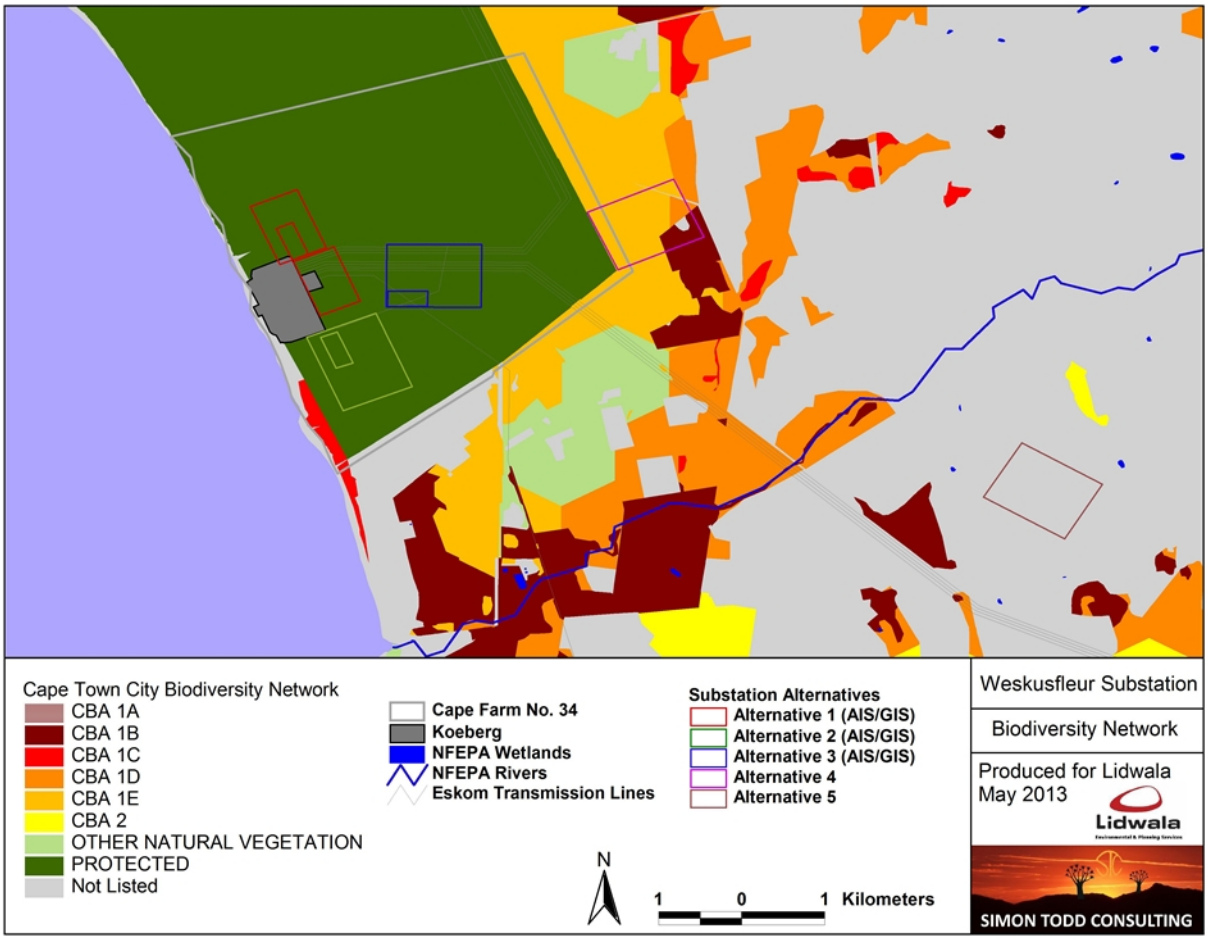

Figure 7.13. The Cape Town City Biodiversity Network (2013) map for the study area. Alternatives 1,2 and 3 all lie within a Critical Biodiversity Area delineated by the Eskom Koeberg property. Although the map indicates that these options fall within a protected area, this is not correct as the area around the power station is not included as part of the proclaimed Koeberg Private Nature Reserve (Figure 7.12). Alternative 4 lies within CBA Tier 1 areas and only Alternative 5 lies outside of an area considered important from a biodiversity and ecosystem process perspective.

7.3.5 Animal Life

Mammals

The site falls within the distribution range of 54 terrestrial mammals, of which 26 can be confirmed as being present based on the previous studies and the species list for the reserve provided by Eskom. An additional 19 are considered highly likely to be present, while the remaining 6 species are less likely to occur in the area. A number of the larger mammals present such as Springbok, Eland, Plains Zebra, Gemsbok and Blue Wildebeest have been introduced and apart from the Eland, would not have occurred naturally in the

area. The presence of these species in the reserve has a visible impact and the majority of the area is visibly grazed. While low levels of grazing may be beneficial for plant communities, prolonged heavy grazing has negative impacts and may promote the invasion of Fynbos by alien grass species as well as result in the loss of grazing-sensitive species. In this regard it is important to note that the natural density of herbivores in fynbos communities is low and that most fynbos communities are not well adapted to prolonged grazing by large herbivores. Within the reserve, the larger herbivores were observed to be concentrated on the previously transformed areas dominated by *stoloniferous* grasses such as *Cynodon* (kweek) and kikuyu (*Pennisetum clandestinum*).

Alternatives 1 and *2* would remove a significant portion of this habitat from the reserve and this should be taken into account when considering and revising the appropriate stocking rates of larger mammals in the Koeberg reserve. As the larger mammals present are already habituated to human presence, the presence of the new substation would in itself not create a significant disturbance source for these animals. The major impact of the development would be on smaller mammals which rely on cover for movement and protection from predators. The large open and cleared area associated with the substation would represent an inhospitable habitat for many species which would avoid area and if placed within an area with limited alternative movement pathways, could significantly disrupt habitat connectivity for such species.

Two listed species occur in the area, the Honey Badger *Mellivora capensis* (SARDB Endangered) and the White-tailed Mouse *Mystromys albicaudatus* (Endangered). As both these species are widely distributed in the country, the development would not constitute significant overall habitat loss for these species, but the transformed habitats would be least important in terms of the significance of local-level habitat loss.

Amphibians

The site lies within the distribution range of nine amphibian species, of which at least five are highly likely to occur at the site. The only listed species which may occur in the area is the Cape Caco *Cacosternum capense* which is restricted to low lying flat or gently undulating areas with poorly drained clay or loamy soils. There does not appear to be any suitable breeding habitat for this species at the site and especially within the vicinity of the proposed alternatives. Previous studies identified a number of natural and artificial seepages and wetlands at the site which would provide breeding habitat for most of the amphibians resident in the area. Species likely to be present include the Raucous Toad, Cape River Frog and Common Plantanna. Development within the transformed habitats is not likely to have a significant direct impact on amphibians. Potential impacts on amphibians would include pollution of breeding habitats from silty runoff or petrochemical or other pollutants associated with the operation of construction vehicles during the construction phase of the development as well as increased road traffic resulting in increased numbers of frogs being run over during periods of frog movement as may occur during the breeding season. There are no wetlands within the proposed sites themselves and it is not likely that any breeding habitats would be impacted by the proposed

substation. In the long-term the development would result in a small amount of habitat loss for amphibians which would be of minor consequence on the transformed sites.

Reptiles

The site lies in or near the distribution range of 48 reptile species, indicating that the reptile diversity at the site is likely to be of moderate diversity. According to the SARCA database 21 species have been recorded from the area, including three listed species. Listed species known from the area include the Cape Dwarf Chameleon *Bradypodion pumilum* and Southern Adder *Bitis armata* which are classified Vulnerable and the local endemic Bloubergstrand Dwarf Burrowing Skink *Scelotes montispectus* which is classified as Near Threatened and is confirmed for Koeberg (Harrison 1998). As with other fauna, the intact habitats are likely to be the most sensitive and Alternative 3 can be singled out as being the least desirable in terms of reptile impacts. For the burrowing species such as the Bloubergstrand Dwarf Burrowing Skink, hardened infrastructure is likely to represent a significant barrier to movement as such species seldom travel above ground or fall easy prey to predators when they do. The transformed habitats are likely to contain significantly lower reptile species richness than the intact habitats but certain species may still be active in such areas. This includes species such as Mole Snakes *Pseudaspis cana* which are common in transformed habitats where prey species such as gerbils are often abundant. Furthermore, although such areas do not offer viable habitat for many species, they do not pose the same level of obstacle as hardened infrastructure.

7.3.6 Avifauna

According to the Birds in Reserves Project hosted by the ADU, 126 species have been recorded within Koeberg Nature Reserve itself (http://birp.adu.org.za/site_summary.php?site=33401827). Species of significance include the Peregrine Falcon *Falco peregrinus*, African Marsh-Harrier *Circus ranivorus*, Black Harrier *Circus maurus* and Great White Pelican *Pelecanus onocrotalus*. All of these species are vulnerable to collisions with power lines to a greater or lesser degree and would potentially be negatively affected by any new power lines required to link the substation to the power station and grid. According to the SABAP 2 database, 193 species have been recorded from the quarter degree square 3318CB, based on 104 reporting cards which is a relatively high total indicating that the list is likely to be fairly comprehensive. Listed species which are known from the wider area include Secretarybird, Blue Crane, Greater and Lesser Flamingo and Lanner Falcon (**Table 7.4**). Impacts of the development would result from collisions and electrocution associated with the power line infrastructure as well as habitat loss resulting from the presence of the substation itself. Many larger, heavy-bodied species such as bustards, storks and cranes are especially vulnerable to collisions as their vision is poor in front of them and they lack the maneuverability to avoid power lines. Some smaller-bodied fast-flying species such as falcons are also vulnerable to collisions. Habitat loss would clearly be of greater significance at the Alternatives within intact vegetation and would be most severe for the smaller resident species. The length of any new power lines required to link the substation to the power station or the grid would also be of significance due to the Eskom

management practice of clearing or brush-cutting the vegetation beneath the power lines, which decreases the value of these areas as avifaunal habitat.

Table 7.4 Listed bird species known from the quarter degree square 3318CB, according to the SABAP 2 database hosted by the ADU.

English Name	Scientific Name	Status
African Black Oystercatcher	*Haematopus moquini*	NT
Cape Cormorant	*Phalacrocorax capensis*	NT
Crowned Cormorant	*Phalacrocorax coronatus*	NT
Great White Pelican	*Pelecanus onocrotalus*	NT
Black Harrier	*Circus maurus*	NT
Blue Crane	*Anthropoides paradiseus*	VU
African Marsh-Harrier	*Circus ranivorus*	VU
Peregrine Falcon	*Falco peregrinus*	NT
Bank Cormorant	*Phalacrocorax neglectus*	VU
Greater Flamingo	*Phoenicopterus ruber*	NT
Caspian Tern	*Sterna caspia*	NT
Secretarybird	*Sagittarius serpentarius*	NT
Lanner Falcon	*Falco biarmicus*	NT
Lesser Kestrel	*Falco naumanni*	VU
Cape Gannet	*Morus capensis*	VU
African Penguin	*Spheniscus demersus*	EN
Martial Eagle	*Polemaetus bellicosus*	VU

7.3.7 Surface Water

Quaternary Catchment

The alternatives all falls within the quaternary catchment G21B and in the Berg Water Management Area (WMA). Other catchments in the radius of the alternatives include G21A and G21F.

The water resources within the vicinity of the project alternatives include:

- Sout River; and
- Donkergat River; and
- Diep River

All these rivers are perennial. The Donkergat River is a tributary of the Sout River. The Sout and Diep River flow in a south-westerly direction towards the coast. No river channels drain the sites of the different alternatives, except for a small tributary of the

Sout River which run through the western corner of the proposed *Alternative 5* north of the Sterrekus Substation. No dams or reservoirs are present in the study area. **Figure 7.14** indicates the location of water resources in proximity to the proposed alternatives for the Weskusfleur Substation. **Figure 7.14** also indicates the proximity in relation to the identified National Freshwater Ecosystem Priority Areas (NFEPA) rivers and wetlands (Nel et al. 2011).

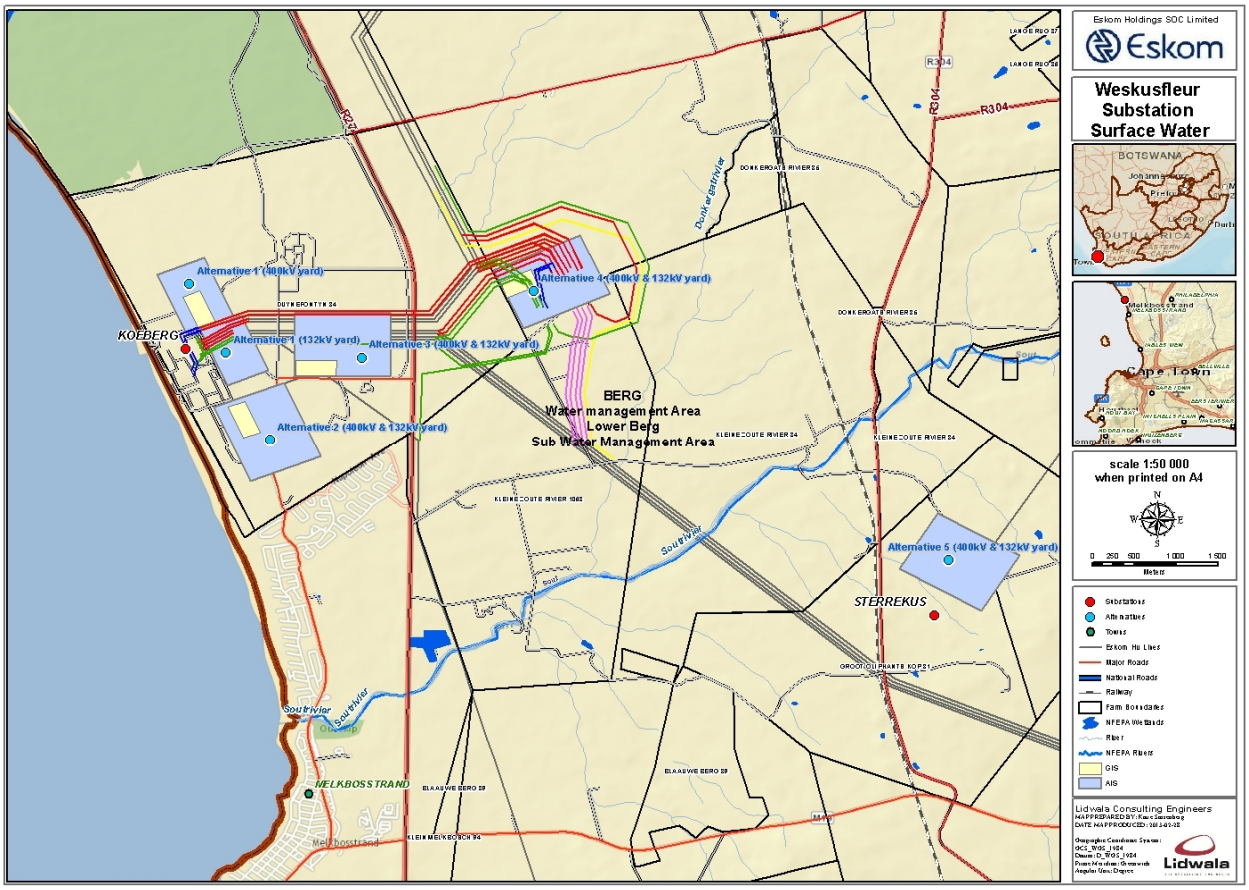

Figure 7.14: The location of water resources in proximity to the proposed alternatives for the Weskusfleur Substation.

Table 7.5 below provides a summary of the quaternary catchment characteristics. The high 'coefficient of variation' (CV) indicates that the river channels in these catchments are generally non-perennial (SRK, 2008).

Table 7.5 Summary of the quaternary catchment characteristics (*Source: SRK Consulting 2008*)

Quat. Catch.	Gross Area (km^2)	Forest Area (km^2)	Irrig. Area (km^2)	Evap. Zone	MAE (mm/a)	Rain Zone	MAP (mm/a)	MAR (mm/a)	MAP-MAR RESP.	NET MAR (Mm^3/a)	GROSS MAR (Mm^3/a)	CV
G21A	523	252	0.0	23C	1 450	G1D	408	32	4	8.0	16.6	1.372
G21B	304	154	3.8	23C	1 445	G2A	424	32	4	4.9	9.6	1.267
G21F	242	221	5.4	23C	1 430	G2A	488	54	4	12.0	13.1	0.823

Background Water Quality

From the numerous studies, investigations and monitoring information that is available on the subject, the following water quality issues are summarised for the Berg WMA:

- A significant water quality problem in the Berg River catchment is salinization in the middle and lower reaches. This is caused by leaching from the natural geology, which extends from the north of Paarl to the Berg River mouth, consists of Malmesbury shale, as well as agricultural practices and the wash-off of salts from irrigated and dryland agricultural lands.
- Borcherds Quarry and Athlone WWTWs discharge into the Black/Salt River and the Potsdam WWTW discharges into the Diep River, which feeds into the ecologically sensitive Rietvlei wetland system.
- These Salt River no longer display seasonal flow patterns, and have become severely modified. High residual nutrients can lead to eutrophication related problems such as nuisance algal growth and excessive growth of aquatic weeds (Western Cape IWRM Action Plan: Status Quo Report Final Draft).

Surface Water Quantity

Mean Annual Runoff

The mean annual precipitation (MAP) in the area is 200-400mm (UPD). The National Water Resource Management Strategy (2004) indicated that the MAR is 207mm for the Lower Berg Sub Area (**Table 7.6**). The quaternary catchment G21B MAP is 424mm.

The Mean Annual Runoff (MAR) for the primary watercourses draining the nearby catchments is 32 mm/a.

Table 7.6: The natural MAR for the Berg River WMA (*Source: DWA 2004*)

Component/ Sub-area	Natural MAR[1]	Ecological Reserve[1,2]
Greater Cape	373	61
Upper Berg	849	124
Lower Berg	207	32
Total for WMA	**1 429**	**217**

1) Quantities are incremental and refer to the sub-area under consideration only.
2) The total volume is based on preliminary estimates, with impact on yield being a portion of this.

Information from the previous studies (based on proximity to alternatives for this study) indicates the following calculated peak flows (m^3/s):

Table 7.7: Peak flows (m^3/s) adapted from previous assessments

Return Period	Alternative 1 & 2	Alternative 3	Alternative 4	Alternative 5
1:50	3.45	Not available	5.06	6.39
1:100	3.91	Not available	5.74	Not available
1:200	4.41	Not available	6.46	Not available

(Adapted from SRK Consulting 2008 & Eyethu Engineers 2004)

These peak flows have been calculated using the Rational Method and are indicative of the expected runoff downstream.

Flood Volumes

The Sout River is approximately 5 km from *alternatives 1-4* and 2 km from *alternative 5*. Initial indication is that floodlines and flood levels will not play a significant role in terms of the current identified alternatives for the proposed type of development.

It should be indicated that a detention facility have been constructed below the Sterrekus Substation at *alternative 5* to prevent flooding below the substation, erosion of sand and silting of a tributary of the Salt River. A high runoff has been experienced from the hard surfaces and increased flow volumes from the substation drainage leaving the substation. Design rainfall data has been used to determine the capacity of the detention facility.

Water Authority

The Department of Water Affairs act as the Regional Water Authority through their office that is located in Bellville. The City of Cape Town is the appointed Water Service Provider who has the responsibility to supply potable water to the area.

Wetlands

The location of wetlands on the sites and the extent thereof and their significance as well as their biological diversity has been determined in previous studies (PBMR and Nuclear 1) for example. A separate specialist study will confirm and determine these in the EIA phase and will be integrated in further surface water studies. **Figure 7.15** indicates the location of wetlands on the Koeberg Nuclear Power site.

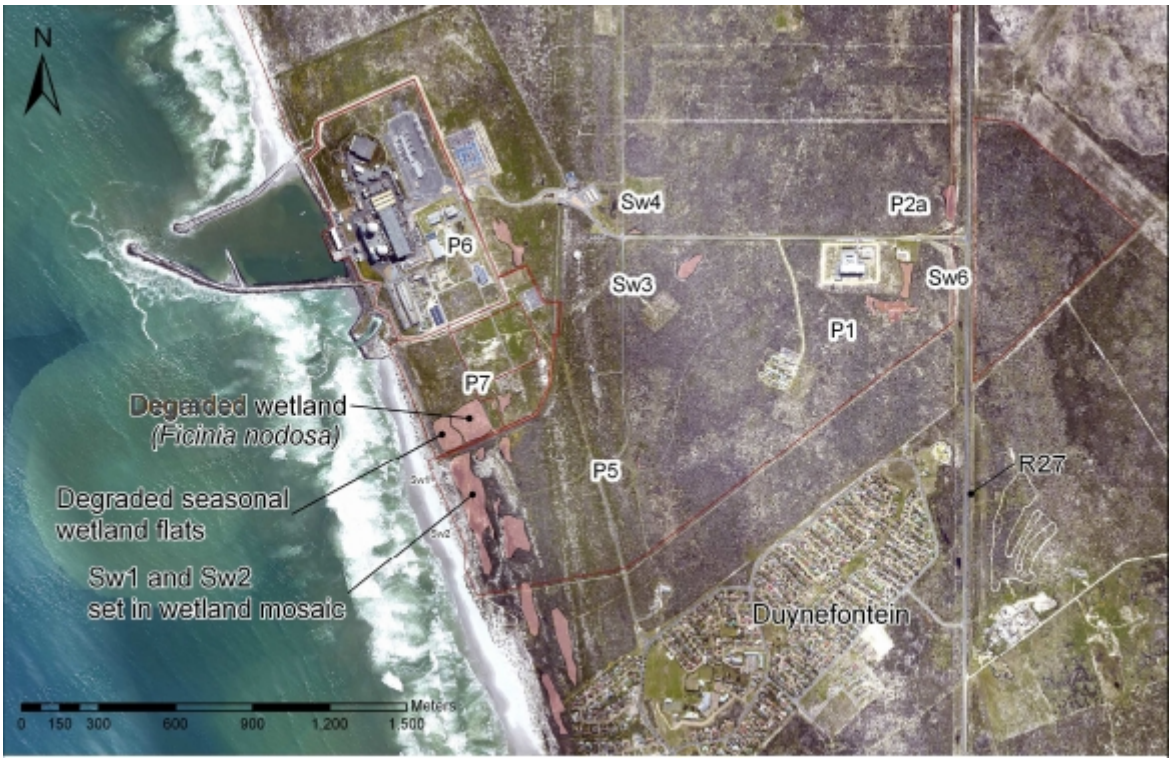

Figure 7.15: The location of wetlands on the Koeberg Nuclear Power site (*Source The Fresh Water Consulting Group)*.

None of these wetlands are located on one of the proposed alternatives although wetlands are in close proximity of *Alternative 2* and also south of *Alternative 3* where the PBMR project was proposed.

7.3.8 Heritage

Cultural heritage

According to Hart (2010), Hermanus Dempers (1799) was the first owner of Duynefontein, but it is unclear who the first grantee was. Tenants were apparently awarded certain land rights in 1731, and paid rent to the Cape Government at the time. When the property was surveyed in 1834, there is no indication of houses or any built structures. The site of Dempers house is not known as is that of any of his tenants. According to Hart (2010), it is possible that ephemeral evidence of its presence may lie under the dune sands somewhere on the property, although this is unlikely. Hart (2010) has argued that Duynefontein is not a farm that played any significant role in the Colonial history of the Cape.

Groot Oliphantskop (site *Alternative 5*) was first granted in 1773, but may have been used as a grazing farm prior to this (Orton & Hart 2004). The homestead, including outbuildings is dated to the late 18th or early 19th Century (Kaplan 2006), but the surrounding rural cultural landscape has been compromised by construction of the Eskom Sterrekus Omega substation.

Brakke Fontein No. 32/1 (*Alternative 4*) was first granted in 1855, but it is likely that the area, which included a number of other farms, was already inhabited during Dutch reign in the Cape sometime between 1652 and 1759. According to Geldenhuys (2012), it appears that the farm was used as, a cattle grazing farm when it was first granted. Geldenhuys (2012) notes that the whole area was called Slagtersvled during that time as Governors from the Dutch East India Company (VOC) used to send out hunters on their behalf to hunt behind the `Blaauwe Berg'.

Fossil heritage

Fossiliferous deposits dating to the Miocene period (about 5-6 million years ago) were first encountered during geo-technical excavations at the KNPS in the 1970s, and in the years since then, Duinefontein has been firmly established `as a highly sensitive (paleontological) site' (Hart 2010).

Fossiliferous marine gravels, known as the `Duynefontein Member' of the Varswater Formation contain a diversity of fossils including teeth, bones and scales of sharks, rays and bony fish, fossil whale bone, dolphin and seal teeth, marine birds, terrestrial mammals, and reptiles. Plant pollens in thin peaty sands cap the Varswater Formation. These peaty sands (remnants of coastal vleis) are in turn overlain by a gravelly sand unit (the `Gastropod Bed') containing gastropod casts and shark teeth. The `Springfontyn Formation', a mix of fine and course sand varying in colour upwards, contains some terrestrial fossils of middle Pleistocene (about 300-400 000 years old) age. Calcareous sands and limestone (known as the Langebaan Formation) cap the `Springfontyn Formation' and it is in these deposits that the Pleistocene fauna and associated Middle Stone Age artefacts occur. Windblown sands of the Witsand Formation finally seal these deposits on the surface (Hart 2010).

Archaeological heritage

Melkbosstrand, south of the KNPS, is known for its rich archaeological heritage (Kaplan 1993; Rudner 1968). More than 40 Archaeological Impact Assessments (or AIAs) have been undertaken in the surrounding area as part of the EIA process. Sites ranging from Later Stone Age (LSA) coastal shell middens, deflated sites with pottery, stone implements and ostrich eggshell, and ancient Early (ESA) and Middle Stone Age tools have all been documented in the coastal zone, and further inland in an agricultural context. At Duinefontein, scatters of LSA tools, shellfish, bone, hearth features and cultural remains have been encountered in the dunes in the nature reserve (Klein 1975; Hart 2010), but that these types of sites are quite sparse and ephemeral.

But it is undoubtedly the archaeological excavations at Duinefontein 2, north of the KNPS that established the name as a `place of world class scientific discovery' (Hart 2010:27). The site was first discovered in 1973 when fragments of fossil bone were uncovered during geotechnical excavations for the power station and has been excavated annually between 1998 and 2003. Duinefontein 2 produced a wealth of Pleistocene fauna (about 300 000 years old), and associated MSA implements on old buried land surfaces (Cruz-Uribe et al 2003; Klein et al 1999).

Hart (2010 and 2013 pers. comm.) argues that Duinefontein 2 was not a fortuitous discovery, and that similar deposits lie buried beneath the windblown sands of the Witsand Formation, in what he calls the Nuclear - 1 Corridor both north and south of the reactor, in which site *alternatives 1* and *2* are proposed.

Burials

While no unmarked or buried pre-colonial human remains have yet been uncovered at Duinefontein/KNPS, Melkbosstrand has produced an extremely high density of burials (Morris 1992). To date more than 55 Khoisan human remains have been recovered from the coastal dunes between Milnerton and Melkbosstrand (Kaplan 2013; Orton 2010). Two burials associated with stone tools and ostrich eggshell beads were also excavated from a large sand dune on the farm Groot Oliphantskop (Kaplan 1996). Most of the unmarked human remains were routinely uncovered during excavations for water pipelines, substations, building foundations, roads and other bulk services.

7.3.9 Visual Aspects

Zone of Visual Influence (ZVI)

A viewshed was generated for each of the site alternatives for 10 m height above ground level to represent the smaller structures, and 35 m above ground level to represent the larger structures and transmissions lines. The viewshed of the proposed project was overlaid onto the Koeberg Viewshed, which was generated from the Koeberg site at an averaged representative height of 50m above ground level (**Figure 7.16)**. Refer to visual impact scoping report **Appendix J** for viewshed maps for the different alternatives.

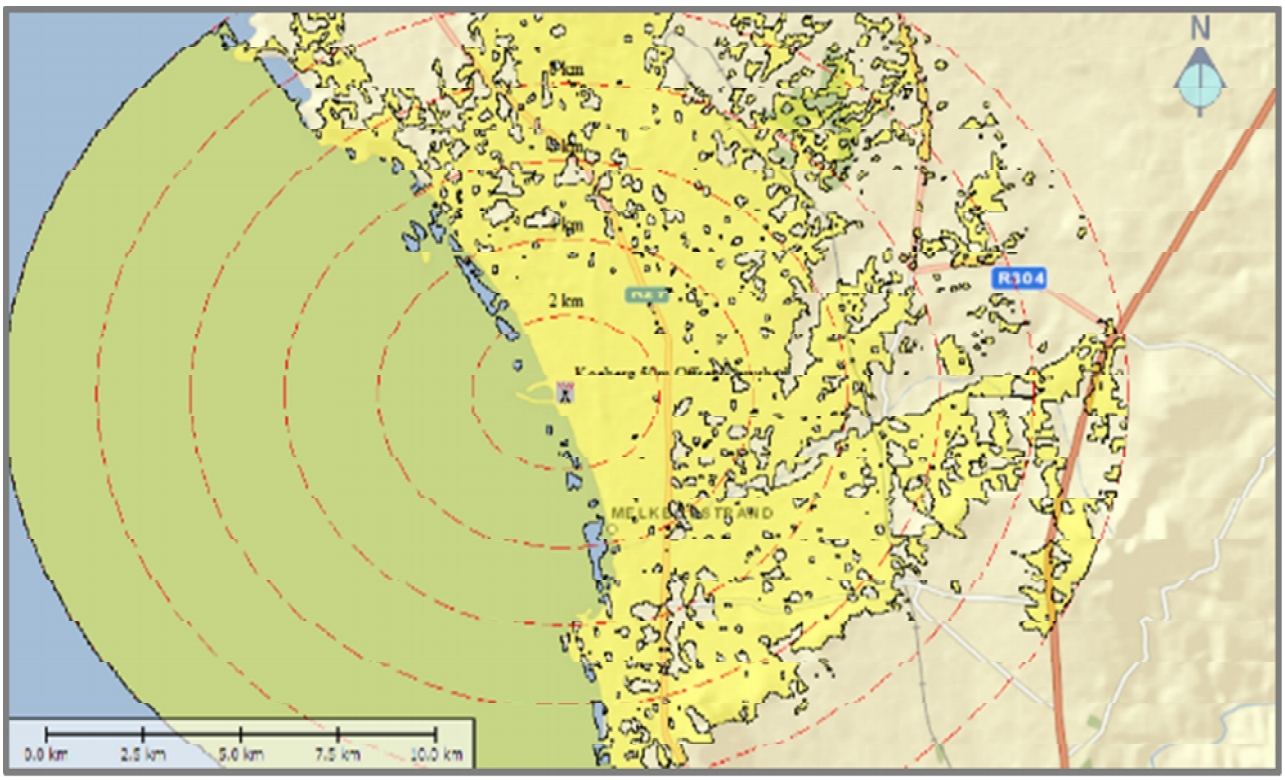

Figure 7.16: Koeberg 50m Offset Viewshed Map

The viewshed survey found that the viewshed of *Alternatives 1, 2 & 3* mirrored the existing Koeberg viewshed, as a result of their close proximity to the existing Koeberg Power Station. Their area coverage was less than the existing Koeberg viewshed, and their proposed project zone of visual influence would not extend into new areas.

Alternative 4 is located offsite and to the east of the R27. As a result, the viewshed patterning differs from that of the Koeberg viewshed. Hence, its and the zone of visual influence would expand to small pockets to the south of the site, but only should a large structure be constructed. The existing precedent for transmission lines on the *Alt 4* site is strong. Hence, new powerlines in the area will not generate high levels of visual contrast. Due to the already high levels of visual contrast generated by the existing Koeberg Power Station, it is likely that visual intrusion from a similar type of electrical landscape modificaiton would not be percieved as visually intrusive.

Alternative 5 is also located away from the Koeberg visual complex, but is in close proximity to the existing Sterrekus substation, which already generates strong levels of visual contrast within the immediate surroundings. However, the substation infrastructure is of a diffuse nature. The site does have precedence for large structures (like the proposed Busbar). As indicated in the viewshed analysis, the proposed structure of 40m would extend the zone of visual influence of the existing substation into agricultural areas to the north west of the site.

The Visual Absorption Capacity (VAC) is defined as the ability of the receiving landscape to absorb physical changes without the wholesale transformation in its visual character and

quality. The Koeberg complex site has a high VAC, as it is defined by large structures, many transmission lines, roads, surrounding buildings and communication towers which generate higher levels of visual contrast. The site further away has moderate VAC levels. The proposed sites viewed against the backdrop of the Koeberg complex. The only site which has low VAC levels is that of *Alt4*, which is fairly open and removed from large forms.

Due to the height of the proposed structures in relation to the generally flat surrounding terrain which is covered with small fynbos type vegetation, the viewshed for all sites were found to be high with the exception of the *Alt1* GIS and *Alt5*. *Alt1* GIS is topographically screened to the east and north by the surrounding dunes of medium height, and to the south by the Koeberg complex which obscures any views by southern receptors. *Alt5* is located in a shallow topographic depression with raised ground to the east and south, and a long line of gums trees which screens much of the views of the site to the west.

The Zone of Visual Influence is defined as 'the area within which a proposed development may have an influence or effect on visual amenity.' Due to the higher VAC levels created by the existing Koeberg complex, the ZVI for most sites is moderated. The exceptions are sites *Alt2* AIS and *Alt3* AIS which are located in the 'buffer' zone between the R27 and Duinefontein receptors. The buffer zone has essentially become a strong feature of the local sense of place and as such the influence fo these sites would be more strongly noticed or experienced.

Scenic Quality

Scenic quality was assessed for all sites using the Visual Resource Management (VRM) scenic quality criteria of landform, vegetation, water presence, colour, adjacent scenery, scarcity of the landscape within the surrounds and existing cultural modifications. These criteria were rated from 1 (low value) to 5 (high value) and then assigned a Scenic Quality category based on the total score. Due to the close proximity of either the Koeberg or Sterrekus complex, no category A landscape were defined. *Alternative 1, 2* (AIS) and *3* were defined Category B (Moderate) due to higher vegetation ratings which added value to colour and scarcity. *Alternatives 2* (GIS), *4* and *5* were rated Category C (Low) due to the low ratings for vegetation and low ratings for adjacent scenery. *Alternative 4* is covered with alien vegetation which limits colour variation, is bordered on two sides by transmission corridors and is common in the region.

Receptor Sensitivity

The receptor sensitivity to landscape changed was assessed making use of the VRM questionnaire. Criteria assessed were exposure, type of users, the amount of use, public interest, adjacent users concern for visual integrity and whether the area is zoned as special land use. *Alt1* GIS and *Alt2* GIS were rated medium due to the close proximity to the Koeberg complex. *Alt1* AIS was rated high as the site intrudes into the sensitive dune fields to the north of Koeberg in the Koeberg Private Nature Reserve. *Alt2* AIS, *Alt3* GIS and AIS were rated high due to closer proximity to the R27 and Duinefontein residential receptors where the buffer zone between the power station and the residential area has

been incorporated into the local sense of place. *Alt4* AIS was rated medium due to the closer proximity to the existing two transmission corridors which have degraded the landscape character to some extent. Although *Alt5* is in close proximity to the Sterrekus substation which detracts from the landscape character, the site is surrounded by a strong agricultural sense of place. Some farmstead residential nodes located in the vicinity would increase sensitivity to landscape change.

Visual Resource Management

Evaluation of the suitability of a proposed landscape modification is undertaken by means of assessing the proposed modification against a predefined management objective assigned to each class. The Visual Resource Management (VRM) class objectives are defined as follows:

1. The Class I objective is to preserve the existing character of the landscape, where the level of change to the characteristic landscape should be very low, and must not attract attention. Class I is assigned to those areas where a specialist decision has been made to maintain a natural landscape.
2. The Class II objective is to retain the existing character of the landscape and the level of change should be low. Management activities may be seen, but should not attract the attention of the casual observer.
3. The Class III objective is to partially retain the existing character of the landscape, where the level of change should be moderate. Management activities may attract attention, but should not dominate the view of the casual observer.
4. The Class IV objective is to provide for management activities which require major modifications of the existing character of the landscape. The level of change to the landscape can be high.

The Class II visual objective, which requires low levels of landscape change in order to protect the visual resources of the area, were defined for *Alternatives 1* (AIS), *2* (AIS, *3* (AIS and GIS). Implementing the proposed project in these areas would generate high levels of visual contrast and a strong change in landscape character would be felt by the surrounding receptors. The other sites were defined as Class III and would allow for moderate levels of visual contrast, with the exception of *Alternative 2* GIS which is located on transformed land in close proximity to the Koeberg power station. This site was defined as Class IV which could absorb high levels of landscape change without affecting the surrounding area's sense of place or landscape character.

Key Observation Points

To define the Key Observation Points (KOPs), potential receptor locations were identified in the viewshed analysis, and screened, based on the following criteria:

- Angle of observation
- Number of viewers
- Length of time the project is in view
- Relative project size

- Season of use
- Critical viewpoints, e.g. views from communities, road crossings
- Distance from property

Making use of the above criteria, the following receptor locations were identified:

- *Alt1*: R27
- *Alt2*: Edward Crescent and Jacobs Crescent
- *Alt3*: Jacobs Crescent and R27
- *Alt4*: Farmsteads and R27
- *Alt5*: Farmsteads and Mamre Road

Alternatives 1, 2 & 3 - R27 scenic route

The R27 is a national road linking Cape Town to the northern tourist and industrial area of Saldanha Port and Langebaan. It is a scenic route, used by tourists as being well as a main transport route for industry. Due to the undulating sand dunes between the receptor and site, the views of the substation as seen from this location would be screened. The views of the power lines would extend to the north but would not significantly alter the landscape character as the powerline views are already strongly established.

Alternatives 2 - Residential Dwellings in Jacobus Crescent

The view from the northern Melkbosstrand residential dwellings as seen from Jacobus Crescent indicates the open space between the residential area and the power station which has become a component of the local residential area sense of place. Changes to the landscape character would be strongly experienced.

Alternatives 2 & 3 - Edward Crescent Beach

Edward Crescent beach is halfway along the Melkbosstrand beach and the view point is located between 1 and 3km from the proposed *alternative* sites *1 – 4* and about 6 km from *Alternative 5*. It is a popular tourist and local beach.

Alternative 4 - Farmsteads

Located on the routing line for the proposed *Alt4* transmission lines are four dwellings which would be exposed to high levels of visual intrusion to the new powerline routing.

Alternative 5 - District Road

The M19 is an east-west link route between the north-south coastal routes of the R27 and the N7 to the west. Both these routes are important tourist routes and the M19 would carry tourist traffic and should be treated as a tourist view corridor. The landscape character should be protected from significant landscape change.

Figure 7.17: Photo plate of the general landscape

7.3.10 Social Environment

The study area falls within the Western Cape Province between Blouberg and Atlantis. The distance of towns from the Koeberg Power Station is: Blouberg = 17,2km, Atlantis = 12,6km, Melkbosstrand = 5,5km and Duinefontein = 2, 2 Km. The R27 (provincial road) is located just south of Koeberg.

The total population of City of Cape Town is 3 740 025 as of 2011 growing at about 2.6% per annum. The local population has a youthful age structure and the immediate significance of this young age structure is that the population will grow rapidly in future and this implies a future high growth rate in the labour force. At present the local economy is unable to provide sufficient employment opportunities to meet the needs of the economically active population. A youthful population structure also implies a relatively higher dependency ratio.

There are 1 068 572 households in the Municipal area. The Municipality is made up of 28 suburbs and townships which are Atlantis, Bellville, Blue Downs, Blouberg, Bracken fell, Cape Town, Crossroads, Durbanville, Eerste Rivier, Elsie's, Elsie's River, Fish Hoek, Goodwood, Gordon's Bay, Guguletu, Hout Bay, Khayelitsha, Kraaifontein, Kuils River, Langa, Melkbosstrand, Mfuleni, Milnerton, Mitchell's Plain, Noordhoek, Nyanga, Parow, Simon's Town, Somerset West Strand. The main administrative office is situated in Cape Town City.

Key Developmental challenges and trend

- Urbanisation -Cape Town is experiencing rapid urbanisation as a result of both natural growth and in-migration. The city's population expanded by 36,4% between 1999 and 2007, and growth in 2010 was estimated at 3% per annum
- Natural and cultural environment and resource capacity- the rapid increase in the population rate puts pressure on the resources, such as water, electricity and sanitation
- The population growth rates tend to be much higher than the economic growth rate, which implies that the economy is unable to produce sufficient employment opportunities to absorb new entrants to the labour market.

Spatial Location and Description and the Economy

The City of Cape Town Metropolitan Municipality is located in the Western Cape Province. The municipal area is 2,461 km² in size and strategically located on a macro scale on the west coast which is a point of entry to South Africa from the entire world. Approximately 3 740 025 (2011 census) people currently live in City of Cape Town which is classified as a Urban Municipality with a density of 67 persons/km². The Municipality's spatial strategies and land use management decisions are based on the spatial trends, analysis and the land

use management scheme. The following spatial issues will be analysed: Land use, Engineering services and Transportation

The City's economy does not operate within municipal boundaries. Cape Town's economy is interdependent with that of the province, and more specifically, the cities and towns that are within a 50 km radius of Cape Town. A review conducted in 2008 by the Organisation for Economic Co-operation and Development (OECD) defines a broad area (including Saldanha, Malmesbury, Paarl, Stellenbosch and Hermanus) as the city's functional region. Key regional economic interdependencies include a commuting labour force, shared consumer catchment area, transport infrastructure, and a second port located at Saldanha, as well as the agricultural and tourism areas surrounding the city.

As the regional market is relatively small in global terms, linkages to national and international markets are important for city firms. These connections and the efficiency of the port, airport and other city logistics systems are thus critical for economic growth. External freight movement is dominated by land-based freight to and from Gauteng. Approximately ten times more freight enters or leaves the city along the N1 corridor than along the N2 or N7 corridors.

The other major regional infrastructure in Cape Town includes Cape Town International Airport (CTIA). As the airport becomes busier and expands its capacity, the demand it places on infrastructural land-side support systems is increasing, and its environmental health implications for surrounding land uses may become cause for concern.

Economic drivers

- Tourism and hospitality;
- Business and financial services;
- Media, film and knowledge industries;
- Warehousing, distribution, freight logistics;
- Trade (wholesale and retail);
- Food and agro-processing;
- Industrial/manufacturing;
- Retail.

Employment Status

The employment/ unemployment statistics of the Municipality are taken from the census 2011 provincial/municipal report. Unemployment refers to the statistics of those individuals who are actively looking for a job but are not in any type of paid employment. **Table 7.8** below shows that in general unemployment is higher amongst black communities as compared to White. This suggests that there is still a need to empower Black Communities.

Table 7.8: Unemployment Rate (%)

Race group	Population	Number of unemployed	Unemployment rate
Black	1 024 871	233 126	34.54%
Coloured	1 078 456	150 263	22.67%
White	409 264	14 173	4.71%
Asian	38 443	2 350	9.91%

Source: census, 2011

It is evident from **Table 7.8** above that the majority of the people are employed in the services sector within the City of Cape Town Municipality.

Tourism

Cape Town has a rapid growing tourism industry and has a lot of natural, historical and cultural resources. Cape Town has a history of many intertwining threads and layers both shady and bright, from the city's cosmopolitan trade roots under Dutch, and then British with the oldest building being the castle of good hope. There is also a cultural and historical and technology museums in and around the city. There are botanical gardens. And mostly importantly the Robin island.

The following are some of the key existing natural and cultural resources that need to be preserved, promoted and developed into Tourism attraction sites from a District level:

- Table Mountain;
- The Cape Fynbos, one of the richest veld types in the world (The world is roughly divided into 6 floristic kingdoms and the Cape Fynbos is the richest in biodiversity). It is however also the most threatened.
- Robben island – heritage;
- The Good Hope Castle – heritage;
- Kirstenbosch National Botanical Garden – Cape Fynbos;
- Two oceans Aquarium – oceanographic;
- District Six – heritage;
- Iziko South African Museum;
- Seal Island, South Africa – natural;
- Cape Point Vineyards – wine and culture.

Some conclusions:

- From the scoping exercise it is obvious that the CCTMM area is under pressure due to all sorts of developments and proposed developments. Population increase is extremely high and therefore pressure on natural resources seems unavoidable;
- From an tourism point of view the CCTMM is highly ranked worldwide and specific attributes are highly valued as part of the tourism industry;

- The Cape Fynbos is seen as very important to many tourist groups and more specialist nature groups. Due to the high impact already experienced all available natural pieces of land still present in the lower areas, coastal and plains, are seen as important conservation areas. Reference can be made to the Plattekloof first registered Natural Conservation site in the early 1990's by Frank van der Kooy (Pr Sci Nat). The land under the power lines certain rare species were found and therefore the management practices changed to encourage the Fynbos to re-establish and those species protected. (*Serruria aemula*, Strawberry Spiderhead, critically endangered).

Plattekloof powerlines between Monte Vista and Edgemead. Good example of how urban conservation can happen in co-existence of some development.