5 PROJECT ALTERNATIVES

5.1 Introduction

The consideration of project alternatives is a key requirement of an EIA as it provides a basis for choice for the competent authority and I&APs. The NEMA EIA Regulations of 2006 define alternatives in relation to a proposed activity as "*different means of meeting the general purpose and requirements of the activity, which may include alternatives to the –*

(a) property on which or location where it is proposed to undertake the activity;

(b) type of activity to be undertaken;

(c) design or layout of the activity;

(d) technology to be used in the activity; and

(e) operational aspects of the activity;"

Alternatives are considered as a means of reaching the same need and purpose as the originally proposed project in a way that minimises its negative and maximises its positive impacts. Alternatives that are considered must be reasonable and feasible.

This section describes the alternatives that have been considered during the EIA Phase. These include the following:

- Location of the power station;
- Forms of power generation;
- Nuclear plant types;
- Layout of the nuclear plant;
- Fresh water supply and utilisation of abstracted groundwater;
- Management of brine;
- Intake of sea water;
- Outlet of water and chemical effluent;
- Management of spoil material;
- Access to the proposed sites; and
- The no-development alternative (i.e. 'No-Go').

The alternatives that have been considered are only presented in this Chapter. An assessment of the alternatives and recommendations on the preferred alternatives, based on the assessment of impacts undertaken by the specialists, is contained in Chapter 9 of this EIR.

5.2 Location of the NPS

The consideration of alternative locations for the proposed Nuclear-1 power station was derived from the findings of the Nuclear Site Investigation Programme (NSIP) study undertaken by independent consultants during the 1980s and the findings of the Scoping Phase of this EIA process. Details pertaining to the above-mentioned studies are briefly discussed below. This section also outlines the response of the Department of Environmental Affairs (DEA) to the recommendations made in the Scoping Report. Thereafter, the sites considered as feasible and reasonable alternative locations for the proposed power station are discussed further.

5.2.1 The outcome of the NSIP undertaken during the 1980s

The Scoping Phase of the EIA process documented the NSIP, commissioned by Eskom and aimed at identifying the most suitable sites for location of nuclear power stations in South Africa. The NSIP included a wide range of specialist studies, such as engineering, social science, geology, ecology and town planning.

The primary objective of the NSIP was to identify sites along the coastline of South Africa, suitable for the construction and operation of future nuclear power stations. The NSIP comprised of three phases, where Phases 1 and 2 involved desktop studies, which assessed the general suitability of regions located along the coast. Subsequent to this, specific sites within the identified regions were earmarked for further detailed investigations. Phase 3 involved field investigations of those sites, identified during the preceding phases, by various specialists. Field investigations were undertaken in order to determine the suitability and sensitivity of the sites identified and culminated in the identification of five suitable sites, namely:

- Brazil (Northern Cape);
- Schulpfontein (Northern Cape);
- Duynefontein (Western Cape);
- Bantamsklip (Western Cape); and
- Thyspunt (Eastern Cape).

5.2.2 The outcome of the Scoping Phase of the EIA process

The EIA team, comprising the lead consultants and specialists, undertook site visits to each of the five sites in order to obtain an overview of the potential environmental risks and key impacts associated with the proposed NPS. Risks and key impacts associated with the construction, operational and decommissioning phases were identified and addressed in consultation with I&APs. Potential negative impacts identified during the Scoping Phase included the following:

- Geological and geotechnical suitability;
- Depth of water table and associated dewatering requirements as well as the repercussions in terms of surrounding water users;
- Source of water supply for operations of the NPS;
- Disturbance and disruption of terrestrial ecological processes such as loss of habitat and associated flora and fauna. The disruption of faunal migration patterns between the coast and inland as well as mobile dunes;
- Marine ecology disturbance through requirements for cooling water, the potential for desalination and activities associated with the disposal of brine;
- Health, safety and security of the site as well as limitations on surrounding land use;
- Changes to community structures through the influx of workers and associated infrastructural requirements;
- Change in tourism activities;
- Visual disturbance;
- Loss of heritage and cultural resources;
- Loss of potential agricultural land;
- Wind generated dust;
- Construction of required facilities and infrastructure associated with accessibility to the site, transport as well as the integration of the generated power into the networks;
- Security; and
- Waste handling and management.

The power generated by any technology must be integrated into the existing networks in an efficient and strategic manner. There are two primary aspects pertaining to the integration of power, namely integration into the national grid, and exportation of the excess power to areas outside of the local network. Integration of the power on a local level, to supply the local area network requires a number of transmission lines, either 400 kV or 750 kV, linking into the main load substations or transmission nodes. The export of power requires either the development of new transmission line corridors or the utilisation of existing corridors through the necessary reinforcements.

The investigation undertaken during the Scoping Phase highlighted that the Brazil and Schulpfontein sites would require the:

- construction of new power corridors; and
- exportation of the majority of the power to areas of demand, given the limited local demand.

In light of the above and for the reasons outlined below, the Brazil and Schulpfontein sites were deemed unsuitable for Nuclear-1 and were therefore excluded from further assessment during this EIA.

Reasons for the exclusion of Brazil and Schulpfontein were as follows:

- Optimal, strategic and cost effective utilisation of existing infrastructure associated with the Duynefontein, Bantamsklip and Thyspunt sites, with respect to the local integration and exportation of power via existing power corridors;
- Lengthy time delays associated with the authorisation and construction of the new power corridors applicable to the Northern Cape sites, which will prevent Eskom from providing power within the required timeframes;
- Unnecessary environmental impacts associated with the construction of new power corridors given that there is existing infrastructure at the other three potential sites; and
- Cost implications associated with the development of new power corridors at the present time.

Despite Brazil and Schulpfontein's proposed exclusion from the EIA Phase for Nuclear-1, this does not preclude these sites from consideration in the future. The three site alternatives taken forward for further assessment in the EIA Phase of this project are Duynefontein, Bantamsklip and Thyspunt (**Figure 5-1**).

5.2.3 DEA's response to the proposed exclusion of Brazil and Schulpfontein

The then DEAT provided a formal response to the Nuclear-1 Scoping Report and Plan of Study for EIA on 20 November 2008 (**Appendix B2**). DEAT approved the proposed exclusion of the Brazil and Schulpfontein sites for the purposes of the Nuclear-1 EIA and acknowledged that these sites may, however, be subject to future investigations for future nuclear power generation developments.

Figure 5-1: Three sites deemed suitable for further consideration in the EIA Phase of the EIA process

5.2.4 Sites identified for detailed assessment in the EIA Phase

The following section provides a brief description of the three sites deemed suitable for further consideration in the EIA Phase of the EIA process.

(a) Duynefontein

The site is located adjacent and to the north of the existing Koeberg NPS, which is situated on the Cape West Coast, approximately 35 km north of Cape Town (**Figure 5-2**). The proposed site falls within the existing Eskom-owned property (which includes the site of the existing Koeberg NPS) as well as the Koeberg Nature Reserve. Eskom has for many years engaged in a process of removing alien vegetation from the Eskom-owned property and introducing game onto the property.

The existing infrastructure on the Eskom-owned property includes the following:

- Koeberg has two 900 MW Pressurised Water Reactors (PWR) units, with a total output of 1 800 MW;
- Associated infrastructure including bulk stores,
- Transmission lines;
- Nature conservation centre;
- Visitors centre; and
- Weather station.

The Duynefontein site will increase the existing installed capacity in this power pool thus increasing the concentration of power generation in this area for the Western Cape. It is close to the existing main transmission infrastructure and the power will connect directly to the Cape Peninsula loads with excess power evacuated via the main transmission system to the north.

Figure 5-2: View of Duynefontein looking east towards the coast, with the existing Koeberg NPS visible in the left background

(b) Bantamsklip

Bantamsklip is situated along the Southern Cape coast located approximately mid-way between Danger Point and Quoin Point (**Figure 5-3**). The site for the proposed Nuclear-1 forms a part of the total Bantamsklip property. The proposed site is vacant and only utilised for activities such as flower harvesting, as well as fishing and illegal harvesting of abalone.

The Batamsklip site also increases the power pool generation capacity in the Western Cape, but is located relatively far from the existing transmission infrastructure. Thus significant new transmission lines will be required to first connect it to the main transmission system before the power can be distributed either to the Western Cape loads or to the north.

Figure 5-3: View of the eastern portion of Bantamsklip

(c) Thyspunt

Thyspunt is situated in the Eastern Cape on the coast between the towns of Oyster Bay in the west and St. Francis Bay in the east (**Figure 5-4**). The site for the proposed Nuclear-1 NPS is currently vacant. There are a number of houses on the adjacent properties but these are far outside the proposed emergency planning zone (EPZ) of 800 m from the NPS. To the north of the sand dunes, which span the northern portion of the site, the dominant land use is diary farming.

The Thuyspunt site will provide a completely new generation pool for the Eskom transmission system to supply both the Eastern Cape loads as well as export excess power to the rest of the network. Besides the advantages of diversity of generation the Thuyspunt site will link up to the new transmission lines under construction to Port Elizabeth, thus maximising the benefits of the new transmission infrastructure, as well as provide a voltage controllable busbar in the Eastern Cape, which is of significant value to the operation of this network and the transmission system as a whole.

Figure 5-4: View of the coastal portion of Thyspunt looking east

5.3 Forms of power generation

The alternative activity type assessment was undertaken during the Scoping Phase and the results thereof are captured in **Chapter 8** of the **Final Scoping Report** (FSR). A brief summary of the findings is provided hereunder, together with additional information of relevance to alternative forms of power generation.

In order for Eskom to achieve its objectives, Eskom requires a reliable source of power generation that will supply a consistent base load that can be efficiently integrated into the existing South African power network. Only certain electricity generation technologies are presently commercially available, although not necessarily financially viable in South Africa, based largely on the availability of resources (fuel) and geographical constraints. The range of viable technologies, which were discussed and compared during the Scoping Phase of the EIA, is listed in **Table 5-1**.

Table 5-1: Summary of electricity generation technologies that are commercially available, but not necessarily financially viable for Eskom

Development Phase	Technology
Proven base load technologies	Conventional coal (pulverised fuel)
	Light Water Reactor NPSs, which include Pressurised Water Reactors and Boiling Water Reactors
	Fast Breeder Reactors
	Heavy Water Reactors
	New coal-based technologies: • Fluidised bed combustion; and • Supercritical coal stations
	Imported hydro-electric energy
	Combined Cycle Gas Turbine (CCGT) (insufficient quantities of fuel are available)
Proven peak load technologies	Open cycle gas turbine (OCGT)
	Pumped storage schemes
	Hydro-electric generation on the Orange River
Proven (non-dispatchable)	Wind
Demonstration	Pebble Bed Modular Reactor (PBMR) (Nuclear)
	Underground Coal Gasification (UCG)
	Concentrated Solar Thermal and its storage capability
Research	Tidal energy and ocean currents
	Biomass

5.4 Nuclear plant types

Table 5-2 depicts the five reactor technologies that Eskom short-listed following the screening phase, which occurred in 2006/7. The table provides a list of the various technologies and the salient features associated with each reactor type.

Table 5-2: Summary of Eskom's short-listed nuclear plant type technologies

REACTOR TYPE	TECHNOLOGY	PLANT TYPE	SALIENT TECHNICAL FEATURES
Light Water Reactors	**Pressurised Water Reactor**	**AP1000**	Reactor Thermal Power : 3 400 MWt Electrical Power Output: approximately 1140 MWe Safety systems such as: Passive core cooling system (PXS) Passive containment cooling system (PCS) Control room emergency habitability systems (VES) Containment isolation Efficiency (overall): 33.53%
		EPR	Reactor Thermal Power: 4 616 MWt Electrical Power Output: approximately 1 650 MWe Safety systems such as: Three protective barriers Core Catcher Safety injection system In-containment refuelling water storage system (IRWST) Efficiency of 35.75%
		RSA 1000	• Reactor Thermal Power : 2 895 MWt • Electrical Power Output: 1 020 MWe • Safety Aspects: o Several interconnecting systems resulting in various complex failure mechanisms o Proven technology with more likely design base incident optimized as a result of OE. o Operator intervention only necessary after 20 minutes. Overall efficiency: ~33%
	Advanced Boiling Water Reactor	**ABWR**	Reactor Thermal Power: 3 992 MWt Electrical Power Output: approximately 1 371 MWe Safety systems such as: Vessel-mounted recirculation pumps Fine motion control rod drives Advanced digital and multiplexed instrumentation and control system Efficiency: Unknown with present data Overall efficiency: 34.34%

REACTOR TYPE	TECHNOLOGY	PLANT TYPE	SALIENT TECHNICAL FEATURES
Heavy Water Reactors	**CANDU**	**CANDU-6**	Reactor Thermal Power: 2100 MWt Electrical Power Output: approximately 700 MWe Safety features such as: Defence in depth design approach incorporate tri-level passiveness Preventative boundaries (safety systems are separated physically and functionally) and two independent shutdown systems are built in at different levels Efficiency: 33.33%

At the time of writing, Eskom had not yet chosen a preferred vendor for the supply and installation of PWR technology. Thus, Eskom has identified an "envelope" that defines the full range of different technologies, in terms of their footprints and the emissions to air, land and water that they may cause. The envelope represents a "worst case scenario" of potential impacts from a NPS. The envelope was presented in the form of a "consistent dataset" that was provided to all specialists, to serve as the basis for their assessment.

The envelope data are as indicated in **Appendix C**. Only the key features of the envelope are indicated in **Table 5-3**.

Table 5-3: Key features of the Nuclear-1 NPS envelope

	Unit	Envelope
Auxiliary Steam Boiler		
Auxiliary Steam Boiler (x3)	t/h	32
Diesel Storage Tanks (x2)	m³	230
Chlorination		
CRF (Main Cooling Water)		
Normal Operation-Continuous	mg/kg	2.00
Shock (3x/day for 15 min)	mg/kg	4.00
Continuous consumption rate	kg	13 565
Shock consumption rate	kg	848
Total consumption rate	kg	14 413
Civil Works		
(Existing landscape)		
Maximum height above MSL	m	14
Minimum height above MSL	m	6
Sand removal for Construction	m³	15 000 000
Finished Terrace above MSL	m	10
Desalination Plant		
Will the sea water needed be taken up through the uptake pipes used for cooling water?		Not initially. Will later be incorporated when the intake basin is complete
What input volume of water will be needed and how does it compare to the uptake of cooling water	m³/day	9 000 maximum = 0.14% of

	Unit	Envelope
		intake
Output of plant (earth works)	m³/day	3 x 3 000
Output of plant (Construction)	m³/day	1 x 600
Output of plant (operation)	m³/day	2 x 2 000
Brine		
Input	ppm	35 000
Output	ppm	59 000
Diesel Generators		
(Per nuclear unit)		
Emergency Diesel Generators		
Number of generators	each	4
Output Capacity	MW	8
Diesel storage arrangement		Run at rated power for 72 hours
Testing hours per week	h	2.00
Diesel storage tanks	kl	1 000
Dose Rates		
Radiation Worker		
Normal Operation		
(For Power Station)		
100m	nSv/h	0.30
300m	pSv/h	27.00
1000m	pSv/h	0.20
Incident Conditions		
100m	nSv/h	2.50
300m	nSv/h	0.20
1000m	pSv/h	1.60
Public Radiation		
(For Power Station)		
Normal Operation	mSv	0.10
Incident and Accident	mSv	10.00
Electrical and thermal characteristics		
(per unit)		
Gross Electrical Output	MWe	1 784
Net Electrical Output	MWe	1 650
House Load	MWe	134
Thermal Output	MWth	4 616
Efficiency	%	35.75%
Availability	%	
18 months	%	91.5%
First 2 years	%	91.5%
Power factor at generation terminals		0.90
Employees on Site		
Please note that this will be the maximum number of employees per group. The peak will not be at the same time for all groups		

	Unit	Envelope
Eskom project staff		140
Consultants		40
Vendor staff		2 172
Vendor construction workers		5 000
Eskom operation staff		1 385
Housing		
General Facilities		
Land requirement	ha	44.2
Vendor Staff		
Land requirement	ha	89.5
Total vendor construction staff	ea	2 172
Eskom Project Personnel		
Land requirement	ha	12
Total Eskom project staff	ea	140
Consultants	ea	40
Vendor Construction Workers		
Land requirement		65.7
Workers on site	ea	5 000
% Local	%	25
Workers require housing	ea	3 750
Intake / Outfall Structure		
Intake		
Distance off shore	m	1000 to 2000
Number of Tunnels (for power station)	ea	1 or 2
Diameter of tunnels	m	5 to 10
Water velocity at intake	m/s	approx 1,0
Water velocity in tunnel	m/s	approx 3,0
Depth of tunnels	m	Approximately 30
Spoil		Placed in Rock Retaining Wall and unsuitable material to be used to level HV yard. Any additional will be transported to a suitable approved location off site
Outfall		
Outfall type		Can be off shore via tunnels or out flow like Koeberg.
Tunnel alternative		
Number of tunnels	ea	3 to 4
Diameter of tunnels	m	approximately 3
Distance off shore	m	approximately 500

	Unit	Envelope
Depth Of Tunnels	m	approximately 5
Water velocity at the outfall	m/s	approx 1,0
Gas turbines (only at Thyspunt)		
General specifications		
Gross Output Power (2off)	MW	25.30
Gross Efficiency	%	34.00
Fuel mass flow	kg/s	1.74
Noise		
Average sound attenuation @ 1m from the package and 1,5m above ground	dB(A)	85
After additional sound damping	dB(A)	80
Stack		
Gas		Ventilation
Location of release point;	ft	Next to reactor
Height of release above ground;	m	96.00
Vent tip diameter;	m	3.00
Gas exit volume	m³/min	
Exit gas velocity (normal)	m/s	5.80
Exit gas velocity (outage)	m/s	6.35
Exit gas temperature (winter)	℃	Ambient
Exit gas temperature (summer)	℃	Ambient
Gas Turbine Exhaust Gas		
Exhaust gas mass flow	kg/s	85
Exhaust gas temperature	℃	538
Gas Composition		
N_2	%Vol	74.80
O_2	%Vol	13.90
CO_2	%Vol	4.20
H_2O	%Vol	6.20
Ar	%Vol	0.90
SO_2	%Vol	0.00
Nuclear fuel		
Enrichment of fuel (by weight)	%	4.95
Rods / assembly	each	265
Assemblies / load	each	241
Fuel active height	m	4.20
Fuel assembly pitch	m	0.215
Mass of fuel rod	kg	2.80
Mass of assembly	kg	780
Total assembly mass in reactor	ton	187.98
Duration of fuel in reactor	months	18
Spent fuel over lifecycle (Approx)	ton	1 880
(Approx)	m³	468
Nuclear waste		
Low level waste / year	Steel drums	470
Mass of steel drums (approx)	kg	50-100
Intermediate level waste / year	Concrete	160

	Unit	Envelope
Mass of concrete drums (approx)	ton	6.3
Number of trucks to transport the low and intermediate level waste / year	each	The existing Eskom lorry / trailer at Koeberg can take 80 steel drums at a time plus 3 concrete drums. We transport at our own and Necsa's convenience to ensure it is optimised for both parties. As there is a lot of storage space, when and how often we transport is not an issue. We stay away from school holidays and rainy season as part of the road is not tarred.
Primary energy		
Eskom coal usage	ton/MWh	0.56
Reactor pressure vessel		
Design pressure	bar	167
Design temperature	℃	351
Reactor power	MWth	4616
Coolant Pressure	Mpa	15.50
Hot leg temperature	℃	330.00
Cold leg temperature	℃	295.20
Seismic design		
Peak Ground Acceleration (PGA)		
Horizontal		0.25
Vertical		0.19
Sewer		
People during construction	ea	8 000
Water consumption / person / day	l	120
Sewer plant to treat 70% (rounded)	m³/day	750
Waste water treatment plant		
Potentially active waste (SEK/KER): 6 tanks	m³	750
Potentially active waste TER: 2 tanks	m³	750

The EIA investigation have been based on this "envelope" of NPS characteristics, and any NPS design that conforms to this envelope will by implication be acceptable at the recommended site.

5.5 Layout of the nuclear plant

Preliminary site 'envelope' layouts of the power station footprint were developed by Eskom for each site. These layouts were provided to the EIA team and were subsequently refined to address some of the issues and concerns that the specialist raised during the specialist integration workshop held on the 25 August 2008, at a second integration meeting with a smaller group of specialists held on the 26 September 2008 (both during the Scoping Phase of the EIA process), as well as a specialist integration workshop held on 24 and 25 November 2009, during the EIA Phase.

One of the main changes that were made to the layout was the shifting of the proposed power station from 100 m from the ocean to at least 200 m from the high water mark. This shift was to allow for the maintenance of ecological corridors, whilst also limiting the impact on sensitive dunes and heritage features, across all sites. The setback from the high water mark will also assist in preventing impacts on the station due to a sea level rise associated with climate change. The proposed layouts have allowed for three slightly different positions for the proposed power station and associated infrastructure[1]. Each layout indicates a position for Nuclear-1 with subsequent expansions. The position for Nuclear-1 could be in either of the proposed areas for expansion provided. The specialists assessed the entire possible footprint area (EIA corridor) and provided recommendations on mitigation measures, areas of high sensitivity and no-go areas.

Figure 5-5 to **Figure 5-7** provide an indication of the proposed layout of the nuclear plant at the three alternative sites. The "EIA Corridor" on these plans indicates the area within which a power station can be placed. Adjacent to the corridor is an area indicated for the possible placement of the High Voltage (HV) yard. Three possible positions for the HV yard are indicated. In the case of the Bantamsklip alternative site, an area of the EIA corridor is indicated as being subject to land purchase. This land does not currently belong to Eskom, but it could be purchased in future. This area has been included in the assessments of all specialists.

In the case of all alternatives sites, the EIA corridor is large enough to accommodate additional units based on the specifications in the "consistent dataset" below. A single power station consisting of 2 to 3 units may be placed anywhere within the EIA corridor.

It is important to note that there are constraints with respect to the Emergency Planning Zones (EPZ) that determine how far a power station position can be moved on the sites. In the case of all three alternative sites, there will be an EPZ with a radius of at least 800 m from the power station. Thus the power station can be moved no closer than 800 m from the closest road, as no public access is allowed within the EPZ.

[1] It must be noted that the final position of the nuclear power station will be determined following the appointment of the final vendor and the detailed investigations on the inter-site geological conditions and there positions proposed by the specialists and EAP are to be used as a guideline. Should the position have to be shifted outside that proposed in this EIR additional assessments would need to be undertaken by Eskom.

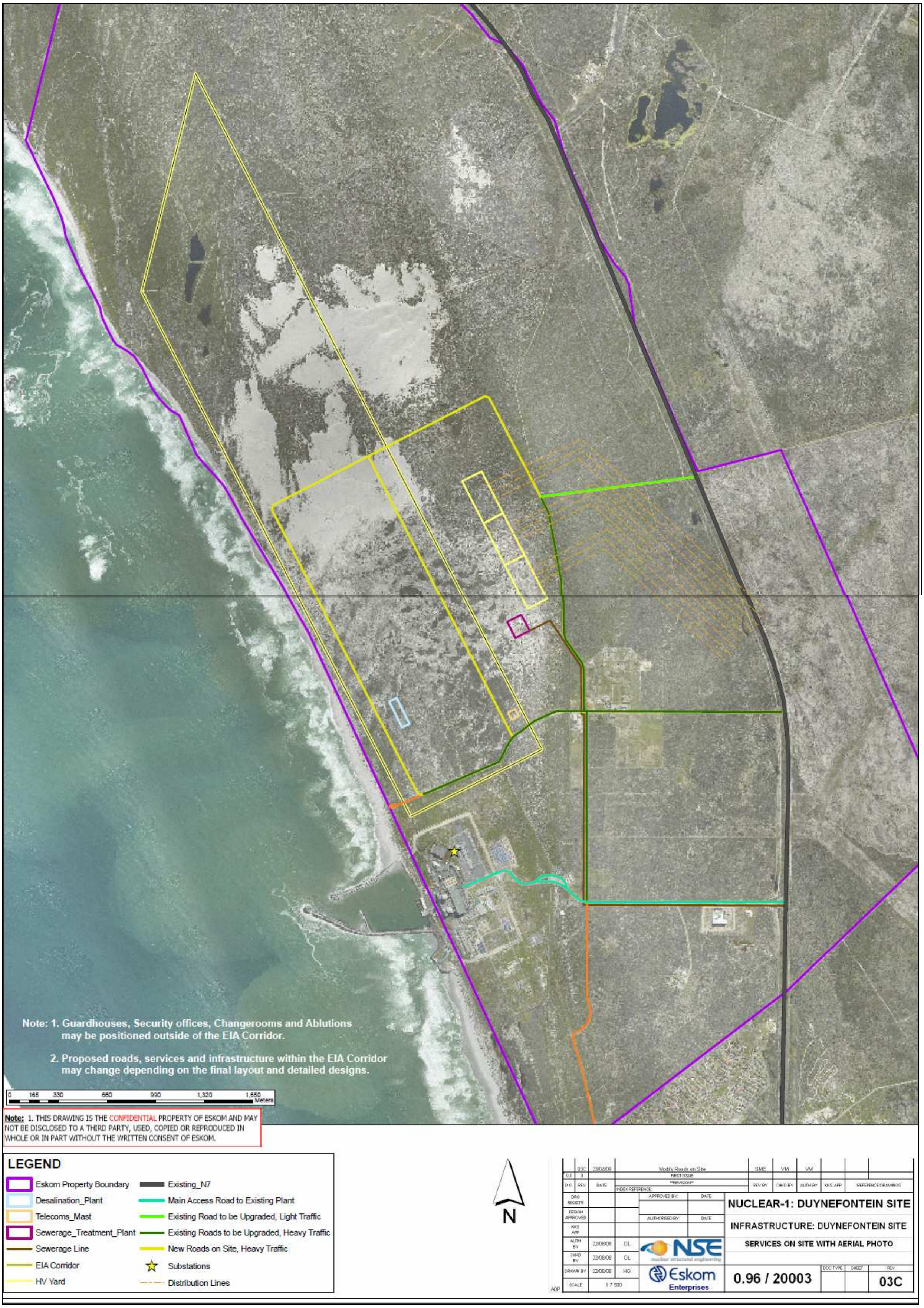


Figure 5-5: Nuclear-1 EIA corridor at Duynefontein

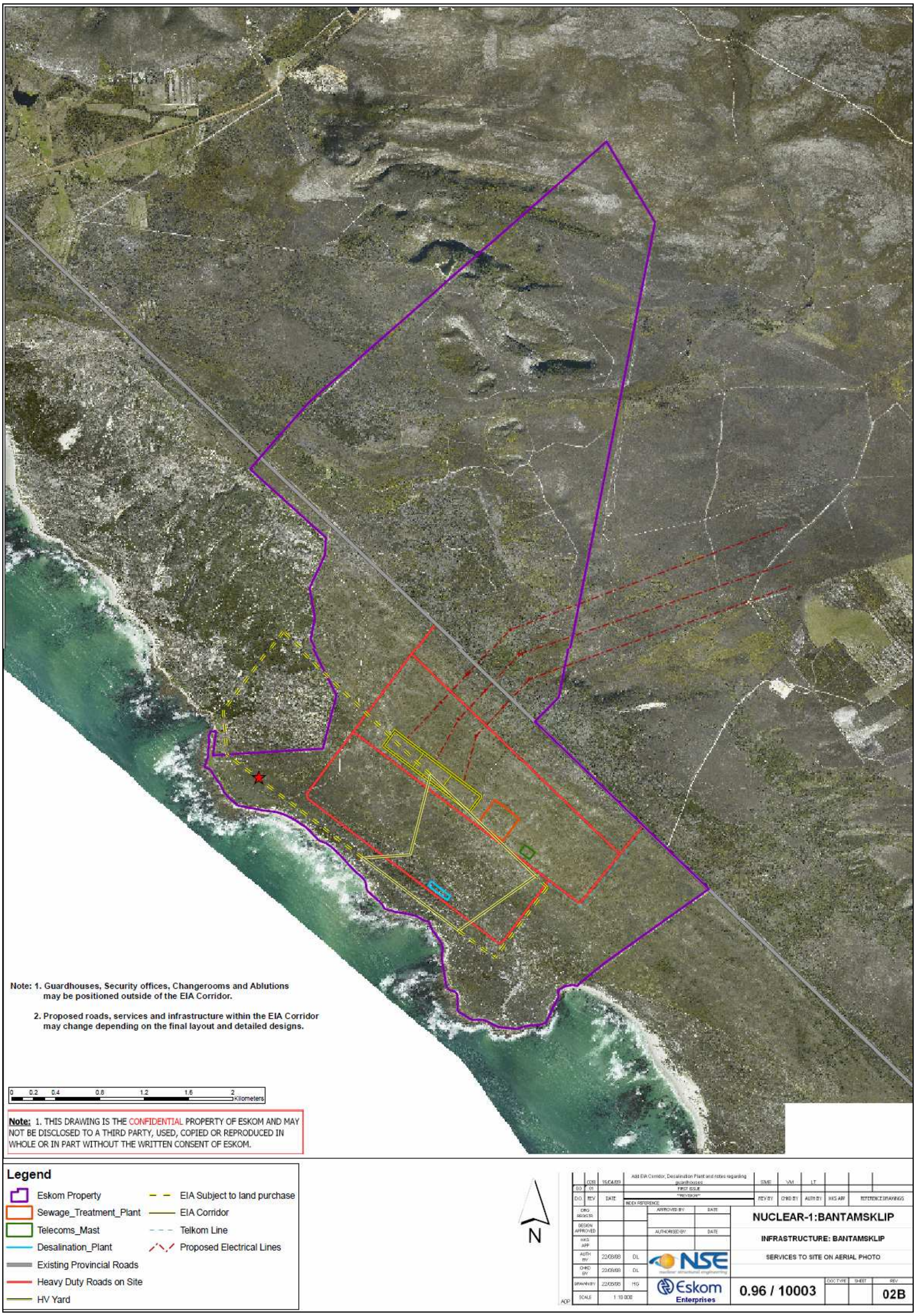


Figure 5-6: Nuclear-1 EIA corridor at Bantamsklip

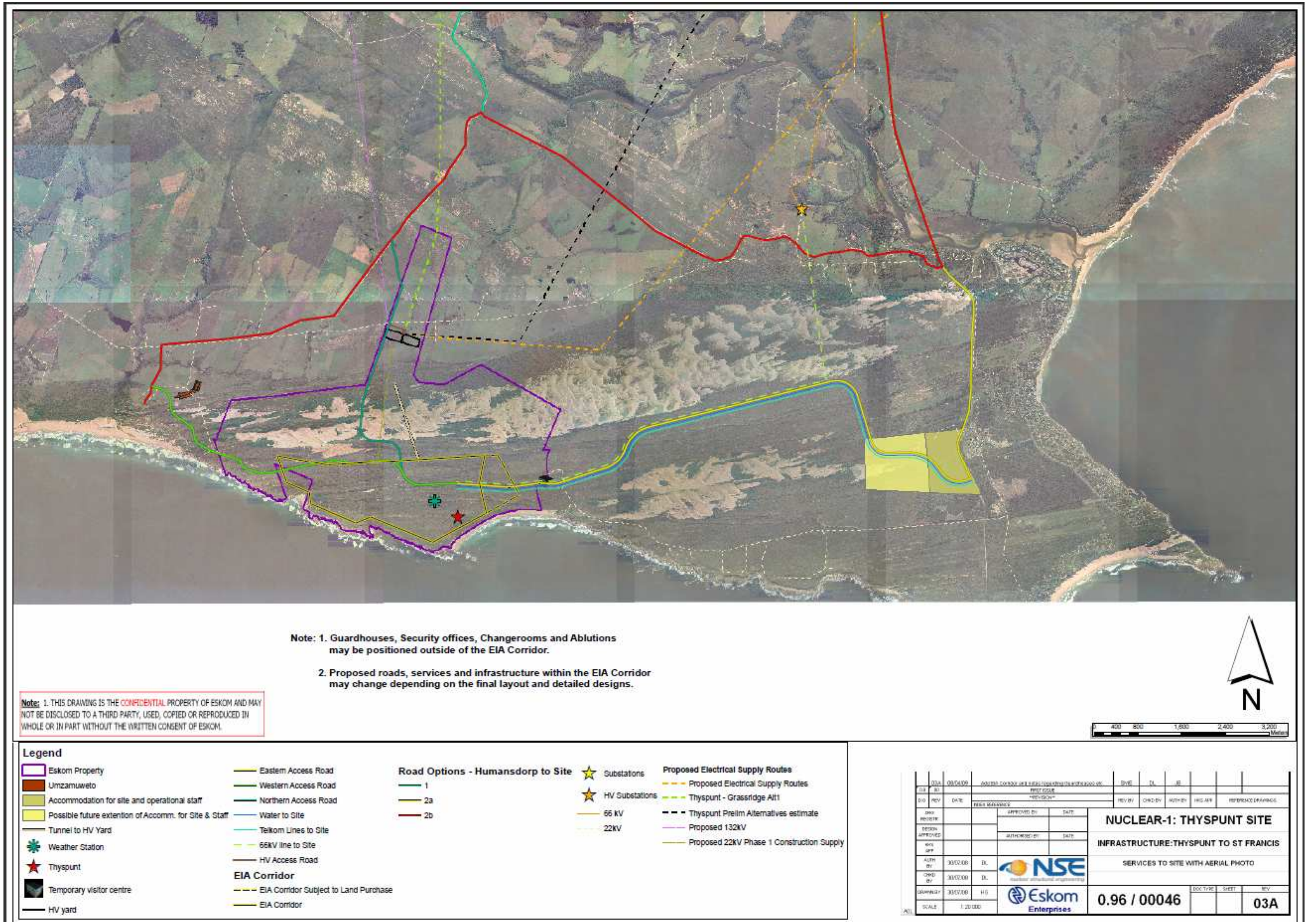


Figure 5-7: Nuclear-1 EIA corridor at Thyspunt

5.6 Modes of transport for the construction phase (Bantamsklip only)

Road transport was the only mode of transport considered for delivering construction materials, including heavy and extra-heavy loads, to the proposed alternative sites for Nuclear-1. However, ocean-based transport of materials was also considered for the Bantamsklip site due to the inability of current road transport system (particularly bridges) between Cape Town and Bantamsklip to cope with heavy and extra heavy loads. Barging was therefore considered as an alternative early on the design process for the Bantamsklip alternative site. This would require the construction of suitable landing facilities on the beach at the Bantamsklip site.

The two transport alternatives for the construction (only in the case of Bantamsklip) are therefore:

- Road transport; and
- Barging.

5.7 Utilisation of abstracted groundwater

As part of the excavations required to establish the power station, it may be necessary to lower the water table around the excavation by means of dewatering. The extent of dewatering is determined by the elevation of the ground water below the natural ground level. This varies amongst the three alternative sites.

The fate of the abstracted groundwater will be determined by the total volume of water abstracted over the duration of the construction period. Three alternative uses for the abstracted groundwater were considered and are discussed in this section, namely:

- Transfer to the municipal water system;
- Storage and utilisation;
- Discharge to sea.

5.8 Fresh Water Supply

The groundwater abstracted as a result of dewatering during the construction phase, will occur over a relatively short period of time and would therefore not sustain the water requirements for the duration of the operational phase of the power station. Based on the limitations and projections of the water resources in the three water management areas, it was necessary for Eskom to consider alternative water sources applicable to each of the three sites. The following alternatives have been explored for the three alternative sites (not all alternatives are relevant to each of the sites).

- Use of underground water;
- Municipal water supply;
- Desalination;
- Obtaining water from local rivers and/ or water transfer schemes.

5.9 Management of brine

The desalinisation process results in the creation of brine (concentrated salt) as a waste product, which must be utilised and/or discarded. This section considers two potential alternatives for utilising/discarding the brine emanating from the desalinisation plant during the operational phase of the NPS.

The following two alternatives were considered:

- Disposal of brine directly into the sea; and
- Co-disposal of brine and cooling water into the sea.

5.10 Intake of Sea Water

The basis for locating a NPS at the coast is access to large volumes of water required to cool and condense the steam that drives the turbines. Alternative methods to obtain the water are:

- Utilising the existing intake structures at Koeberg NPS; and
- Installation of intake tunnels and inlet structures.

5.11 Outlet of water and chemical effluent

Two alternatives have been considered for the outlet of the water that is used to cool and condense the steam that drives the turbines. These are a:

- Near shore outfall; and
- Offshore outfall tunnel.

5.12 Management of spoil material

The development of the nuclear plant (Nuclear Island and turbine hall), the intake basin and associated tunnels will entail extensive excavations. The extent of the excavations will be determined by the depth of the soil profile overlying the bedrock and will therefore vary amongst the sites. The quantities of spoil that will be excavated are vast and thus, alternatives for disposal and/or utilisation warrant further consideration. This section discusses seven alternatives for the discard/utilisation of the spoil. It should be noted that a combination of alternatives may be required in order to completely discard the full volume of the spoil material.

The following alternatives have been considered:

- Discard in the sea;
- Discard on land;
- Development of rock retaining walls;
- Development of terraces;
- Building of dunes;

- Levelling of the HV yard (only applicable at Thyspunt); and
- Commercial uses of the spoil.

5.13 Access Routes to the Proposed Sites

5.2.5 Duynefontein

The Duynefontein site can be accessed via the following three currently unsignalised access routes (**Error! Reference source not found.**), namely:

(a) R27 / Main Access Road

This access route operates as a main access point to the Duynefontein site. The road will require an upgrade and the transportation study recommended that this intersection is signalised by 2016.

The PBMR construction lay down area is proposed to be located opposite the Duynefontein site on the eastern side of the R27. It is therefore recommended that the eastern leg of the R27 / Main Access Road intersection is constructed by 2013 to allow for access to the PBMR lay down area, should this project receive the required approvals.

(b) R27 / Emergency Access Road

This access route operates as an emergency access point only. The road will also require an upgrade. According to the transportation study, this access point was recommended for construction vehicle access in order to isolate the Nuclear 1's construction vehicle impact on the normal traffic operations of the Koeberg power station as well as from the proposed PBMR construction traffic.

(c) Narcissus Avenue / Ou Skip Road

This operates as a secondary access to the Koeberg NPS and is not recommended as a primary access route.

5.2.6 Bantamsklip

At present, there is no formalised access to the site, off the R43. It is recommended that access to the site occurs via a new access road that must be constructed as a T-junction intersection directly off the R43. There are no other feasible access alternatives at Bantamsklip.

5.2.7 Thyspunt

Currently, the site can be accessed from Oyster Bay via a gravel track or from the R330 in the vicinity of Sea Vista. Three alternative access roads are provided to the site, of which two will be utilised.

(a) Eastern Access Road from St. Francis Bay

This access road from the east turns off the R330 in the vicinity of Sea Vista and proceeds between the two dunes to the site. The route selection of this road minimises the impact of the road on the wetlands that it traverses while respecting the 100 m exclusion zone to the dunes. This road will be designed for the purpose of all access to the site for both construction vehicles and power station personnel. As such, this road will also be designed to carry the super load vehicles to be used for the transportation of the heavy load plant items. The R330 is currently tarred and the road and bridges are of a good standard.

(b) Western access road

This access road originates near Oyster Bay from the west that turns off the 1730 gravel road in the vicinity of Oyster Bay. The route selection of this road is aimed at minimising the impact of the road on the dunes, as it runs close to the coastline, while respecting the 100 m exclusion zone to the high water mark.

(c) Northern “panhandle” access route

The northern access route turns off the Oyster Bay – Humansdorp road (a dirt road) and entrers the “panhandle” section of the site, and then runs down the western boundary of the panhandle. It then crosses the mobile dune system south of the panhandle before swinging east and then south again, before entering the EIA corridor.

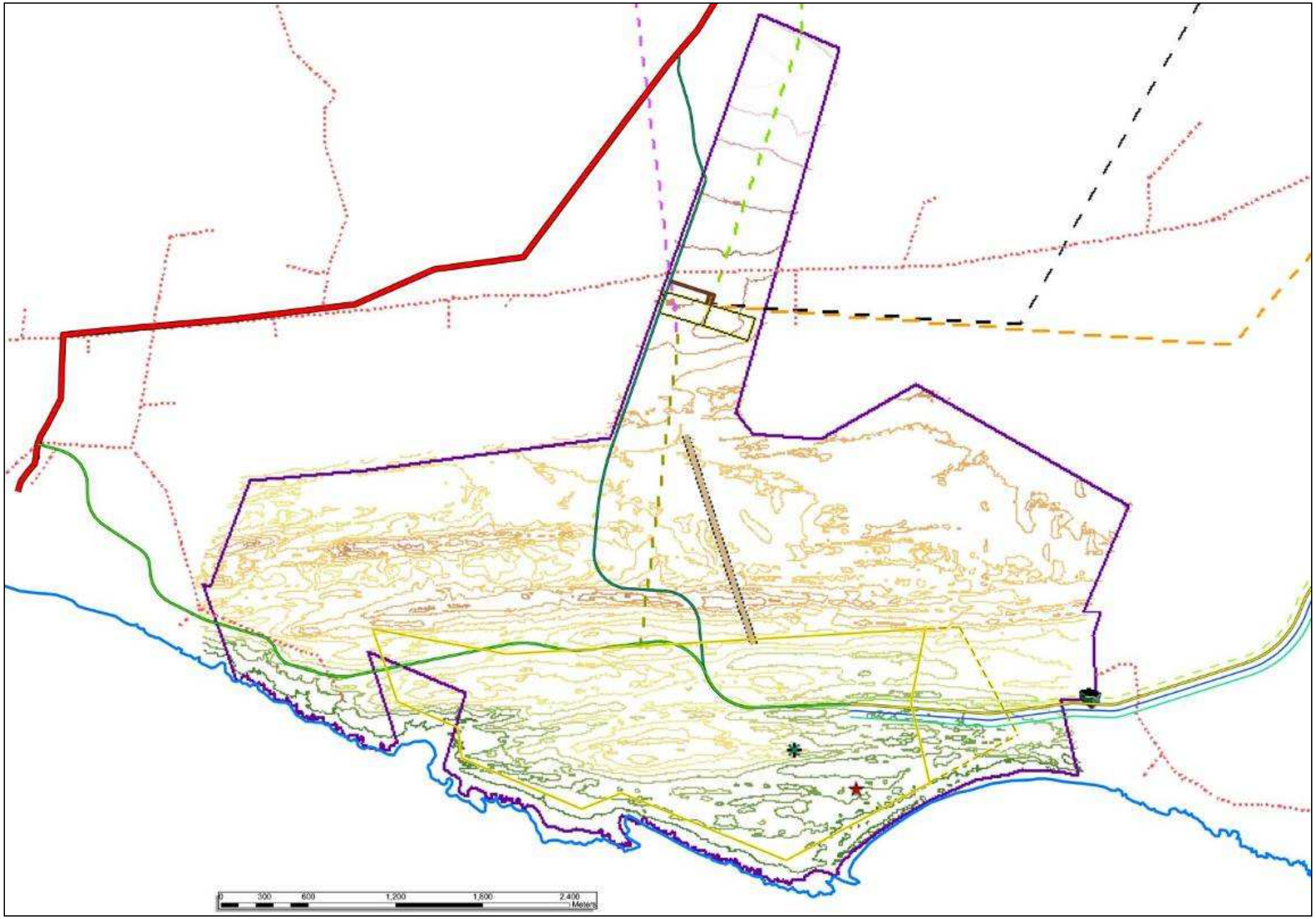


Figure 5-8: Alternative routes to Thyspunt (Not to scale)

5.14 Accommodation

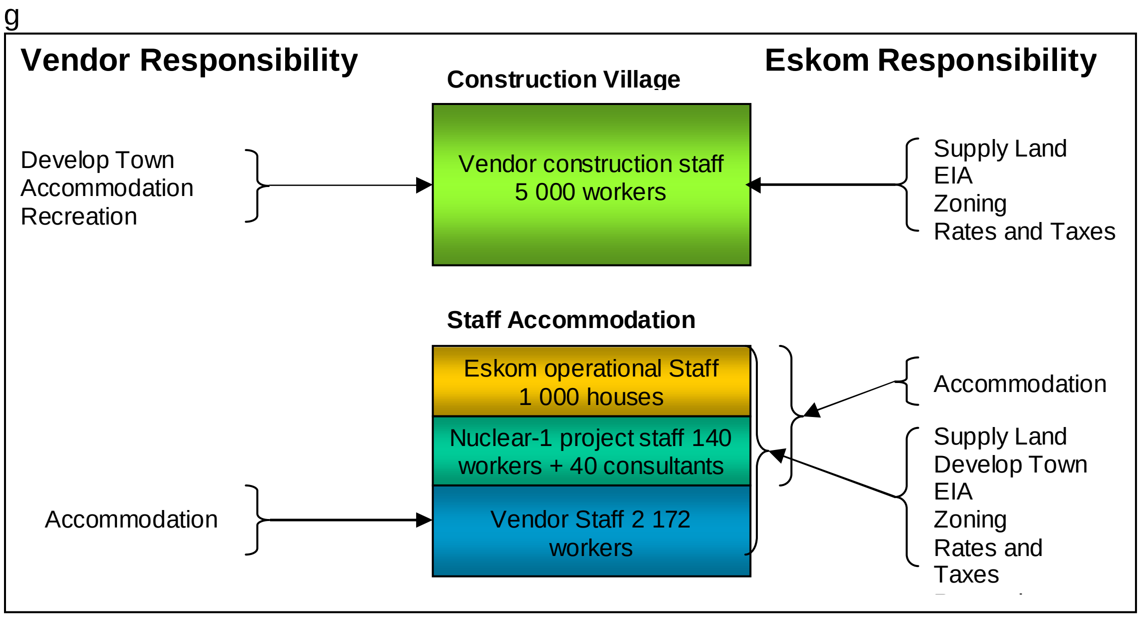
The magnitude of the proposed project and the number of personnel required during the construction and operation phases necessitate the consideration of various alternatives for their accommodation. This provides an overview of the general concepts and site specific alternatives presented by Eskom. It must be noted, as stated before, that the construction of accommodation outside the EIA corridor does not form part of this EIA and will have to be subject to a separate EIA process. The discussion on accommodation alternatives therefore provides a general description of the alternatives that Eskom will have to consider (to enable a complete picture of the project scope), but does not assess the environmental impacts of these alternatives.

The preferred alternative must consider the long-term utilisation and sustainability in order to maximise the utilisation and enhance the benefits associated therewith. It should also be noted that the capacity of the proposed power station may over time be increased within the existing environmental and Transmissions constraints[2]. This may entail the addition of new nuclear units. Thus, the selected site could be subjected to additional construction phases during the life of Nuclear-1 and it would therefore be cost-effective to utilise the same accommodation facilities for future construction activities.

The following factors should be considered when assessing the accommodation alternatives for the construction phase associated with the proposed development:

- Incorporation of the accommodation into the site facilities plan;
- Utilisation as facilities for full time contractors and outage contractors;
- Utilisation as accommodation during outages;
- Utilisation as normal residential accommodation by the community; and
- Limitations of the exclusion zone imposed by the operation of Nuclear-1.

It is Eskom's intention to include the development into the overall community integration strategy for the Eskom residential developments. The diagram below gives a visual perspective of the accommodation activities.



2 Such expansion would require new EIA processes.

5.2.8 Site Variations

There are substantial differences in the local municipal / private infrastructure in the vicinity of the three sites. The Bantamsklip alternative site has very little infrastructure compared to the other two sites and it is therefore the intention of Eskom to execute the infrastructure development at this site in a different manner.

Eskom will develop villages for Eskom project and operational staff as well accommodation for the vendor staff at the Bantamsklip site. Possible commercial development alternatives of these villages are described below.

Eskom will not develop staff villages at the Duynefontein and Thyspunt alternative sites. It will be expected from the staff to either purchase or rent existing accommodation in the neighbouring towns of choice. Eskom might discuss the requirements with developers to cater for any new demand. Eskom will build a construction village at all the sites in towns adjacent to sites.

5.2.9 Construction phase accommodation

The following section provides the alternatives available to Eskom in terms of the accommodation required for all construction workers during the construction phase.

(a) Establishment of a construction village

Eskom will source land in a town close to the site for the establishment of a construction village. The EIA on this land as well as the zoning will preferably be completed by the time that Eskom acquires it, but it may also be done by Eskom. Nuclear-1 will own the facility and the premises must be vacated by the vendor within 3 months after completion of sections of the contract. The accommodation will then be used for maintenance and outage contractors as well as the possible sale of some units to the open market. After completion of the project, all remaining properties will be transferred to the Nuclear Sites Team for further administration.

Eskom will also consult with the local authorities before building will commence to establish needs and standards.

The following alternatives are being considered by Eskom:

- Appointment of a contractor to build the accommodation ;
- Inclusion of accommodation in the main contractor scope of supply; and
- Entering into a partnership with a developer and the local municipality to supply the construction village (or part thereof) that could be used / converted to low / medium cost housing after the construction phase has been concluded.

(b) Vendor and Eskom project staff village at Bantamsklip during the construction phase

Eskom will source land in a town close to the site for the establishment of a staff village. If required, the EIA on this land as well as the zoning would need to be completed by Eskom. Eskom would own the accommodation and each individual house must be vacated by the vendor within 3 months after completion contract of the employee.

Eskom can then make part of the accommodation available to operational staff or sell it in the open market as the units become available. Some of the vendor staff will only be on site for a very short time (6 months maximum) and guest house facilities will be procured from the open market. Any shortcoming in the supply of this type of accommodation will be built by Eskom. After completion of the project, all remaining properties will be transferred to the Nuclear Sites Team for further administration.

The following alternatives are considered by Eskom:

- Appointment of a contractor to build the accommodation;
- Inclusion of accommodation in the main contractor scope of supply; and
- Entering into a private partnership with a developer to supply a certain number of housing units for Eskom to rent over a long period. The developer can then sell the accommodation if Eskom does not require it any more.

(c) Vendor and Eskom project staff village at Duynefontein and Thyspunt during the construction phase

It will be expected from the Eskom and vendor staff to either purchase or rent existing accommodation in the neighbouring towns of choice. Eskom will not develop staff villages at the Duynefontein and Thyspunt sites. Eskom might discuss the requirements with developers to cater for any new demand.

5.2.10 Operational Phase Accommodation

The following section provides the alternatives available to Eskom in terms of the accommodation required for permanent (Eskom operations) personnel only.

(a) Eskom staff village at Bantamsklip during the operational phase

Eskom will source land in a town close to the site for the establishment of a staff village. The EIA on this land as well as the zoning will preferably be completed by the time that Eskom acquires it, or the EIA may be commissioned by Eskom.

The following alternatives are considered by Eskom:

- Appointment of a contractor to build the accommodation;
- Selling stands to employees to build own houses;
- Renting or selling finished houses to employees;
- Making construction staff accommodation available to operational staff; and
- Entering into a private partnership with a developer to supply a certain number of housing units for employees to rent or buy.

(b) Eskom staff village at Duynefontein and Thyspunt during the operational phase

It will be expected from the Eskom staff to either purchase or rent existing accommodation in the neighbouring towns of choice. Eskom will not develop staff villages at the Duynefontein and Thyspunt alternative sites. Eskom may discuss the requirements with property developers to cater for any new demand.

5.15 No-Go (No development) alternative

In the context of this project, the No-Go alternative implies that the power station will not be constructed on any of the three alternative sites. The current biophysical, social and economic environments would not be altered by the development of the proposed project.