# EMPR FOR THE SALDANHA BAY NETWORK STRENGTHENING PROJECT, WESTERN CAPE PROVINCE

## ENVIRONMENTAL MANAGEMENT PROGRAMME

**Submitted as part of the EIA Report**

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# PROJECT DETAILS

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**Title** : Environmental Assessment Process
EMPr for the Saldanha Bay Network Strengthening Project, Western Cape Province

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# DEFINITIONS AND TERMINOLOGY

**Alien species:** A species that is not indigenous to the area or out of its natural distribution range.

**Alternatives:** Alternatives are different means of meeting the general purpose and need of a proposed activity. Alternatives may include location or site alternatives, activity alternatives, process or technology alternatives, temporal alternatives or the 'do nothing' alternative.

**Ambient sound level**: The reading on an integrating impulse sound level meter taken at a measuring point in the absence of any alleged disturbing noise at the end of a total period of at least 10 minutes after such meter was put into operation.

**Assessment:** The process of collecting, organising, analysing, interpreting and communicating information which is relevant.

**Biological diversity:** The variables among living organisms from all sources including, terrestrial, marine and other aquatic ecosystems and the ecological complexes they belong to.

**Commence:** The start of any physical activity, including site preparation and any other activity on site furtherance of a listed activity or specified activity, but does not include any activity required for the purposes of an investigation or feasibility study as long as such investigation or feasibility study does not constitute a listed activity or specified activity.

**Cumulative impacts:** Impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities (e.g. discharges of nutrients and heated water to a river that combine to cause algal bloom and subsequent loss of dissolved oxygen that is greater than the additive impacts of each pollutant). Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.

**Direct impacts:** Impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity (e.g. noise generated by blasting operations on the site of the activity). These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.

**Disturbing noise**: A noise level that exceeds the ambient sound level measured continuously at the same measuring point by 7 dB or more.

**Ecosystem:** A dynamic system of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit.

**Endangered species:** Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating. Included here are taxa whose numbers of individuals have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction.

**Endemic:** An "endemic" is a species that grows in a particular area (is endemic to that region) and has a restricted distribution. It is only found in a particular place. Whether something is endemic or not depends on the geographical boundaries of the area in question and the area can be defined at different scales.

**Environment:** the surroundings within which humans exist and that are made up of:

i. the land, water and atmosphere of the earth;
ii. micro-organisms, plant and animal life;
iii. any part or combination of (i) and (ii) and the interrelationships among and between them; and
iv. the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.

**Environmental Impact:** An action or series of actions that have an effect on the environment.

**Environmental Impact Assessment:** Environmental Impact Assessment (EIA), as defined in the NEMA EIA Regulations and in relation to an application to which scoping must be applied, means the process of collecting, organising, analysing, interpreting and communicating information that is relevant to the consideration of that application.

**Environmental management:** Ensuring that environmental concerns are included in all stages of development, so that development is sustainable and does not exceed the carrying capacity of the environment.

**Environmental Management Programme:** An operational plan that organises and co-ordinates mitigation, rehabilitation and monitoring measures in order to guide the implementation of a proposal and its on-going maintenance after implementation.

**Environmental assessment practitioner:** An individual responsible for the planning, management and coordinating of environmental management plan or any other appropriate environmental instruments introduced by legislation.

**Habitat:** The place in which a species or ecological community occurs naturally.

**Hazardous waste:** Any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment (Van der Linde and Feris, 2010;pg 185).

**Incident:** According to Section 30 of National Environmental Management Act (NEMA), an "Incident" is defined as unexpected sudden occurrence, including a major emission, fire or explosion leading to serious danger to the public or potentially serious pollution of or detriment to the environment, whether immediate or delayed.

**Indigenous:** All biological organisms that occurred naturally within the study area prior to 1800.

**Indirect impacts:** Indirect or induced changes that may occur as a result of the activity (e.g. the reduction of water in a stream that supply water to a reservoir that supply water to the activity). These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.

**Interested and Affected Party:** Individuals or groups concerned with or affected by an activity and its consequences. These include the authorities, local communities, investors, work force, consumers, environmental interest groups and the general public.

**Pollution:** A change in the environment caused by substances (radio-active or other waves, noise, odours, dust or heat emitted from any activity, including the storage or treatment or waste or substances.

**Rare species:** Taxa with small world populations that are not at present Endangered or Vulnerable, but are at risk as some unexpected threat could easily cause a critical decline. These taxa are usually localised within restricted geographical areas or habitats or are thinly scattered over a more extensive range. This category was termed Critically Rare by Hall and Veldhuis (1985) to distinguish it from the more generally used word "rare".

**Red data species:** Species listed in terms of the International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species, and/or in terms of the South African Red Data list. In terms of the South African Red Data list, species are classified as being extinct, endangered, vulnerable, rare, indeterminate, insufficiently known or not threatened (see other definitions within this glossary).

**Significant impact:** An impact that by its magnitude, duration, intensity or probability of occurrence may have a notable effect on one or more aspects of the environment.

**Waste:** Any substance, material or object, that is unwanted, rejected, abandoned, discarded or disposed of, or required to be discarded or disposed of, by the holder of that substance, material or object, whether or not such substance, material or object can be re-used, recycled or recovered and includes all wastes as defined in Schedule 3 of the NEM WA; or any other substance, material or object that is not included in Schedule 3 of the NEM WA that may be defined as a waste by that is identified as waste by the Minister of Environmental Affairs (by notice in the Gazette). Any waste or portion of waste, referred to in the section above, ceases to be a waste:

(i) once an application for its re-use, recycling or recovery has been approved or, after such approval, once it is, or has been re-used, recycled or recovered;
(ii) where approval is not required, once a waste is, or has been re-used, recycled or recovered;
(iii) where the Minister of Environmental Affairs has, in terms of Section 74 of the NEM WA, exempted any waste or a portion of waste generated by a particular process from the definition of waste; or
(iv) where the Minister of Environmental Affairs has, in the prescribed manner, excluded any waste stream or a portion of a waste stream from the definition of waste.

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# PROJECT DETAILS CHAPTER 1

## 1.1. Project Overview

Eskom Holdings Ltd is responsible for the provision of reliable and affordable power to its consumers in South Africa. Electricity cannot be stored and therefore must be used as it is generated. It is, therefore, required that electricity must be efficiently transmitted from the point of generation to the end user.

If Eskom is to meet its mandate and commitment to supply the ever-increasing needs of end-users, it has to plan, establish and expand its infrastructure of generation capacity and transmission power lines on an on-going basis. As part of the envisaged developments in the Saldanha Bay area, Eskom has been prompted to re-assess the capability of the existing electricity network in the area in order to meet the forecasted load requirements from industrial customers, the Industrial Development Zone (IDZ), local distributors and also to facilitate the integration of renewable generation within the region. Power to the Saldanha Bay area is currently supplied from Aurora Substation which is located 28km east of Saldanha Bay. Aurora Substation supplies Blouwater, Saldanha Steel and Smelter distribution Substations. From the load forecast for the area, it has become evident that there will be a constraint at Aurora Substation in the next five year period. The projected new load of approximately 200 MVA that will be realised in the area together with the natural load growth will increase Aurora Substation demand from 517 MVA to approximately 890 MVA in year 2030. The firm capacity in the area will be exceeded in 2018 if the additional loads are to be supplied from Aurora Substation. The transformation capacity is also insufficient to evacuate all of the potential renewable generation planned in the area, amounting to 2 885 MW.

Eskom is therefore proposing the Saldanha Bay Network Strengthening Project, which includes the following:

» Construction of a new 400/132kV Transmission Substation in the Saldanha Bay area with a planned capacity of 3 x 500 MVA transformers. The transmission substation footprint will be 600m x 600m.
» Construction of a new 132/66/11kV Distribution Substation near the current Blouwater Substation in the Saldanha Bay area and decommissioning of the existing Blouwater Substation. The new substation footprint will be 160m x 300m.
» The construction of two 400kV power lines (approximately 20km in length) from the Aurora Substation to the new proposed distribution and transmission substations. A servitude of 55m is required for each power line.

» Three 132kV servitudes (31m each) are required to integrate the new 132/66/11kV substation into the proposed 400/132kV main transmission station. These will be double circuit lines.
» Replacing two of the four existing 250 MVA 400/132kV transformers at Aurora Substation with 2 x 500 MVA transformers.
» Establishing 2 x 132kV feeder bays at Aurora Substation.
» The development and/or widening of access roads.

The purpose of the proposed project is to:

» Improve the reliability of the existing network within the Saldanha area
» Ensure that transmission capacity keeps up with both electricity generation capacity and electricity demand within the area
» Create additional Transmission network capacity to be able to supply the increasing electricity demand.

Technically feasible **alternative substation (Dx & Tx) positions and transmission power line corridors** and have been identified for investigation within a broader study area during the EIA process. From the studies undertaken within the EIA, the following is recommended for implementation (refer to Figure 1.1):

» Construction of a new 400/132kV Transmission Substation at **Site F** in the Saldanha Bay area with a planned capacity of 3 x 500 MVA transformers. The transmission substation footprint will be 600m x 600m.
» Construction of a new 132/66/11kV Distribution Substation at **Site A** near the current Blouwater Substation in the Saldanha Bay area. The distribution substation footprint will be 160m x 300m.
» The construction of three double-circuit 132kV power lines (31m each) to integrate the new 132/66/11kV substation at DX site A into the proposed 400/132kV main transmission station to be located at TX Site F.
» The construction of two 400kV power lines (approximately 20 km in length) from the Aurora Substation to the new proposed distribution and transmission substations. The power lines should follow **Corridor 6**.
» Replacement of two of the four existing 250 MVA 400/132kV transformers at Aurora Substation with 2 x 500 MVA transformers.
» Establishment of 2 x 132 kV feeder bays at Aurora Substation.
» Decommissioning of the existing Blouwater Substation.
» The development and/or widening of access roads.

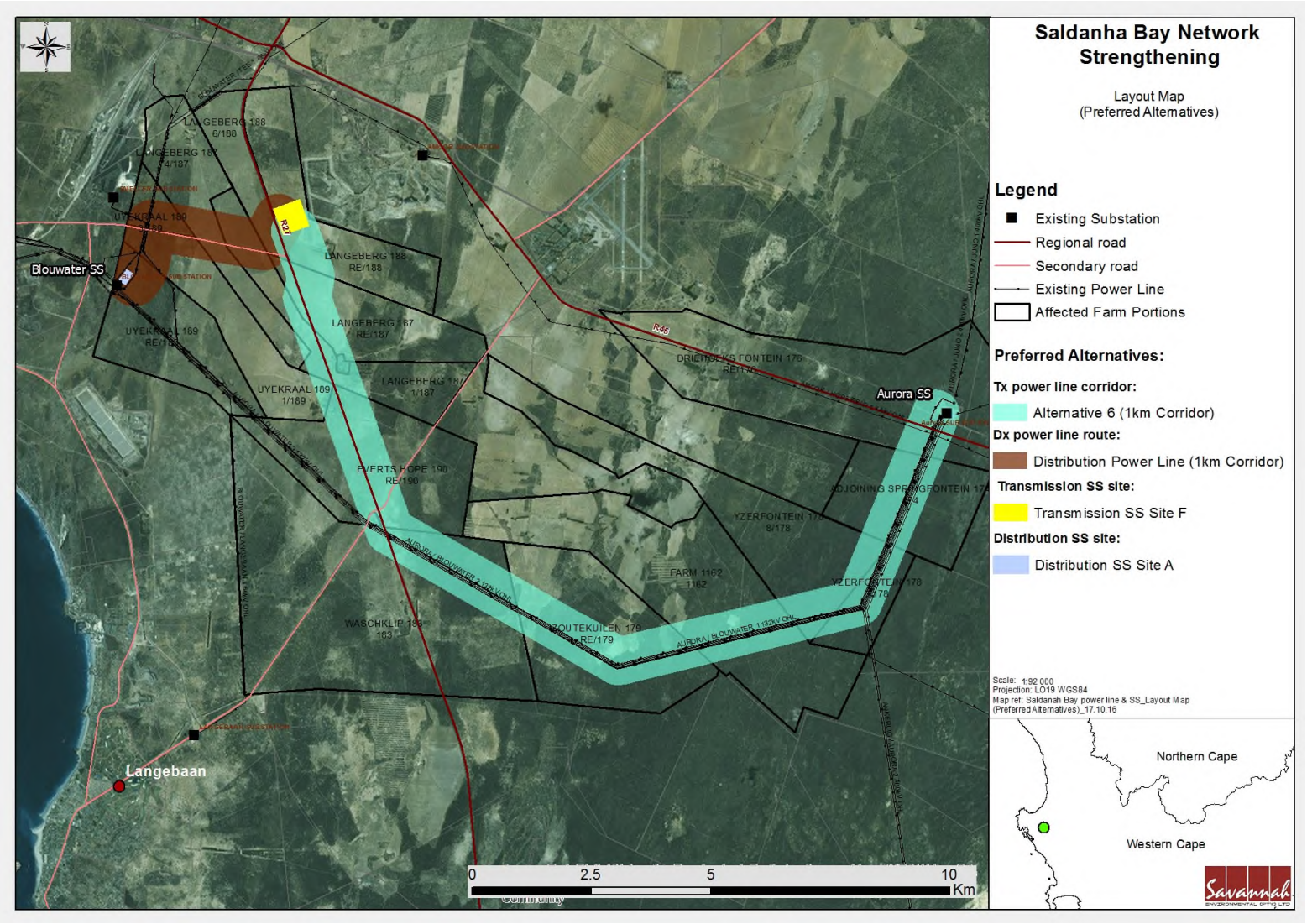


**Figure 1.1:** Locality map indicating the preferred power line route and substation sites

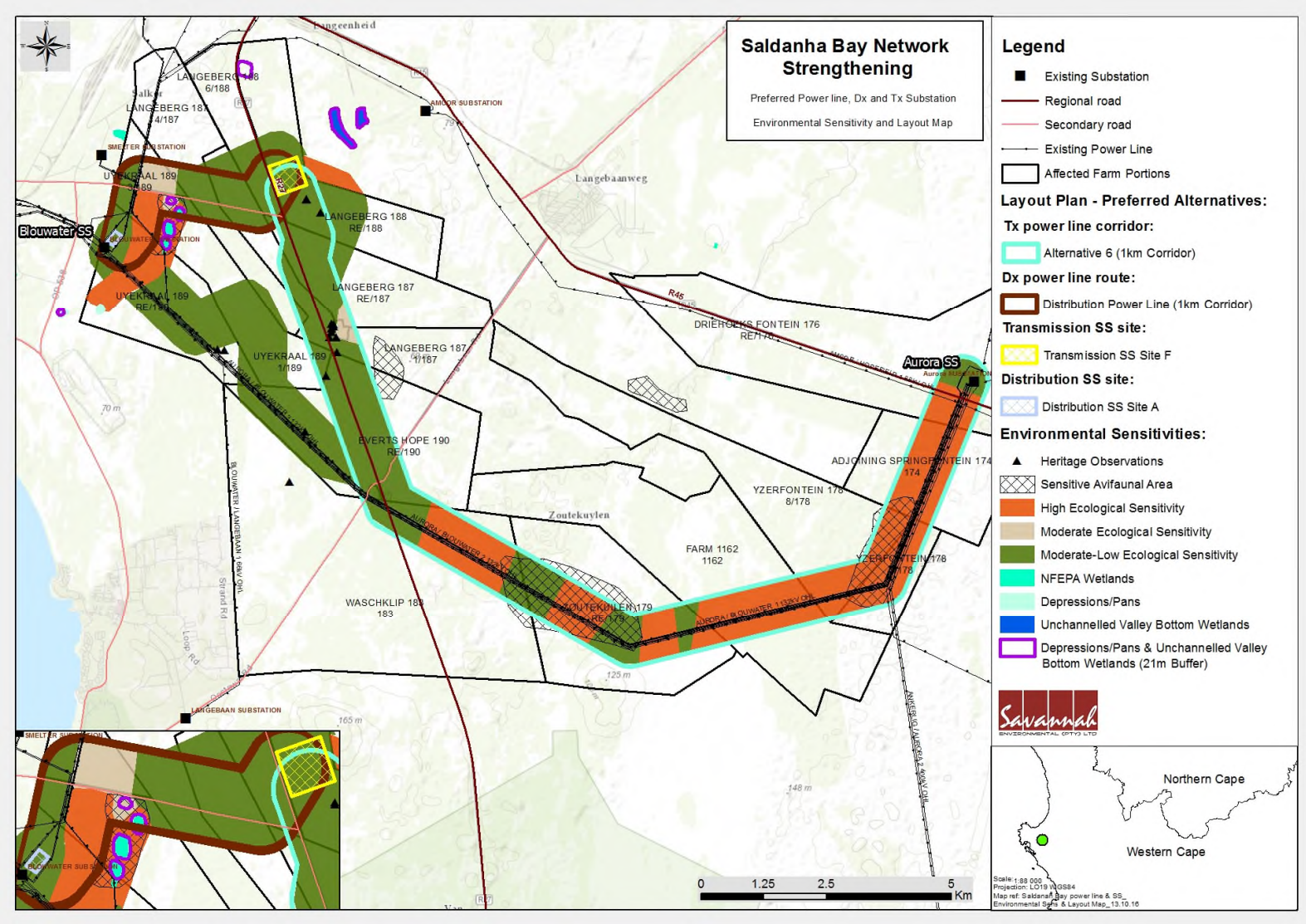


**Figure 1.2:** Locality map indicating the preferred power line route and substation sites in relation to identified environmental sensitivities

## 1.2. Potential impacts

The following sections provide a summary of the assessment of the proposed Saldanha Network Strengthening project.

### *1.2.1. Local site specific impacts resulting from the physical modification/disturbance of the site primarily during the construction phase*

#### i. Flora, Fauna and Ecology

The dominant vegetation type in the study area is Saldanha Flats Shrubland which occupies the majority of the study area. Dominant vegetation identified on site included *Eriocephalus africanus*, *Euphorbia* spp, *Aloe perfoliata, Limonium peregrinum* and *Asparagus capensis*. Four species of conservation concern were identified during the site visit. *Lampranthus vernalis* and *Limonium capense* were identified at the DX substation sites. *Cephalophyllum rostellum* was also identified at the DX substation sites. *Leucospermum hypophyllocarpodendron*, classified as vulnerable, was identified along Corridor Alternative 3, lines 1 and 2.

Low mammal diversity was predicted for the site due to large scale habitat modification and the high levels of human disturbance. The majority of faunal species recorded within the study area are often associated with disturbed habitats and have generalist habitat and dietary requirements. Low reptile diversity was expected due to the degraded nature of the site and lack of suitable habitats. Low amphibian diversity was recorded within the study area due to extremely limited habitat diversity.

No Red Data faunal species are predicted to be present within the development footprint due to high levels of disturbance and habitat transformation already present within the area.

A number of potential impacts relating to loss of indigenous vegetation, proliferation of alien invasive species, habitat fragmentation, loss of Red Listed species, loss of faunal habitat, direct faunal impacts and disturbance to fauna are predicted to occur as a result of the proposed strengthening project.

Mitigation measures are proposed to lower the significance of these impacts. Provided these mitigation measures are fully adhered to and implemented as part of the Environmental Management Programme during both the construction and operational phase of the development, the project is expected to have a limited long term impact on the surrounding environment.

Once the substation site and power line tower positions have been selected and pegged, a site visit must be conducted by a suitably qualified botanist to

determine the presence of Red Listed and Endemic species within the site footprint, prior to the commencement of any construction and construction related activities. Any bulbs and red listed plant species must be immediately translocated to an undisturbed area outside of the development footprint.

Power line corridor alternatives 4 or 6 are the preferred corridor alternatives as these routes are situated within a highly disturbed area and will have the least impact on the receiving environment. Due to the current levels of disturbance, distribution substation alternative A and transmission substation alternative A or F are preferred from an ecological perspective.

**ii. Wetlands**

A desktop and field investigation identified the presence of eight wetland systems within the study area. The impact assessment identified that no direct or indirect impacts would occur on the delineated wetland systems within the study area as a result of the proposed project. None of the alternative Distribution substation or Transmission substation sites will have a direct impact on the wetlands, with the closest wetland occurring approximately 520m away. Alternative TX substation Site A and DX substation Site A are preferred as these are located furthest away from wetland areas. None of the alternative power lines corridors will have a direct impact on any of the wetlands delineated as they do not pass over these systems. Best practice guidelines for general construction activities within the area must however be enforced in an Environmental Management Programme.

### *1.2.2. Impacts on Avifauna*

Due to the current agricultural, industrial and power line developments present within the study area, the proposed substation and power line development is unlikely to have any long-term significant impacts on avifaunal species within the study area. During the site visit, predominantly common bird species were recorded (Cape Sparrow, Karoo Prinia, Pied Starling and various granivorous species). Blue Cranes and Southern Black Korhaan were the only Red Listed species recorded within the study area.

The construction of the proposed transmission substations at any site alternative is adequate from an avifaunal perspective and a poses a limited threat to the birds occurring in the vicinity of this infrastructure. This is largely due to the homogenous nature of the area, high levels of disturbance due to the agricultural practices. The impact of displacement due to habitat transformation should only affect avian species (both Red-data and Non Red-data) at a local level. The construction of the distribution substation at site alternative A and associated 132kV power lines is recommended. Selection of this substation alternative will

also minimise impacts associated with the decommissioning of the Blouwater Substation as activities would be consolidated into a single area.

The construction of the two new 400kV power lines within corridor alternative 3 and 6 are considered to be the most favourable from an avifaunal perspective. This is due to the fact that these line alternatives follow existing power line routes and traverse a largely agricultural habitat. Due to the susceptibility of Blue Cranes (identified within the study area) Lesser Flamingo and Greater Flamingo to collisions, it is imperative that anti-collision measures are implemented on the selected line.

Given the relative homogeneity of the habitat within the study area as well as existing levels of disturbance (existing power line and substation infrastructure, roads, urban development, agricultural and stock farming), the proposed project is unlikely to have a significant, long-term impact on the local avifauna, provided that mitigation measures outlined in this report are implemented.

### *1.2.3. Impacts on Soil and Agricultural Potential*

Most of the study area consists mainly of sandy soils underlain by calcrete/limestone at varying depths ranging from <300 mm to >1 200 mm. According to the average annual rainfall for this area (280 mm), the dryland crop production potential is low, combined with the marginal crop production potential of the soil, due to the low moisture-holding capacity of the sandy soils and soil depth. The overall agricultural potential is therefore low to medium-low.

There is no preference for any of the identified power line routes or substation sites from an agricultural perspective. Impacts will be minimal for any option selected mainly due to low potential of area, as well as nature of infrastructure.

It is concluded that the proposed development will not have a large impact due to the overall low agricultural potential of the areas where the construction of the transmission and distribution stations are planned. The main aspect that will have to be managed in this area if vegetation is removed will involve an increased wind erosion susceptibility due to the sandy nature of the soils.

### *1.2.4. Visual Impacts*

The proposed development will occur within the Coastal Plain LCA as defined above. This is an area where rural land uses currently provide the main landscape character influencing elements. However, rural characteristics are diluted to a large degree in areas by infrastructure development including existing electrical infrastructure.

The main sensitive areas including the edges of urban areas, the coastal strip and protected areas to the south all fall outside the areas of visual influence noted above and are therefore highly unlikely to be impacted to any significant degree.

The main visual issues relate to roads that run through the area that are important for tourism related traffic as well as local homesteads. The proposed development alternatives will be seen in different ways relative to existing infrastructure. Impacts are expected to be low to moderate for all impacts identified.

DX Substation Site A and associated 132kV power lines is preferred from a visual perspective. Selection of this substation alternative will also minimise impacts associated with the decommissioning of the Blouwater Substation as activities would be consolidated into a single area. Both Power line Alternative 4 with TX Substation Site D and Power line Alternative 6 with TX Substation Site F would significantly extend impacts of electrical infrastructure particularly on the R27 which is an important tourist route used by visitors to the West Coast. It is suggested that these should only be considered if there are significant biodiversity or social issues that are likely to outweigh the importance of visual perceptions of the area.

### *1.2.5. Impacts on Heritage and Palaeontological Resources*

Although archaeological resources and the cultural landscape may be negatively affected by the proposed project, the significance of impacts to these resources will be low. There is, however, the potential for highly significant impacts to palaeontological resources to occur. These are deemed manageable and, in fact, positive impacts will be felt with the implementation of successful palaeontological mitigation. Given the limited information available at present, any fossil finds should be treated as significant and would require careful recording and possible systematic excavation in order to ensure that benefits are derived.

This assessment has demonstrated that the proposed project is feasible and that there are no fatal flaws from a heritage perspective. The requirement of HWC to specifically assess archaeological and palaeontological resources as part of the HIA has been met.

Section 38(3)(d) requires an evaluation of the impacts on heritage resources relative to the sustainable social and economic benefits to be derived from the development. The present project will ensure a sustainable electricity supply for the further industrial development of the Saldanha Bay IDZ. The negative impacts to heritage resources are not of such a significance as to outweigh the social benefits of the project. In addition, the palaeontological impacts will be positive with mitigation.

Transmission power line corridor 3, TX substation alternative A and DX substation alternative A are nominated as the preferred options from a heritage and palaeontological perspective. As the mitigation and management of any archaeological and palaeontological impacts that might arise are entirely feasible, it is recommended that the proposed project be allowed to proceed from a heritage point of view.

### *1.2.6. Social Impacts*

The proposed Saldanha Bay Network Strengthening Project is unlikely to result in permanent damaging social impacts. The potential positive impacts outweigh the potential negative impacts associated with the improvement in electricity generation. The potential for positive socio-economic benefits can be realised through direct and indirect job creation. The Saldanha Bay Network Strengthening project is necessary for the improvement of current electricity capacity in the area and it will allow for the meeting of the forecasted load requirements from industrial customers, the Industrial Development Zone (IDZ), local distributors and also to facilitate the integration of renewable generation in the area. However, the project will also bring with it some negative impacts such as in-migration of people, alteration to the visual sense of place and landscape as well as safety and security risks, which can be minimised.

All power line corridors are considered to be acceptable from a social perspective. During consultation with stakeholders, possible land use conflict between transmission substation site A and the proposed Mulilo Gas Project was identified. This alternative is therefore not preferred from a social perspective. Power line corridor alternatives 4 & 6 and transmission substation sites D & F are considered acceptable from a social perspective. There is no preference regarding the DX substation alternatives, although it is noted that selection of substation alternative A will minimise impacts associated with the decommissioning of the Blouwater Substation as activities would be consolidated into a single area.

From a social perspective it is concluded that the project can be developed subject to the implementation of the recommended mitigation measures and management actions contained in this SIA report.

### *1.2.7. Land Use*

There are a number of existing and planned land uses within the study area which could potentially conflict with the proposed project. Considering the existing and planned land uses in the study area, inputs from landowners and stakeholders in the area, and with the experience of the writer in terms of Town and Regional Planning, the following is concluded:

» The Preferred Tx Power Line Route is **Alternative 6**, due to less impact on current and future planning within the area.
» **Transmission Site F** is the preferred option from a Town and Regional Planning perspective as this site reduces the potential for any land use conflict with planned developments in the area.
» The preferred distribution SS Site is **Distribution Site A** and associated 132kV power lines because of its close proximity to the Blouwater Substation and less impact from a Future and current Town Planning Perspective. Selection of this substation alternative will also minimise impacts associated with the decommissioning of the Blouwater Substation as activities would be consolidated into a single area.

### *1.2.8. Cumulative Impacts*

The study area is situated the Saldanha Bay area, approximately 130km north west of Cape Town, in the Western Cape Province. The closest towns are Saldanha Bay, Langebaan and Vredenburg. The study area essentially consists of agricultural land with isolated patches of natural vegetation. The surrounding area is characterised by flat agricultural farm areas, primarily wheat and crop production activities with some grazing and game farming activities. Few farmsteads occur within the study area and within the surrounding area and adjacent farms. A number of properties within the study area are potentially affected by the proposed alternative transmission power line corridors and substation sites. These are mostly owned by private landowners. On a regional scale, the R27 and R45 roads provide access to the study area. The area is a highly sensitive environment characterized by a network of power line and railway lines. Prominent features in or near the study area include:

» Nearby areas are comprised of developments such as the Saldanha Bay Smelter, Langebaan Air Force Base and Independent Power Producers' Wind Farms.
» Saldanha Steel (ArcelorMittal South Africa, Saldanha Works) is located approximately 1km north west of the study area
» Vredenburg town is located approximately 10km north west of the study area.
» Thali-Thali Game Lodge is located within the southern section of the study area. Thali Thali is a 1.460ha Cape West Coast game and fynbos reserve situated just off the R27 near Langebaan. The game lodge has a 3-star grading with 8 accommodation units.
» West Coast Fossil Park is located within the northern section of the study area. According to the Saldanha Bay SDF (2011) the West Coast Fossil Park is a national asset and the significance of this tourism attraction should be emphasised. The fossil park in the area is an important heritage resource which could potentially form part of a network of protected areas within the Saldanha Bay municipal area. The unique qualities of the fossil park should be enhanced as an important regional tourist attraction.

» West Coast National Park (Langebaan) is located approximately 2km south of the study area
» Elandsfontein Private Nature Reserve is located approximately 5km south east of the study area
» Hopefield Private Nature Reserve is located approximately 4km south east of the study area
» Elandsfontein Phosphate Mine is located approximately 2km east of the study area
» Coastal areas to the west of the study area are also developed as tourist destinations. Mykonos, Langebaan and areas to the south particularly around the lagoon are tourism areas of possible national importance.
» Existing power lines and substations are apparent within the study area.
» Oil storage, paper production and steel production have all been attracted to the area around the port of Saldanha Bay. The necessary infrastructure to supply power and support these heavy industries is also evident throughout the landscape.
» According to the Western Cape Provincial Spatial Development Framework, the R27 and R45 are secondary scenic routes. Both these secondary scenic routes traverse the study area.

There are a number of planned developments within the study area, including (refer to Figure 6.2):

» The Votem Energy CCGT Power Station (which has received environmental authorisation).
» The proposed Arcelor Mittal 1500MW LNG Power Plant (for which an EIA process is underway).
» The proposed Mulilo OCGT project which comprises 2 projects (for which an EIA process is underway).

Considering the nature of the proposed project, as well as the existing and planned developments in the area, there is the potential for cumulative impacts to occur. Based on the findings of the specialist assessments undertaken for the project, the cumulative impacts for the proposed Saldanha Bay Strengthening Project are expected to be low to moderate

## 1.3. Activities and Components associated with the Proposed Power Lines

### *1.3.1. Technical Details of Transmission Power Lines*

Power lines are constructed in the following simplified sequence:

**Step 1:** Determination of technically feasible alternatives
**Step 2:** EIA input into route selection
**Step 3:** Negotiation of final route with affected landowners

**Step 4:** Survey of the route (by air)
**Step 5:** Determination of the conductor type
**Step 6:** Selection of best-suited conductor, towers, insulators, foundations
**Step 7:** Final design of line and placement of towers (including final walk-though survey by environmental specialists and compilation of site-specific Environmental Management Programme (EMP)).
**Step 8:** Issuing of tenders, and award of contract to construction companies
**Step 9:** Vegetation clearance and construction of access roads (where required)
**Step 10:** Tower pegging
**Step 11:** Construction of foundations
**Step 12:** Assembly and erection of towers
**Step 13:** Stringing of conductors
**Step 14:** Rehabilitation of disturbed areas and protection of erosion sensitive areas
**Step 15:** Testing and commissioning

Construction of the proposed the 400kV lines will take approximately 24 months to complete. Construction crews for the power lines and substations will constitute mainly skilled and semi-skilled workers. No construction workers will reside on site. It is most likely that construction workers will be accommodated within formal housing within towns surrounding the study area.

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

### *1.3.2. Technical Details of the Substations*

The proposed substations would be constructed in the following simplified sequence, and will take approximately 12 months to complete:

**Step 1:** Survey of the substation site
**Step 2:** Site clearing and levelling and construction of access road to substation site
**Step 3:** Construction of terrace and substation foundation, including the installation of stormwater drainage on the surface to dispose of such stormwater on the terrace
**Step 4:** Assembly, erection and installation of equipment (including transformers and control building)
**Step 5:** Connection of conductors to substation infrastructure
**Step 6:** Rehabilitation of any disturbed areas and protection of erosion sensitive areas.

A number of fences will be installed to secure the substations and the substation sites. These fences include a 2.4 m high security fence to enclose all assets, a 1.8 m high fence around the yards, and a 1.2 m high boundary fence on the property-line.

Construction of the substations will take approximately 12 months to complete. Construction crews for construction of the substation will constitute mainly skilled and semi-skilled workers. No construction workers will reside on site. It is most likely that construction workers will be accommodated within formal housing within towns surrounding the study area.

The proposed 400kV transmission substation footprint will be up to 600 m x 600 m. The 132kV distribution substation will be 160 m x 300 m in size.

Upgrades to the existing Aurora Substation are also required as part of the project. This involves replacing two of the four existing 250 MVA transformers with 2 x 500 MVA transformers. The upgrade also involves establishing 2 x 132kV feeder bays at Aurora Substation.

## 1.4. Project Operation Phase

The expected lifespan of the proposed infrastructure is between 35 and 40 years, depending on the maintenance undertaken on the power line structures. During the life-span of the power lines and substations, on-going maintenance is performed. Power line inspections are undertaken on an average of 1 – 2 times per year, depending on the area. During this maintenance period, the power line is accessed via the access routes, as agreed with affected landowners during the negotiation phase. During maintenance activities on the substations, components may require replacement in order to significantly extend the lifespan. Maintenance of the power lines and substations are required to be undertaken in accordance with the specifications of the Environmental Management Programme (EMPr) (refer to Appendix L).

The creation of additional employment opportunities during the operational phase of the power lines and substations will be limited, and will be restricted to skilled maintenance personnel employed by Eskom.

### *1.4.1. Servitude Maintenance Responsibilities*

The management of power line servitude is dependent on the details and conditions of the agreement between the landowner and Eskom, and are therefore site-specific. These may, therefore, vary from one location to another. However, it is a common occurrence that there is a dual responsibility for the maintenance of the servitude:

» Eskom will be responsible for the tower structures, maintenance of access roads, watercourse crossings, and gates and fences relating to servitude access.
» The landowner will retain responsibility for the maintenance of the land and land use within the servitude (e.g. cropping activities, veld management, etc.).

Exceptions to the above may arise where, for example dual use is made of the access roads and gates or specific land use limitations are set by Eskom Transmission within the servitude which directly affects the landowner (e.g. forestry). Maintenance responsibilities are, ultimately, clearly set out in the servitude agreement.

## 1.5. Decommissioning Phase

The project infrastructure is expected to have a design lifespan in excess of 25 years (extendable with appropriate refurbishment). The infrastructure would only be decommissioned once it has reached the end of its economic life. It is most likely that decommissioning activities of the infrastructure would comprise the disassembly and removal of the individual components and the rehabilitation of the impacted area to a suitable state for the required future use.

The following decommissioning activities will form part of the project scope and will be applicable for the decommissioning of the Blouwater Substation.

**Site Preparation**

Site preparation activities will include confirming the integrity of the access to the site to accommodate the required equipment (e.g. lay down areas, construction platform) and the mobilisation of decommissioning equipment.

**Disassemble and Replace Existing Components**

When the project is ultimately decommissioned, the equipment to be removed will depend on the proposed land use for the site at that time. At this time, all above ground facilities that are not intended for future use at the site will be removed. Underground equipment (e.g. foundation, wiring) will be removed, and the surface restored to a stable slope. Much of the above ground wire and steel, of which the infrastructure is comprised are recyclable materials and would be recycled to the extent feasible. The components of the various infrastructure would be deconstructed and recycled or disposed of in accordance with regulatory requirements. The site will be rehabilitated and can be returned to agricultural or other beneficial land-use.

# PURPOSE AND OBJECTIVES OF THE EMPR CHAPTER 2

An Environmental Management Programme (EMPr) is defined as "an environmental management tool used to ensure that undue or reasonably avoidable adverse impacts associated with the planning, construction, operation and decommissioning of a project are avoided or mitigated, and that the positive benefits of the projects are enhanced."[1] The objective of this EMPr is to provide consistent information and guidance for implementing the management and monitoring measures established in the permitting process and help achieve environmental policy goals. The purpose of an EMPr is to ensure continuous improvement of environmental performance, reducing negative impacts and enhancing positive effects during the construction and operation. An effective EMPr is concerned with both the immediate outcome as well as the long-term impacts of the project.

The EMPr provides specific environmental guidance for the construction and operation phases of a project, and is intended to manage and mitigate construction and operation activities so that unnecessary or preventable environmental impacts do not result. These impacts range from those incurred during start up (i.e. site clearing and site establishment), during the construction activities themselves (i.e. erosion, noise, dust, and visual impacts), during site rehabilitation (i.e. soil stabilisation, re-vegetation), during operation and during decommissioning (i.e. similar to construction phase activities).

This EMPr has been compiled in accordance with Section 33 of the EIA Regulations and will be further developed in terms of specific requirements listed in any authorisations issued for the proposed project. The EMPr has been developed as a set of environmental specifications (i.e. principles of environmental management), which are appropriately contextualised to provide clear guidance in terms of the on-site implementation of these specifications (i.e. on-site contextualisation is provided through the inclusion of various monitoring and implementation tools).

This EMPr has the following objectives:

» Outline mitigation measures and environmental specifications which are required to be implemented for the planning, construction and rehabilitation, operation, and decommissioning phases of the project in order to manage and minimise the extent of potential environmental impacts associated with the power line.

[1] Provincial Government Western Cape, Department of Environmental Affairs and Development Planning: *Guideline for Environmental Management Plans*. 2005

» Ensure that all the phases of the project do not result in undue or reasonably avoidable adverse environmental impacts, and ensure that any potential environmental benefits are enhanced.
» Identify entities responsible for the implementation of the measures and outline functions and responsibilities.
» Propose mechanisms and frequency for monitoring compliance, and preventing long-term or permanent environmental degradation.
» Facilitate appropriate and proactive responses to unforeseen events or changes in project implementation that was not considered in the EIA process.

The management and mitigation measures identified within EIA process are systematically addressed in this EMPr, and ensure the minimisation of adverse environmental impacts to an acceptable level.

Eskom Holdings Ltd must ensure that the implementation of the project complies with the requirements of all environmental authorisations, permits, and obligations emanating from relevant environmental legislation. This obligation is partly met through the development and the implementation of this EMPr and through its integration into the contract documentation. Since this EMPr is part of the EIA process, it is important that this document be read in conjunction with the EIA Report compiled for this project. This will contextualise the EMPr and enable a thorough understanding of its role and purpose in the integrated environmental management process. Should there be a conflict of interpretation between this EMPr and the environmental authorisation, the stipulations in the environmental authorisation shall prevail over that of the EMPr, unless otherwise agreed by the authorities in writing. Similarly, any provisions in legislation overrule any provisions or interpretations within this EMPr.

This EMPr is applicable to all Eskom (Pty) Ltd employees and contractors working on the pre-construction, construction, and operation and maintenance power line. The document will be adhered to, updated as relevant throughout the project life cycle. This EMPr shall be binding on all the parties involved in the construction and operational phases of the project, including Eskom, and shall be enforceable at all levels of contract and operational management within the project.

# STRUCTURE OF THIS EMPR CHAPTER 3

The first two chapters provide background to the EMPr and the proposed project, while the chapters which follow consider the following:

» Planning and design activities;
» Construction activities;
» Operation activities; and
» Decommissioning activities.

These chapters set out the procedures necessary for the construction of the proposed power line to minimise environmental impacts and achieve environmental compliance. For each of the phases of implementation, an over-arching environmental **goal** is stated. In order to meet this goal, a number of **objectives** are listed. The EMPr has been structured in table format in order to show the links between the goals for each phase and their associated objectives, activities/risk sources, mitigation actions, monitoring requirements and performance indicators. A specific EMPr table has been established for each environmental objective. The information provided within the EMPr table for each objective is outlined below.

**OBJECTIVE: Description of the objective, which is necessary to meet the overall goals; which take into account the findings of the BA specialist studies**

| | |
|---|---|
| **Project Component/s** | » List of project components affecting the objective. |
| **Potential Impact** | » Description of potential environmental impact if objective is not met. |
| **Activity/Risk Source** | » Description of activities which could affect achieving objective. |
| **Mitigation: Target/Objective** | » Description of the target and/or desired outcomes of mitigation. |

| **Mitigation: Action/Control** | **Responsibility** | **Timeframe** |
|---|---|---|
| List specific action(s) required to meet the mitigation target/objective described above. | Who is responsible for the measures? | Periods for implementation. |

| | |
|---|---|
| **Performance Indicator** | Description of key indicator(s) that track progress/indicate the effectiveness of the EMPr. |
| **Monitoring** | Mechanisms for monitoring compliance; the key monitoring actions required to check whether the objectives are being achieved, taking into consideration responsibility, frequency, methods, and reporting. |

The objectives and EMPr tables are required to be reviewed and possibly modified whenever changes, such as the following, occur:

» Planned activities change;
» Modification to or addition to environmental objectives and targets;
» Relevant legal or other requirements are changed or introduced; or
» Significant progress has been made on achieving an objective or target such that it should be re-examined to determine if it is still relevant, should be modified, etc.

Any changes made must be approved by DEA prior to implementation thereof.

### 3.1. Project Team

This EMPr was compiled by:

» *Jo-Anne Thomas* – is a registered Professional Natural Scientist and holds a Master of Science degree. She has 19 years' experience consulting in the environmental field. Her key focus is on strategic environmental assessment and advice; management and co-ordination of environmental projects, which includes integration of environmental studies and environmental processes into larger engineering-based projects and ensuring compliance to legislation and guidelines; compliance reporting; the identification of environmental management solutions and mitigation/risk minimising measures; and strategy and guideline development. She is currently involved in undertaking siting processes as well as EIAs for several renewable energy projects across the country.

The Savannah Environmental team has extensive knowledge and experience in EIAs and environmental management, having been involved in EIA processes over the past fourteen years. They have managed and drafted EMPs for other electricity transmission and distribution projects throughout South Africa, including major Eskom transmission lines.

## 3.2. Legislation and Guidelines that have informed the preparation of this EMPr

The following environmental legislation is applicable to the proposed project:

» Constitution of South Africa (Act No. 108 of 1996)
» National Environmental Management Act (Act No 107 of 1998) – NEMA
» Environment Conservation Act (Act No 73 of 1989)
» National Forest Act (Act No 30 of 1998)
» National Water Act (Act No 36 of 1998)
» National Veld and Forest Fire Act (Act 101 of 1998)
» National Environmental Management: Biodiversity Act (Act No 10 of 2004)
» National Environmental Management: Waste Act (Act 59 of 2008)
» Conservation of Agricultural Resources Act (Act No 43 of 1983)
» National Heritage Resources Act (Act No 25 of 1999)
» Hazardous Substances Act (Act No. 15 of 1973)
» National Road Traffic Act (Act No 93 of 1996)

Acts, standards or guidelines which have informed the project process and the scope of issues assessed within the EIA are summarised in Appendix A.

**Overall Goal:** undertake the pre-construction activities (planning and design phase) in a way that:

» Ensures that the design of the project infrastructure responds to the identified environmental constraints and opportunities.
» Ensures that pre-construction activities are undertaken in accordance with all relevant legislative requirements
» Ensures that adequate regard has been taken of any landowner and community concerns and that these are appropriately addressed through design and planning (where appropriate).
» Ensures that the best environmental options are selected for the linear components, including the access roads.
» Enables the construction activities to be undertaken without significant disruption to other land uses and activities in the area.

In order to meet this goal, the following objectives have been identified, together with necessary actions and monitoring requirements.

## 4.1. Objectives

**OBJECTIVE 1: Ensure the power line and substation design responds to identified environmental constraints and opportunities**

From the studies undertaken within the EIA, the following is recommended for implementation (refer to Figure 1.1):

» Construction of a new 400/132kV Transmission Substation at **Site F** in the Saldanha Bay area with a planned capacity of 3 x 500 MVA transformers. The transmission substation footprint will be 600m x 600m.
» Construction of a new 132/66/11kV Distribution Substation at **Site A** near the current Blouwater Substation in the Saldanha Bay area. The distribution substation footprint will be 160m x 300m.
» The construction of three double-circuit 132kV power lines (31m each) to integrate the new 132/66/11kV substation at DX site A into the proposed 400/132kV main transmission station to be located at TX Site F.
» The construction of two 400kV power lines (approximately 20 km in length) from the Aurora Substation to the new proposed distribution and transmission substations. The power lines should follow **Corridor 6**.

» Replacement of two of the four existing 250 MVA 400/132kV transformers at Aurora Substation with 2 x 500 MVA transformers.
» Establishment of 2 x 132 kV feeder bays at Aurora Substation.
» Decommissioning of the existing Blouwater Substation.
» The development and/or widening of access roads.

| | |
|---|---|
| **Project Component/s** | » Power lines<br>» Substations<br>» Access roads |
| **Potential Impact** | » Design fails to respond optimally to the environmental considerations<br>» Power line route and substation design that degrades the environment unnecessarily, particularly with respect to visual aesthetics, loss of indigenous flora, erosion, and impacts on local communities/residents |
| **Activities/Risk Sources** | » Alignment of power line and positioning of towers and access roads within the approved power line corridor<br>» Positioning of the substation within the approved substation footprint |
| **Mitigation: Target/Objective** | » To ensure that the design of the project components respond to the identified environmental constraints and opportunities<br>» To ensure selection of best environmental option for alignment for the power lines and location of the substation |

| Mitigation: Action/Control | Responsibility | Timeframe |
|---|---|---|
| Plan and conduct pre-construction activities in an environmentally acceptable manner. | Eskom | Pre-construction |
| Undertake negotiations with affected landowners within the approved power line corridor and agree on landowner-specific conditions for construction and maintenance | Eskom | Project planning |
| Undertake a detailed geotechnical survey of the proposed substation site and transmission line tower positions in order to fully understand the soils in terms of founding conditions and erosion potential. | Eskom Geotechnical specialist | Design |
| Undertake specialist walk-through surveys of each tower footprint and the substation site in terms of heritage and avifaunal aspects | Ornithologist Heritage specialist | Design |
| Once pegged, the substation site and power line routes must be inspected during the rainy season by a qualified botanist to identify all conservation-important species. These species must be translocated to a suitable habitat outside of the construction footprint, prior to any construction activities. This relocation must be undertaken in accordance with the required permits | Specialist | Pre-construction |

| Mitigation: Action/Control | Responsibility | Timeframe |
|---|---|---|
| Consider planning and design level mitigation measures recommended by the specialists following the walk-though survey. | Eskom | Design |
| Ensure that riparian areas are spanned/ towers are not placed within close proximity to rivers, streams. Ensure placement of footprints outside 1:100 year floodlines. Crossing of riparian systems is only permitted at existing/ approved crossing points, taking due care to prevent additional/ new impacts | Eskom | Design |
| Ensure that bird-friendly power line towers and conductor designs are used. | Eskom | Design |
| Identify the exact power line spans requiring marking to reduce the potential for collision. Bird Diverters to be planned along identified sensitive areas of the power lines. | Developer and ornithologist | Planning |
| Plan route to avoid ruins of heritage value as identified in the EIA. Where this is not possible, a heritage permit should be obtained and the sites appropriately recorded by a specialist prior to destruction. | Eskom Specialist (if required) | Project planning |
| Obtain any additional environmental permits required (e.g. permit to impact on protected plant species, water use license to cross drainage lines). | Eskom | Project planning |
| Consider and incorporate design level mitigation measures recommended by the specialists as detailed within the EIA Report and relevant appendices. | Eskom | Design review |
| External access point and internal access roads to be carefully planned to maximise road user safety and minimise disruptions to affected landowners. | Eskom | Design |
| All access roads must be approved by a botanical specialist prior to construction commencing. If new access roads are required these should be ground-truthed and approved by a local botanist who is highly familiar with the vegetation types and Species of Conservation Concern found in the area. | Specialist | Design |
| Compile a comprehensive storm water management plan for hard surfaces as part of the final design of the project. | Eskom | Design |
| Balance technical and financial considerations against environmental constraints and opportunities in finalising the design of key elements (such as the tower design and required servitude width). | Eskom | Tender Design & Design Phase |
| Tower design should be carefully considered as it could limit negative construction related impacts. | Engineering Design Consultant | Planning & Design Phase |
| Conditions stipulated by property owners in terms of | Eskom | Duration of |

| Mitigation: Action/Control | Responsibility | Timeframe |
|---|---|---|
| the construction activities should be implemented and monitored. | | project life |
| Consolidate infrastructure as far as possible and plan to make use of already disturbed sites rather than greenfields areas. | Eskom | Planning |
| The terms of this EMPr and the Environmental Authorisation (once issued) must be included in all tender documentation and Contractors contracts. | Eskom | Tender process |
| The tender documentation for the construction of the power lines and substation should stipulate the use of local labourers or enterprises | Eskom | Tender Phase |
| Eskom should ensure an equitable process whereby minorities and previously disadvantaged individuals (women) are also taken into account. | Eskom | Tender Phase |

| | |
|---|---|
| **Performance Indicator** | » Design meets objectives and does not degrade the environment.<br>» Design and layouts respond to the mitigation measures and recommendations in the EIA report and recommendations of the specialist walk-though surveys.<br>» Final surveyed route alignment minimises any negative environmental impacts and maximises any benefits. |
| **Monitoring** | » Ensure that the design implemented meets the objectives and mitigation measures in the EIA report through review of the design by the Project Manager and Environmental Control Officer (ECO) prior to the commencement of construction. |

***OBJECTIVE 2: To ensure adequate regard has been taken of landowner / stakeholder concerns and that these are appropriately addressed***

For each 400kV transmission power line a servitude of approximately 55 m is required. This servitude is established along the entire length of the power line, for which the affected landowner is required to be appropriately compensated. Within this servitude, Eskom has certain rights and controls that support the safe and effective operation of the power line. The negotiation process for this servitude is undertaken by Eskom directly with the appropriate landowner and culminates in the signing of a servitude agreement. Here Eskom enters into a legal agreement with the landowner. The agreements will detail such aspects as the exact location and extent of the servitude, and access arrangements and maintenance responsibilities, as well as any specific landowner requirements for

construction and maintenance of the power line, as well as regarding rehabilitation measures.

Negotiation for and development of the substation site must be undertaken in accordance with the appropriate legislation.

| | |
|---|---|
| **Project component/s** | » Power lines<br>» Substations<br>» access roads |
| **Potential Impact** | » Landowners impacted by proposed alignment of the power lines, positioning of towers and access road/s<br>» Landowners affected by the proposed substations and access roads |
| **Activities/risk sources** | » Positioning of towers and access roads<br>» Alignment of power lines and placement of towers within the approved corridor<br>» Positioning of substations and access roads |
| **Mitigation: Target/Objective** | » To ensure adequate regard has been taken of concerns of affected and surrounding landowners and that these are appropriately addressed<br>» Minimise potential impacts on local land use and business potential |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| Initiate negotiations with all affected landowners timeously. | Eskom | Prior to construction. |
| Address reasonable expectations/requests of landowners, where possible. | | |
| Careful consideration should be given to the final route alignment and tower placements to limit the negative impact on properties as far as possible | Engineering Design Consultant | Planning phase |
| Route transmission lines as far away from existing structures as possible | Engineering Design Consultant | Planning phase |
| Careful consideration should be given to the final route alignment and tower placements to limit the negative impact on the existing and planned developments and activities on the affected properties | Engineering Design Consultant | Planning phase |
| A specific contact person should be identified to allow community members and property owners to easily direct their queries and concerns and obtain general information regarding the construction process | Eskom | Planning phase & continuing throughout project implementation |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| Residents should be informed of the construction activities and schedules prior to the construction workforce entering any property | Eskom | Duration of contract |
| Eskom should liaise with landowners and developers in the area, including members of farmers associations and project proponents during the negotiation phase of the project to ensure a route alignment which would ensure the protection of the land value and resources and which would also be to the socio-economic benefit of the communities | Eskom | Planning phase |
| Implement a grievance mechanism procedure for the public to be implemented during both the construction and operational phases of the power line. This procedure should include details of the contact person who will be receiving issues raised by interested and affected parties, and the process that will be followed to address issues. | Eskom | Pre-construction (construction procedure) Pre-operation (operation procedure) |
| Liaison with landowners is to be undertaken prior to the commencement of construction in order to provide sufficient time for them to plan agricultural activities. | Eskom | Pre-construction |

| | |
|---|---|
| **Performance Indicator** | » Appropriate and fair negotiation should be undertaken with all affected landowners.<br>» Landowners should be afforded reasonable and appropriate rights/access.<br>» Effective communication procedures in place. |
| **Monitoring** | » Not applicable |

# MANAGEMENT PROGRAMME: CONSTRUCTION CHAPTER 5

**Overall Goal:** Undertake the construction phase in a way that:

» Ensures that construction activities are properly managed in respect of environmental aspects and impacts.
» Enables the construction activities to be undertaken without significant disruption to other land uses in the area, in particular with regard to effects on local residents, land uses, traffic and road use and noise impacts.
» Minimises the impact on the vegetation, fauna, avifauna and habitats within the area, and where possible adds to the botanical record of this area.
» Minimises the impact on the archaeological, historical and palaeontological value of the area, and where possible adds to the archaeological and palaeontological record of this area.

This section should be read in conjunction with Eskom Transmission's Draft Environmental Management Plan (EMP) for construction. Generic environmental specifications and guidelines included within this draft EMP are not repeated here.

## 5.1. Project Responsibilities and Reporting Structure during the Construction Phase

Several professionals will form part of the construction team. The most important from an environmental perspective are the **Project Manager/Site Manager**, the **Environmental Control Officer** (ECO), the **contractor** and the **developer**.

The Project Manager/Site Manager represents and acts on behalf of Eskom Transmission regarding the administration of contracts, and is responsible for the implementation of the EMP on the site during the pre-construction and construction phases of the project. The ECO is responsible for monitoring the implementation of the EMP during the design, pre-construction and construction phases of the project. The contractor is responsible for abiding by the mitigation measures of the EMP which are implemented by the Project Manager during the construction phase.

Figure 5.1 details the reporting structure for the construction phase of the Transmission power lines and substation.

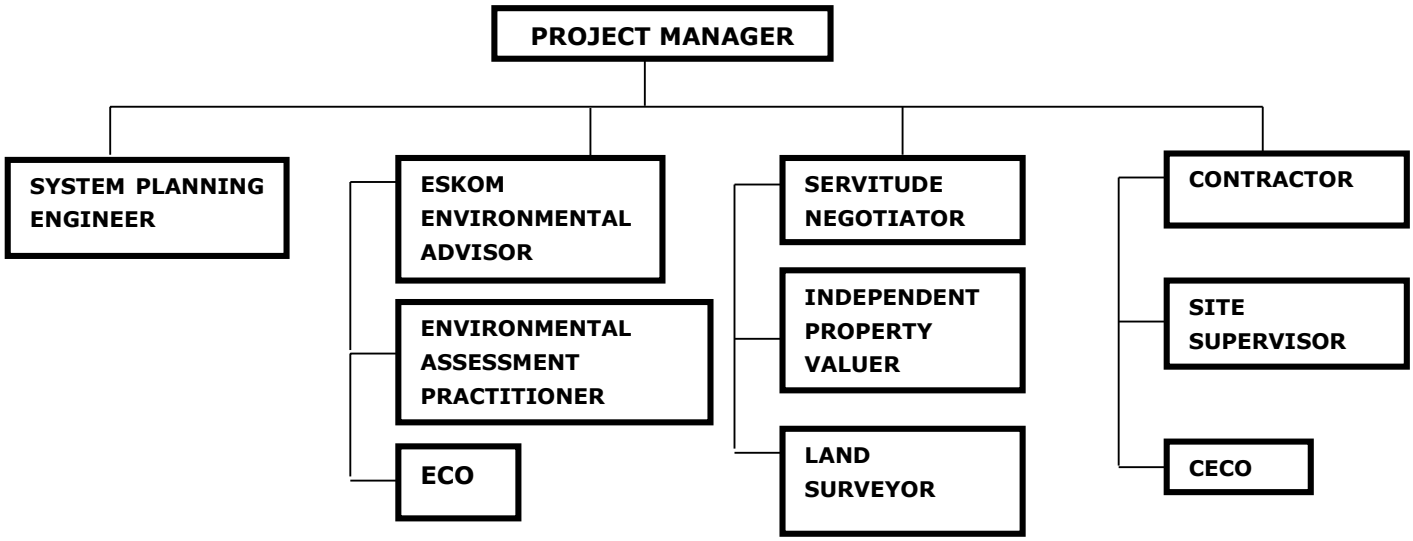


**Figure 5.1:** Reporting structure for the construction phase of a Transmission power line (as per the Eskom Transmission Draft EMP – refer to Appendix E)

The developer (i.e. Eskom) is responsible for the implementation of the EMP during the operational and decommissioning phases of the project. Decommissioning will entail the appointment of a new professional team and responsibilities will be similar to those during the design, pre-construction and construction phases.

Specific responsibilities of each of these parties are detailed in the sections which follow.

### *5.1.1. Project Manager/Site Manager*

The Project Manager/Site Manager is responsible for overall management of project and EMPr implementation. The following tasks will fall within his/her responsibilities:

» Be aware of the findings and conclusions of the Environmental Impact Assessment and the conditions stated within the Environmental Authorisation (once issued).
» Be familiar with the recommendations and mitigation measures of this EMP, and implement these measures.
» Monitor site activities on a daily basis for compliance.
» Conduct internal audits of the construction site against the EMP.
» Confine the construction site to the demarcated area.
» Rectify transgressions through the implementation of corrective action.

### *5.1.2. Environmental Control Officer*

The Environmental Control Officer is responsible for the implementation of the EMP during the construction phase, as well as for liaison between Eskom, the Contractor and the Landowners. The following tasks will fall within his/her responsibilities:

» Be fully knowledgeable with the contents with the EIA.
» Be fully knowledgeable with the contents with the conditions of the Environmental Authorisation (once issued).
» Be fully knowledgeable with the contents with the EMPr.
» Be fully knowledgeable of all the licences and permits issued to the site.
» Be fully knowledgeable with the contents with all relevant environmental legislation, and ensure compliance with them.
» Ensure that the contents of this document are communicated to the Contractor site staff and that the Site Manager and Contractor are constantly made aware of the contents through discussion.
» Ensure that the compliance of the EMPr, EA and the legislation is monitored through regular and comprehensive inspection of the site and surrounding areas.
» Ensure that if the EMPr, EA and/or the legislation conditions, regulations or specifications are not followed then appropriate measures are undertaken to address any non-compliances (for example an ECO may cease construction or an activity to prevent a non-compliance from continuing).
» Monitoring and verification must be implemented to ensure that environmental impacts are kept to a minimum, as far as possible.
» Ensure that the Site Manager has input into the review and acceptance of construction methods and method statements.
» Ensure that activities on site comply with all relevant environmental legislation.
» Ensure that a removal is ordered of any person(s) and/or equipment responsible for any contravention of the specifications of the EMPr.
» Keep record of all activities on site, problems identified, transgressions noted and a task schedule of tasks undertaken by the ECO.
» Ensure that the compilation of progress reports for submission to the Technical Director, with input from the Site Manager, takes place on a regular basis, including a final post-construction audit.
» Ensure that there is communication with the Site Manager regarding the monitoring of the site.
» Ensure that any non-compliance or remedial measures that need to be applied are reported.
» Keep record of all activities on site, problems identified, transgressions noted and a task schedule of tasks undertaken by the ECO.

» Submit independent reports to the DEA and other regulating authorities regarding compliance with the requirements of the EMPr, EA and other environmental permits.

### *5.1.3. Contractor*

The contractor is responsible for the implementation and compliance with recommendations and conditions of the EMP.

» Ensure compliance with the EMP at all times during construction.
» Provide all necessary supervision during the execution of the project. He/ She should be available on site all the time.
» Comply with special conditions as stipulated by landowners during the negotiation process.
» Inform and educate all employees about the environmental risks associated with the various activities to be undertaken, and highlight those activities which should be avoided during the construction process in order to minimise significant impacts to the environment.
» Maintain an environmental register which keeps a record of all incidents which occur on the site during construction. These incidents include:
  * Public involvement / complaints
  * Health and safety incidents
  * Hazardous materials stored on site
  * Non-compliance incidents
» Where construction activities are undertaken is close to any inhabited area, the necessary precautions shall be taken by the Contractor to safeguard the lives and property of the inhabitants.
» The Contractor shall under no circumstances interfere with the property of landowners, Grid staff or nearby communities.
» Should the Contractor require clarity on any aspect of the EMP the Contractor must contact the Environmental Consultant/Officer for advice.

### *5.1.4. Contractor's Safety, Health and Environment Representative*

The Contractor's Safety, Health and Environment (SHE) Representative, employed by the Contractor, is responsible for managing the day-to-day on-site implementation of this EMPr, and for the compilation of regular (usually weekly) Monitoring Reports. In addition, the SHE must act as liaison and advisor on all environmental and related issues and ensure that any complaints received from the public are duly recorded and forwarded to the Site Manager and Contractor.

The Contractor's Safety, Health and Environment Representative should:
» Be well versed in environmental matters.
» Understand the relevant environmental legislation and processes.

» Understand the hierarchy of Environmental Compliance Reporting, and the implications of Non-Compliance.
» Know the background of the project and understand the implementation programme.
» Be able to resolve conflicts and make recommendations on site in terms of the requirements of this Specification.
» Keep accurate and detailed records of all EMP-related activities on site.

## 5.2. Objectives

In order to meet the overall goal for construction, the following objectives, actions, and monitoring requirements have been identified.

***OBJECTIVE 1: Environmentally sensitive location of construction equipment camps along the power line servitude and at the substation site***

The Contractor must take all reasonable measures to ensure the safety of the public in the surrounding area.

| | |
|---|---|
| **Project Component/s** | » Power lines<br>» Substations<br>» Access roads |
| **Potential Impact** | » Damage to protected / endangered vegetation<br>» Damage to and/or loss of topsoil<br>» Compacting of ground<br>» Impacts on the surrounding environment due to inadequate sanitation and waste removal facilities at construction crew camp |
| **Activities/Risk Sources** | » Bush clearing and levelling of equipment storage area/s<br>» Access to and from the equipment storage area/s<br>» Construction crew camp |
| **Mitigation: Target/Objective** | » To minimise impacts on the social and biophysical environment.<br>» To limit equipment storage to within the demarcated site |

| Mitigation: Action/Control | Responsibility | Timeframe |
|---|---|---|
| Secure site, working areas and excavations in an appropriate manner. | Contractor | Site establishment, and duration of construction |
| The exact siting of construction equipment camp/s shall be negotiated with the relevant landowner, and located as close to the construction site as possible | Contractor | Pre-construction |

| Mitigation: Action/Control | Responsibility | Timeframe |
|---|---|---|
| and must take cognisance of any no-go and sensitive areas identified by the EIA studies (refer to Figure 1.2). Construction camps and laydown areas must only be located in previously transformed areas. | | |
| As far as possible, minimise vegetation clearing and levelling for equipment storage areas. | Contractor | Site establishment, and during construction |
| Adequate protective measures must be implemented to prevent unauthorised access to the working area and the internal access routes. | Contractor | Site establishment, and duration of construction |
| Fence and secure contractor's equipment camp. | Contractor | Site establishment |
| Establish appropriately bunded areas for storage of hazardous materials (i.e. fuel to be required during construction). | Contractor | Site establishment |
| All unattended open excavations shall be adequately demarcated and/or fenced. | Contractor | Site establishment, and duration of construction |
| Establish the necessary ablution facilities with chemical toilets and provide adequate sanitation facilities and ablutions for construction workers (1 toilet per every 15 workers) at appropriate locations on site. | Contractor | Site establishment, and duration of construction |
| Ablution or sanitation facilities should not be located within 100 m from a 1:100 year flood line including drainage lines and wetlands. | Contractor | Site establishment, and duration of construction |
| Supply adequate waste collection bins at site where construction is being undertaken. Separate bins should be provided for general and hazardous waste. As far as possible, provision should be made for separation of waste for recycling. | Contractor | Site establishment, and duration of construction |

| | |
|---|---|
| **Performance Indicator** | » Site is secure and there is no unauthorised entry.<br>» The construction camps have avoided sensitive areas.<br>» No members of the public/ landowners injured.<br>» Appropriate and adequate waste management and sanitation facilities provided at construction site. |
| **Monitoring** | » An incident reporting system will be used to record non-conformances to the EMPr.<br>» ECO and SHE Officer to monitor all construction areas on a continuous basis until all construction is completed. Non- |

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| | conformances will be immediately reported to the site manager. |

## *OBJECTIVE 2: Appropriate management of the construction site and construction workers*

It is expected that low skilled and semi-skilled positions will be filled by locals living in and around the area. This will however be dependent on the skills availability in the area. Workers not living in the area, including those required for skilled positions will be transported to site on a daily basis and will not be housed on site. However, the security team will be required on site at all times.

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| **Project Component/s** | » Power lines<br>» Substations<br>» Access roads. |
| **Potential Impact** | » Damage to indigenous natural vegetation and sensitive areas.<br>» Damage to and/or loss of topsoil (i.e. pollution, compaction etc.).<br>» Impacts on the surrounding environment due to inadequate sanitation and waste removal facilities.<br>» Pollution/contamination of the environment. |
| **Activities/Risk Sources** | » Vegetation clearing and levelling of equipment storage area/s.<br>» Access to and from the equipment storage area/s.<br>» Ablution facilities.<br>» Contractors not aware of the requirements of the EMPr, leading to unnecessary impacts on the surrounding environment. |
| **Mitigation: Target/Objective** | » Limit equipment storage within demarcated designated areas.<br>» Ensure adequate sanitation facilities and waste management practices.<br>» Ensure appropriate management of actions by on-site personnel in order to minimise impacts to the surrounding environment. |

| Mitigation: Action/Control | Responsibility | Timeframe |
|---|---|---|
| No vehicles to refuel within or close to drainage lines or wetlands | Contractor | Construction |
| Rehabilitate all disturbed areas at the construction equipment camp as soon as construction is complete within an area. | Contractor | Duration of Contract |
| Ensure waste storage facilities are maintained and emptied on a regular basis. | Contractor | Site establishment, and duration of construction |

| Mitigation: Action/Control | Responsibility | Timeframe |
|---|---|---|
| Ensure that all personnel have the appropriate level of environmental awareness and competence to ensure continued environmental due diligence and on-going minimisation of environmental harm. This can be achieved through the provision of appropriate environmental awareness training to all personnel. Records of all training undertaken must be kept. | Contractor | Duration of construction |
| Contractors must use chemical toilets/ablution facilities situated at designated areas of the site; no ablution activities will be permitted outside the designated areas. These facilities must be regularly serviced by appropriate contractors. A minimum of one toilet shall be provided per 15 persons at each working area such as the Contractor's camp. | Contractor and sub-contractor/s | Duration of contract |
| Cooking and eating of meals must take place in a designated area. No fires are allowed on site. No firewood or kindling may be gathered from the site or surrounds. | Contractor and sub-contractor/s | Duration of contract |
| All litter must be deposited in a clearly marked, closed, animal-proof disposal bin in the construction area. Particular attention needs to be paid to food waste. | Contractor and sub-contractor/s | Duration of contract |
| No one may disturb flora or fauna outside of the demarcated construction area/s. | Contractor and sub-contractor/s | Duration of contract |
| Fire-fighting equipment and training must be provided before the construction phase commences. | Contractor and sub-contractor/s | Duration of contract |
| Draft and implement a code of conduct for construction workers. | Contractor and sub-contractor/s | Pre-construction |
| Contractors must ensure that all workers are informed at the outset of the construction phase of the conditions contained in the Code of Conduct, specifically consequences of stock theft and trespassing on adjacent farms. | Contractor and sub-contractor/s | Construction |

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| **Performance Indicator** | » Ablution and waste removal facilities are in a good working order and do not pollute the environment due to mismanagement.<br>» All areas are rehabilitated promptly after construction in an area is complete.<br>» Excess vegetation clearing and levelling is not undertaken.<br>» No complaints regarding contractor behaviour or habits.<br>» Appropriate training of all staff is undertaken prior to them commencing work on the construction site. |

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| | » Code of Conduct drafted before commencement of construction phase. |
| **Monitoring** | » Regular audits of the construction camps and areas of construction on site by the SHE Officer and ECO.<br>» Proof of disposal of sewage at an appropriate licensed wastewater treatment works.<br>» Proof of disposal of waste at an appropriate licensed waste disposal facility.<br>» Complaints must be investigated and, if appropriate, acted upon.<br>» An incident reporting system must be used to record non-conformances to the EMPr. |

## *OBJECTIVE 3: Appropriate sourcing of labour*

Construction of the substation and power lines will largely require the use of skilled labourers. However, some unskilled labour opportunities exist, mainly associated with excavation of foundations, erection of fencing, etc. Opportunities for low to medium skilled local labour are possible although limited. It is expected that the low to medium skilled people could be sourced from the nearby towns.

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| **Project Component/s** | » Power lines<br>» Substations<br>» Access roads |
| **Potential Impact** | » Job opportunities for unskilled labourers from the local communities |
| **Activities/Risk Sources** | » Unskilled job opportunities (excavation activities, erection of fences, eradication of weed species by hand, etc.) |
| **Mitigation: Target/Objective** | » To ensure that local labour is utilised as far as possible |

| Mitigation: Action/Control | Responsibility | Timeframe |
|---|---|---|
| The use of labour intensive construction measures should be used where appropriate. | Contractor | Duration of Contract |
| Training of labour should be undertaken to benefit individuals beyond completion of the project | Contractor | Duration of Contract |
| Labour should be sourced from the local community where possible, by developing a strategy to involve local labour in the | Contractor | Duration of Contract |

| Mitigation: Action/Control | Responsibility | Timeframe |
|---|---|---|
| construction process. | | |
| The contractors should liaise with the appropriate ward councillors and community structures to determine possible candidates to be employed as sub-contractors. | Contractor | Duration of Contract |
| Contractors should use local skills, or train semi-skilled people or re-skill appropriate candidates for employment purposes where possible. Onsite training should focus on the development of transferable skills (technical, marketing and entrepreneurial skills) to ensure long term benefits to the individuals involved. | Contractor | Duration of Contract |

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| **Performance Indicator** | » Site is secure and there is no unauthorised entry.<br>» No members of the public/ landowners are injured.<br>» To a certain extent, local economic development (LED) is supported. |
| **Monitoring** | » Regular visual inspection of fence for signs of deterioration/forced access.<br>» An incident reporting system (which is in line with Eskom's requirements in this regard) should be used to record non-conformances to the EMP. |

***OBJECTIVE 4: To ensure landowner / stakeholder concerns are adequately addressed***

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| **Project component/s** | » Power lines<br>» Substations<br>» Access roads |
| **Potential Impact** | » Landowners impacted by proposed alignment of the power line, positioning of towers and access road/s |
| **Activities/risk sources** | » Lack of awareness of landowner concerns<br>» Lack of communication with landowners |
| **Mitigation: Target/Objective** | » To ensure adequate regard has been taken of concerns of affected and surrounding landowners and that these are appropriately addressed |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| A Community Liaison Officer or Social Engagement Officer should be on site at all times. | Contractor | Construction |
| Members of the construction team should behave fittingly at all times. | Contractor | Duration of contract |
| Eskom personnel should not access private properties without prior notification of the property owners. | Eskom / Contractor | Duration of contract |
| Eskom should coordinate with landowners in terms of access and construction activities in order to minimise disturbance. | Eskom / Contractor | Duration of contract |

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| **Performance Indicator** | » No complaints received regarding construction activities from property owners.<br>» All complaints and issues received are timeously attended to and addressed |
| **Monitoring** | » An incident reporting system must be used to record non-conformances to the EMPr. |

## *OBJECTIVE 5: Protection of sensitive areas, vegetation and faunal habitats*

The construction of a power line requires the clearance of vegetation at the tower footprints, along access roads, at construction equipment camps and along the centre line of the servitude for stringing of the conductors. Construction of the substations requires the clearance of vegetation within the development footprint and along any new access roads.

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| **Project component/s** | » Power line towers<br>» Substations<br>» Access roads<br>» Construction equipment camp |
| **Potential Impact** | » Localised loss of sensitive, protected and/or Red Data plant species<br>» Disturbance and/or destruction of sensitive terrestrial habitats<br>» Disturbance to plant communities and habitats<br>» Disturbance to avifauna |
| **Activity/risk source** | » Clearing of tower footprints, servitude centre line and access roads<br>» Clearing and levelling of substation site<br>» Traffic to and from site during all phases of construction (i.e. from surveying to rehabilitation of an area)Site preparation and earthworks |

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| | » Excavation of foundations<br>» Mobile construction equipment<br>» Dumping or damage by construction equipment outside of demarcated construction areas. |
| **Mitigation: Target/Objective** | » To retain natural vegetation as far as possible.<br>» To minimise footprints of disturbance of vegetation/habitats along the servitude and on the substation site |

| **Mitigation: Action/control** | **Responsibility** | **Timeframe** |
|---|---|---|
| A site rehabilitation programme shall be formulated following the specialist walk-though survey, and must be implemented as soon as possible after construction is completed in an area. | Contractor in consultation with Specialist | Duration of contract |
| The boundaries of the development footprint areas are to be clearly demarcated and it must be ensured that all activities remain within the demarcated footprint area. | Contractor | Duration of contract |
| The extent of clearing and disturbance to the indigenous vegetation shall be kept to a minimum so that the impact on flora and faunal habitats is restricted. | Contractor | Site establishment & duration of contract |
| During construction, unnecessary disturbance to habitats shall be strictly controlled. Avoiding any sensitive habitats with construction vehicles and equipment during construction must be ensured. | Contractor in consultation with Specialist | Duration of contract |
| Utilise existing access roads as far as possible. | Contractor | Duration of contract |
| A weed eradication programme must be compiled and implemented. | Contractor in consultation with Specialist | Duration of contract |
| Prevent impacts on any surface water as a result of hazardous materials, contamination, unnecessary crossing by vehicles or personnel, extraction, drinking or other human uses, construction and maintenance activities | Contractor | Construction phase |
| Develop emergency maintenance operational plan to deal with any event of contamination, pollution or spillages, particularly in riparian areas | Contractor | Construction phase |
| Sensitive animal or bird species on private properties should be screened from the dust and construction activities in consultation with the property owners and/or breeders | Contractor | Duration of contract |
| Demarcate areas of importance that should be protected during construction phase | SHE Officer | Construction phase |
| Harvesting and collection of any flora must be strictly prohibited | Contractor | Duration of contract |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| Workers must be limited to areas under construction and access to the undeveloped areas must be strictly controlled | Contractor | Duration of contract |
| All Natural areas beyond the development footprint, which have been affected by the construction activities, must be rehabilitated using indigenous plant species. | Contractor | Duration of contract |
| Education and awareness campaigns on faunal species and their habitat are recommended to help increase awareness, respect and responsibility towards the environment for all staff and contractors. | Contractor<br>SHE Officer | Duration of contract |
| Care must be taken when driving within the study site to minimise risk to fauna from vehicular movement. | Contractor | Duration of contract |
| No trapping or hunting of fauna is to take place. Access control must be implemented to ensure that no illegal trapping or poaching takes place. | Contractor | Duration of contract |
| The Angulate Tortoise (*Chersina ungulata*) is a protected species by the Nature Conservation Ordinance No. 19 of 1974 (as amended in 2000) and it must not be collected | Contractor | Duration of contract |
| Should any Red Data faunal species be noted within the development footprint areas, these species must be relocated to similar habitat within the vacant land to the west of the development area with the assistance of a suitably qualified Ecologist. Relocation of protected species must be undertaken in terms of an appropriate permit. | Contractor | Duration of contract |

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| **Performance Indicator** | » No disturbance outside of designated work areas.<br>» Minimised clearing of existing/natural vegetation.<br>» Limited impacts on areas of identified and demarcated sensitive habitats/vegetation.<br>» Absence of alien vegetation throughout the entire development footprint.<br>» Compliance with the Nature Conservation Ordinance No.19 of 1974 (as amended in 2000) ensuring that the collection of Angulate does occur during the construction phase of the project. |
| **Monitoring** | » Observation and monitoring of vegetation clearing activities by the SHE Officer throughout construction phase.<br>» Rehabilitated areas must be monitored to ensure the establishment of re-vegetated areas to a ground of cover of at least 85%.<br>» Supervision of all clearing and earthworks by the SHE Officer.<br>» An incident reporting system must be used to record non-conformances to the EMPr. |

## *OBJECTIVE 6: Protection of avifauna*

During the operation, the threat of collision with the power line is the biggest potential threat to avifauna, particularly sensitive, collision prone species that may occur in the study area. The threat of electrocution while perching on the power line and substation and associated infrastructure serves as a threat to certain sensitive species, depending on the power line and substation structures implemented.

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| **Project Component/s** | » Power lines<br>» Substations<br>» Access roads. |
| **Potential Impact** | » Collision and electrocution events with the overhead power line.<br>» Electrocution on substation infrastructure |
| **Activities/Risk Sources** | » Operation of the power line without appropriate mitigation measures.<br>» Operation of the substation without appropriate mitigation measures. |
| **Mitigation: Target/Objective** | » Install appropriate bird diverters<br>» Utilise bird-friendly towers<br>» Utilise appropriate substation design to minimise risk of electrocution |

| Mitigation: Action/Control | Responsibility | Timeframe |
|---|---|---|
| Fit power lines with bird flight diverters in identified bird sensitive areas. Anti-collision devices must be fitted in accordance with Eskom guidelines. | Contractor | Construction |
| Insulate live components at support structures. | Contractor | Construction |
| Ensure implementation of bird-friendly towers along all power line routes. | Contractor | Construction |
| Ensure implementation of appropriate substation design to minimise risk of electrocution. All relevant perching surfaces within the substation must be fitted with bird guards as deterrents. | Contractor | Construction |
| Any bird nests that are found during the construction period must be reported to the Environmental Control Officer (ECO) | Contractor | Construction |
| No construction should occur during the breeding season of the Southern Black Korhaan | Contractor | Construction |

| Mitigation: Action/Control | Responsibility | Timeframe |
|---|---|---|
| (i.e. from August to November) in areas where this species is reported to be present. | | |
| Bird Guards must be fitted on all self-supporting type towers, as per Eskom Transmission guidelines (refer to Appendix B). Relevant towers should be identified by an ornithologist once line profiles are available | Eskom / specialist / construction teams. | Should be fitted at construction. |

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| **Performance Indicator** | » Bird-friendly infrastructure implemented.<br>» Bird diverters implemented in identified bird sensitive areas. |
| **Monitoring** | » Monitoring of implementation of required measures by SHE Officer.<br>» An incident reporting system must be used to record non-conformances to the EMPr. |

## *OBJECTIVE 7: Protection of sites of heritage value*

Identified heritage indicators within the study area include:

» archaeological resources in the form of several historical ruins that lie beneath the proposed Transmission Line Alternative 4 and 6 alignments (largely Grade IIIC but some NCW);
» palaeontological resources in the form of buried fossils which are likely to occur widely beneath the broader area (largely Grade IIIB but potentially as high as Grade I); and
» the cultural landscape which is a combination of a historical agricultural landscape, an area of relatively natural landscape and a modern electrical and industrial landscape (Grade IIIC).

Although other resources like structures (suggested up to Grade IIIB) and the R45 scenic route (suggested Grade IIIB) are present, they will not be unduly impacted.

The only project components likely to result in archaeological impacts are Transmission Line Alternatives 4 and 6 as they run directly above some historical ruins. As a worst case scenario it is assumed that these ruins may need to be levelled in order to clear the transmission corridor. Due to the low cultural significance of these sites, this would not be considered a fatal flaw and the extent of the impacts would be local. Indirect impacts are not expected. With total destruction of the historical ruins along Transmission Line Alternatives 4 and 6 the impacts could be of medium significance. With mitigation this would be

reduced to low significance. Impacts to archaeological resources for all other potential project components are considered to be of low significance and therefore no mitigations measures are required for these components.

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| **Project component/s** | » Power line towers<br>» Substations<br>» Access roads |
| **Potential Impact** | » Heritage objects or artefacts found during construction are inappropriately managed or destroyed |
| **Activity/risk source** | » Site preparation and earthworks<br>» Excavation of foundations<br>» Construction equipment movement on site |
| **Mitigation: Target/Objective** | » To ensure that any heritage objects found on site are recorded and/or treated appropriately and in accordance with the relevant legislation |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| Areas required to be cleared during construction must be clearly marked in the field to avoid unnecessary disturbance of adjacent areas (which will not be surveyed in detail by a heritage specialist). | Contractor in consultation with Specialist | Pre-construction |
| Familiarise all staff and contractors with procedures for dealing with heritage objects/sites. | Specialist | Pre-construction |
| Project employees and any contract staff should maintain, at all times, a high level of awareness of the possibility of discovering heritage sites. | Contractor | Duration of contract |
| Full-time monitoring by an appropriately-qualified person must be carried out at all substation locations until bulk earthworks are completed. Any fossils found must be recorded following accepted palaeontological standards and the material collected for curation in an approved repository where it will be available for future research. | Specialist | Duration of construction |
| If a heritage object is found, work in that area shall be stopped immediately, and appropriate specialists brought in to assess to site, notify the administering authority of the item/site, and undertake due/required processes. Contact details for Heritage Western Cape are: Tel: 27(0) 21 483 5959; E-mail: hwc.hwc@westerncape.gov.za | Eskom/Contractor in consultation with Specialist | Duration of contract |
| Apply for sampling permits from SAHRA for work on any archaeological sites identified as needing intervention – in other words any archaeological site that will be directly affected by the proposed transmission power lines, substation or access roads. | Eskom in consultation with Specialist | Pre-construction |

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| **Performance Indicator** | » No disturbance of heritage sites outside of designated work areas.<br>» All heritage items located are dealt with as per the legislative guidelines. |
| **Monitoring** | » Observation of substation excavation activities by palaeontologist throughout construction phase.<br>» Supervision of all clearing and earthworks.<br>» Due care taken during earthworks and disturbance of land by all staff and any heritage objects found reported, and appropriate permits obtained from SAHRA prior to the disturbance or destruction of heritage sites.<br>» An incident reporting system should be used to record non-conformances to the EMP. |

## *OBJECTIVE 8: Appropriate management of topsoil*

Topsoil will be required to be stripped in areas affected by construction activities, including excavation of tower foundations, clearance and levelling of the substation sites and establishment of access roads (where required).

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| **Project component/s** | » Power line towers<br>» Substations<br>» Access roads |
| **Potential Impact** | » Loss of topsoil |
| **Activity/risk source** | » Site preparation and earthworks<br>» Excavation for tower base foundations<br>» Construction of access roads |
| **Mitigation: Target/Objective** | » To minimise disturbance to topsoil<br>» Appropriately remove and store topsoil in such a way to ensure effective use of this topsoil in subsequent rehabilitation of disturbed areas |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| Areas to be cleared shall be clearly marked to eliminate the potential for unnecessary clearing of topsoil. | Contractor | Pre-construction |
| Construction activities shall be restricted to demarcated areas so that impact on soils is restricted. | Contractor | Site establishment & duration of contract |
| Prior to the commencement of earthworks the average depth of topsoil shall be determined. The full depth of | Contractor | Site establishment |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| topsoil should be stripped from areas affected by construction and related activities prior to the commencement of major earthworks. This should include the building footprints, working areas and storage areas. Topsoil must be reused where possible to rehabilitate disturbed areas. | | & duration of contract |
| Excavated topsoil shall be stockpiled separately from subsoil and adequately protected against erosion until replaced during rehabilitation. As far as possible, topsoil should not be stored for longer than 3 months. | Contractor | Site establishment & duration of contract |
| The maximum topsoil stockpile height should not exceed 2m in order to preserve micro-organisms within the topsoil, which can be lost due to compaction and lack of oxygen. | Contractor | Duration of contract |

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| **Performance Indicator** | » No disturbance outside of designated work areas.<br>» Minimise loss of topsoil. |
| **Monitoring** | » Observation and monitoring of topsoil stripping and storage activities by SHE Officer throughout construction phase.<br>» Supervision of all clearing and earthworks.<br>» An incident reporting system should be used to record non-conformances to the EMPr. |

## *OBJECTIVE 9: Erosion and sediment control*

The construction of the power lines and the substations require foundations to be constructed in order to increase the stability of the structures. The depth of the foundations will be determined by the underlying geology of an area.

The greatest impact on the geology and soil associated with the construction of any structures is the potential for soil erosion. This impact depends on the soil erosion potential of the overlying soils. The potential soil erosion rate of the area is considered to be high due to the nature of the soils in the area, and numerous eroded areas present within the study area.

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| **Project component/s** | » Power line towers<br>» Substations<br>» Access roads |
| **Potential Impact** | » Erosion and soil loss associated with both wind and water<br>» Sediment entering surrounding hydrological system |
| **Activities/risk** | » Water and wind erosion of cleared and excavated areas |

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| **sources** | » Stormwater run-off from sealed surfaces at the substation site |
| **Mitigation: Target/Objective** | » To minimise erosion on site and along gravel access roads during construction<br>» To provide permanent erosion and sediment control measures, where required<br>» To minimise the risk of sedimentation of water resources during the construction phase |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| A Stormwater Management Plan for the substation site, detailing the location and design of stormwater and sediment control devices shall be prepared and approved prior to the commencement of construction activities. | Contractor | Pre-construction |
| All areas susceptible to erosion shall be protected with suitable erosion control measures from the onset of the project. | Contractor | Duration of contract |
| All stockpiles shall be positioned away from drainage lines and wetlands. | Contractor | During site establishment and any activity related to earthworks |
| The time from commencement of construction to rehabilitation shall be kept to a minimum in order to limit the period of surface exposure and thereby limit the potential for erosion. | Contractor | Duration of contract |
| Disturbance of vegetation and topsoil shall be kept to a practical minimum. | Contractor | Duration of contract |
| Movement of vehicles on-site must be on approved and formalised access roads only, which shall be adequately maintained throughout construction. | Contractor | Duration of contract |
| Culverts of adequate size must be provided across drainage lines for any access roads established to the substation site and within the power line servitude. | Contractor | Erection: during site establishment<br>Maintenance: for duration of contract |
| The use of silt fences and sand bags must be implemented in areas that are susceptible to erosion. | Contractor | Duration of contract |
| Disturbed areas must be rehabilitated immediately after construction has been completed in that area. In areas where natural vegetation was disturbed appropriate indigenous plant species must be used for this purpose | Contractor | Duration of contract |
| Access roads and/or tracks used during construction which are not required for maintenance purposes or for | Contractor | Completion of construction |

| Mitigation: Action/control | Responsibility | Timeframe |
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| use by the landowner shall be closed and appropriately rehabilitated. | | |

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| **Performance Indicator** | » No evidence of erosion is present in construction areas or along gravel access roads.<br>» Surface and groundwater meet required water quality guideline levels.<br>» No evidence of excessive sedimentation of water resources. |
| **Monitoring** | » Regular visual inspections of the construction areas and along gravel access roads for signs of erosion.<br>» Fortnightly visual inspection of sediment and water quality control devices throughout construction phase and during or following major rain events.<br>» Immediate reporting by personnel of damaged or ineffective sediment control measures or potential water contamination to Site Manager.<br>» An incident reporting system should be used to record non-conformances to the EMPr. |

## *OBJECTIVE 10: Appropriate Handling and Storage of Equipment and Materials*

Construction equipment and materials will be required to be stored on site. The appropriate handling of storage of these materials and equipment is important in order to minimise impacts on the surrounding environment.

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| **Project component/s** | » Power lines<br>» Substation<br>» Access roads |
| **Potential Impact** | » Hazards to the natural environment, landowners, community members and the general public<br>» Security of materials and equipment |
| **Activities/risk sources** | » Storage and handling of potentially hazardous materials<br>» Storage and maintenance of construction equipment |
| **Mitigation: Target/Objective** | » To ensure environmental best practice in terms of the storage and handling of construction materials and equipment<br>» To ensure that the storage and handling of chemicals and hydrocarbons on-site does not cause pollution to the environment or harm to persons<br>» To ensure that the storage and maintenance of machinery on-site does not cause pollution of the environment or harm to persons |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| All construction equipment shall be stored within the formal construction equipment camp | Contractor | Duration of contract |
| Routine servicing and maintenance of vehicles will not take place on-site (except for emergency situations or large cranes which cannot be moved off-site). If repairs of vehicles must take place outside of designated areas, an appropriate drip tray will be used to contain any fuel or oils. | Contractor | Duration of contract |
| All stored fuels must be maintained within a bund and on a sealed surface. | Contractor | Duration of contract |
| Only designated areas must be used for storage of construction materials, soil stockpiles, machinery and other equipment | Contractor | Duration of contract |
| Specific areas shall be designated for cement batching plants (if required). The cement batching plant must be contained within a bunded area. Sufficient drainage for these plants must be in place to ensure that soils do not become contaminated. | Contractor | Duration of contract |
| Cement, concrete and chemicals must be mixed on plastic linings and provisions should be made to contain spillages or overflows into the soil. | Contractor | Duration of contract |
| Any storage tanks containing hazardous materials must be placed in bunded containment areas with sealed surfaces. The bund walls must be high enough to contain 110% of the total volume of the stored hazardous material. | Contractor | Duration of contract |
| Any hazardous substances must be stored away from any water body | Contractor | Duration of contract |
| Noise created by the loading and off-loading of construction material should be limited as far as possible | Contractor | Duration of contract |
| Workshop areas shall be monitored for oil and fuel spills and such spills shall be cleaned and remediated. | Contractor | Duration of contract |
| The Contractor shall be in possession of emergency spill kits that must be complete and available at all times on site. | Contractor | Duration of contract |
| In the event of a major incident (including a major emission, fire or explosion leading to serious danger to the public or potentially serious pollution of or detriment to the environment, whether immediate or delayed), the responsible person must, as soon as reasonably practicable after knowledge of the incident:<br><br>(a) take all reasonable measures to contain and minimise the effects of the incident, including its | Contractor | Duration of contract |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| effects on the environment and any risks posed by the incident to the health, safety and property of persons;<br>(b) undertake clean-up procedures;<br>(c) remedy the effects of the incident;<br>(d) assess the immediate and long-term effects of the incident on the environment and public health. | | |
| Hazardous waste handling and spill response training shall be included for staff and contractors as part of site induction. | Contractor | Duration of contract |
| Corrective action must be undertaken immediately if a complaint is made, or potential/actual leak or spill of polluting substance identified. This includes stopping the contaminant from further escaping, cleaning up the affected environment as much as practically possible and implementing preventive measures. | Contractor | Duration of contract |
| Spill response procedures must include removal/ disposal of potentially contaminated water and soil. | Contractor | Duration of contract |
| Any contaminated/polluted soil removed from the site must be disposed of at a licensed hazardous waste disposal facility. | Contractor | Duration of contract |
| Oily water from bunds at the substation shall be removed from site by licensed contractors. | Contractor | Duration of contract |
| Spilled cement must be cleaned up as soon as possible and disposed of at a suitably licensed waste disposal site. | Contractor | Duration of contract |
| Any storage and disposal permits/approvals which may be required shall be obtained, and the conditions attached to such permits and approvals shall be compiled with. | Contractor | Duration of contract |
| Transport of all hazardous substances shall be in accordance with the relevant legislation and regulations. | Contractor | Duration of contract |
| Once construction has been completed on site and all excess material has been removed, the storage area must be appropriately rehabilitated. If the area has been badly damaged, re-seeding shall be done and fencing in of the area shall be considered if livestock will subsequently have access to such an area. | Contractor | Completion of construction |

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| **Performance Indicator** | » Construction equipment and materials are appropriately stored.<br>» No impacts on the surrounding environment occur as a result of the inappropriate handling and storage of equipment and materials. |

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| **Monitoring** | » Regular inspection of the construction equipment camp to ensure that appropriate handling and storage practices are in place.<br>» Regular monitoring of the area surrounding the construction equipment camp/s to identify any impacts on the environment from this area/s.<br>» A complaints register shall be maintained, in which any complaints from the community will be logged. Complaints shall be investigated and, if appropriate, acted upon.<br>» An incident reporting system (which is in line with Eskom's requirements in this regard) should be used to record non-conformances to the EMP |

## *OBJECTIVE 11: Appropriate Access and Traffic Management*

The construction phase of the project will be the most significant in terms of generating traffic impacts; resulting from the transport of equipment and materials and construction crews to the site and the return of the vehicles after delivery of materials. Potential impacts associated with transportation and access relate to works within the site boundary and external works outside the site boundary. The components for the proposed power lines and substations will be transported to site by road.

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| **Project Component/s** | » Delivery of project components to site.<br>» Movement of construction vehicles and equipment |
| **Potential Impact** | » Impact of construction vehicles on road surfaces, and possible increased risk in accidents involving people and animals.<br>» Traffic congestion, particularly on narrow roads or on road passes where overtaking is not permitted.<br>» Deterioration of road pavement conditions (both surfaced and gravel road) due to abnormal loads. |
| **Activities/Risk Sources** | » Construction vehicle movement.<br>» Speeding on local roads.<br>» Degradation of local road conditions.<br>» Site preparation and earthworks.<br>» Foundations or plant equipment installation.<br>» Transportation of ready-mix concrete from off-site batching plant to the site.<br>» Mobile construction equipment movement on-site.<br>» Power line construction activities. |
| **Mitigation: Target/Objective** | » Minimise impact of traffic associated with the construction of the power line on local traffic volume, existing infrastructure, property owners, animals, and road users.<br>» To minimise potential for negative interaction between |

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| | pedestrians or sensitive users and traffic associated with construction activities.<br>» To ensure all vehicles are roadworthy and all materials/ equipment are transported appropriately and within any imposed permit/licence conditions. |

| Mitigation: Action/Control | Responsibility | Timeframe |
|---|---|---|
| Source general construction material and goods locally where available to limit transportation over long distances. | Contractor | Construction |
| Appropriate dust suppression techniques must be implemented to minimise dust from gravel roads. | Eskom and Contractor | Construction |
| Construction vehicles and those transporting materials and goods should be inspected by the contractor or a sub-contractor to ensure that these are in good working order and not overloaded. | Contractor | Construction |
| Strict vehicle safety standards should be implemented and monitored. | Contractor | Construction |
| A designated access to the proposed site must be created to ensure safe entry and exit. | Contractor | Pre-construction |
| No deviation from approved transportation routes must be allowed, unless roads are closed for whatever reason outside the control of the contractor. | Contractor | Duration of contract |
| Appropriate road management strategies must be implemented on external and internal roads with all employees and contractors required to abide by standard road and safety procedures. | Contractor (or appointed transportation contractor) | Pre-construction |
| Any traffic delays because of construction traffic must be co-ordinated with the appropriate authorities. | Contractor | Duration of contract |
| The movement of all vehicles within the site must be on designated roadways. | Contractor | Duration of contract |
| Signage must be established at appropriate points warning of turning traffic and the construction site (all signage to be in accordance with prescribed standards). | Contractor | Duration of contract |
| Appropriate maintenance of all vehicles of the contractor must be ensured. | Contractor | Duration of contract |
| All vehicles of the contractor travelling on public roads must adhere to the specified speed limits and all drivers must be in possession of an appropriate valid driver's license. | Contractor | Duration of contract |
| Appropriate signs must be placed along construction roads to identify speed limits, travel restrictions and other standard traffic control information. Signage must be maintained on an on-going basis and must be clearly visible to all road users. | Contractor | Duration of contract |

| Mitigation: Action/Control | Responsibility | Timeframe |
|---|---|---|
| No deviation from approved transportation routes shall be allowed, unless roads are closed for whatever reason outside the control of the contractor. | Contractor | Duration of contract |
| Appropriate dust suppression techniques shall be used to minimise dust emissions on gravel roads (water spraying). | Contractor | Duration of contract |
| Vehicle movements on local roads shall be limited to standard construction operating hours wherever possible to limit noise impacts and dust nuisance. | Contractor | Duration of contract |
| Times for arrival and departure of heavy vehicles shall be co-ordinated as far as possible in order to minimise congestion. | Contractor | Duration of contract |
| All hazardous substances shall be transported in accordance with the relevant legislation and regulations. | Contractor | Duration of contract |
| Appropriate maintenance of all vehicles shall be ensured. | Contractor | Duration of contract |
| All vehicles travelling on public roads shall adhere to the specified speed limits and all drivers shall be in possession of an appropriate valid driver's license. | Contractor | Duration of contract |
| Landowners shall be informed timeously of the construction programme, duration, access requirements, and all interference with their daily activities | Contractor | Duration of contract |
| Access roads must be maintained for the duration of the construction phase in order to ensure that they are passable and that the potential for erosion is minimised. | Contractor | Duration of contract |
| Appropriate access gates shall be installed where required and fitted with locks. These shall be kept closed at all times, | Contractor | Installation: site establishment<br>Maintenance: Duration of contract |
| Access roads and/or tracks used during construction which are not required for maintenance purposes or for use by the landowner shall be closed and appropriately rehabilitated. | Contractor | Completion of construction |
| The contractors should consult with the relevant officials and key stakeholders regarding the traffic schedule, routes, diversions, road closures and so forth. | Contractor | Duration of contract |

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| **Performance Indicator** | » Gravel access roads maintained in passable condition with no erosion occurring |

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| | » Upon completion of construction, all private roads are left in at least the original condition<br>» No traffic incidents involving Eskom personnel or appointed contractors<br>» No complaints resulting from traffic congestion, delays or driver negligence associated with construction of the power lines and/or substation |
| **Monitoring** | » Pre-construction photographic record of existing access roads to be used for construction purposes.<br>» Visual monitoring of the condition of access roads to ensure appropriate maintenance thereof.<br>» Visual monitoring of traffic control measures to ensure they are effective.<br>» Visual monitoring of dust produced by traffic movement.<br>» A complaints register shall be maintained, in which any complaints from the community will be logged. Complaints will be investigated and, if appropriate, acted upon.<br>» An incident reporting system shall be used to record non-conformances to the EMPr. |

***OBJECTIVE 12: To avoid and or minimise the potential risk of increased veld fires during the construction phase***

The increased presence of people on the site could increase the risk of veld fires, particularly in the dry season.

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| **Project Component/s** | » Power lines<br>» Substations<br>» Access roads. |
| **Potential Impact** | » Veld fires can pose a personal safety risk to local farmers and communities, and their homes, crops, livestock and farm infrastructure, such as gates and fences. |
| **Activities/Risk Sources** | » The presence of construction workers and their activities on the site can increase the risk of veld fires. |
| **Mitigation: Target/Objective** | » To avoid and or minimise the potential risk of veld fires on local communities and their livelihoods. |

| Mitigation: Action/Control | Responsibility | Timeframe |
|---|---|---|
| Ensure that open fires on the site for cooking or heating are not allowed except in designated areas. | Contractors | Duration of construction |
| Provide adequate firefighting equipment onsite. | Contractors | Duration of |

| Mitigation: Action/Control | Responsibility | Timeframe |
|---|---|---|
| | | construction |
| Provide fire-fighting training to selected construction staff. | Contractors | Duration of construction |

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| **Performance Indicator** | » Designated areas for fires identified on site at the outset of the construction phase.<br>» Fire-fighting equipment and training provided before the construction phase commences. |
| **Monitoring** | » SHE Officer must monitor indicators listed above to ensure that they have been met for the construction phase. |

## *OBJECTIVE 13: Appropriate handling and management of waste*

The construction of the substation and power lines will involve the generation of various wastes. In order to manage the wastes effectively, guidelines for the assessment, classification and management of wastes, along with industry principles for minimising construction wastes must be implemented.

The main wastes expected to be generated by the construction activities will include:

» general solid waste
» hazardous waste
» liquid waste (including grey water and sewage)

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| **Project component/s** | » Power lines<br>» Substations<br>» Access roads |
| **Potential Impact** | » Inefficient use of resources resulting in excessive waste generation<br>» Litter or contamination of the site or water through poor waste management practices |
| **Activity/risk source** | » Construction wastes<br>» Hydrocarbon use and storage<br>» Spoil material from excavation, earthworks and site preparation |
| **Mitigation: Target/Objective** | » To comply with waste management guidelines<br>» To minimise production of waste<br>» To ensure appropriate waste storage and disposal<br>» To avoid environmental harm from waste disposal |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| Construction contractors shall provide specific detailed waste management plans to deal with all waste streams. | Contractor | Pre-construction |
| Supply a wastewater management system that will comply with legal requirements and be acceptable to Eskom. | Contractor | Pre-construction |
| Supply waste collection bins at construction equipment and construction crew camps. | Contractor | Erection: during site establishment Maintenance: for duration of Contract within a particular area |
| Specific areas shall be designated on-site for the temporary management of various waste streams, i.e. general refuse, construction waste, and contaminated waste. Location of such areas must seek to minimise the potential for impact on the surrounding environment, including prevention of contaminated runoff, seepage and vermin control. | Contractor | Duration of contract |
| Hazardous and non-hazardous waste shall be separated at source. Separate waste collection bins must be provided for this purpose. These bins must be clearly marked and appropriately covered. | Contractor | Erection: during site establishment Maintenance: for duration of Contract within a particular area |
| All solid waste collected shall be disposed of at a registered waste disposal site. A certificate of disposal shall be obtained and kept on file. The disposal of waste shall be in accordance with all relevant legislation. Under no circumstances may solid waste be burnt on site. | Contractor | Erection: during site establishment Maintenance: for duration of Contract within a particular area |
| Where possible, construction and general wastes on-site shall be reused or recycled. Bins and skips shall be available on-site for collection, separation and storage of waste streams (such as wood, metals, general refuse etc). A recycling plan shall be developed in accordance with the requirements of the National Waste Management Strategy and submitted for Eskom approval. | Contractor | Duration of contract |
| Disposal of waste will be in accordance with relevant | Contractor | Duration of |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| legislative requirements, including the use of licensed contractors. | | contract |
| Where a registered waste site is not available close to the construction site, a method statement shall be provided with regard to waste management. | Contractor | Site establishment |
| Documentation (waste manifest) shall be maintained detailing the quantity, nature and fate of any regulated waste. | Contractor | Duration of contract |
| Regularly serviced chemical toilets facilities shall be used to ensure appropriate control of sewage. | Contractor | Duration of contract |
| An incident/complaints register shall be established and maintained on-site. | Contractor | Duration of contract |
| No waste may be buried or burnt on site under any circumstances. | Contractor | Duration of contract |

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| **Performance Indicator** | » No complaints received regarding waste on site or indiscriminate dumping<br>» Internal site audits ensuring that waste segregation, recycling and reuse is occurring appropriately<br>» Provision of all appropriate waste manifests for all waste streams |
| **Monitoring** | » Observation and supervision of waste management practices throughout construction phase<br>» Waste documentation completed ad maintained on site<br>» A complaints register will be maintained, in which any complaints from the community will be logged. Complaints will be investigated and, if appropriate, acted upon<br>» An incident reporting system will be used to record non-conformances to the EMP |

## 5.4. Detailing Method Statements

The environmental specifications are required to be underpinned by a series of Method Statements, within which the Contractors and Service Providers are required to outline how any identified environmental risks will practically be mitigated and managed for the duration of the contract, and how specifications within this EMP will be met. That is, the Contractor will be required to describe how specified requirements will be achieved through the submission of written Method Statements to the Site Manager and ECO.

A Method Statement is defined as "a written submission by the Contractor in response to the environmental specification or a request by the Site Manager, setting out the plant, materials, labour and method the Contractor proposes using to conduct an activity, in such detail that the Site Manager is able to assess

whether the Contractor's proposal is in accordance with the Specifications and/or will produce results in accordance with the Specifications". The Method Statement must cover applicable details with regard to:

» Responsible person/s;
» Construction procedures;
» Materials and equipment to be used;
» Getting the equipment to and from site;
» How the equipment/material will be moved while on-site;
» How and where material will be stored;
» The containment (or action to be taken if containment is not possible) of leaks or spills of any liquid or material that may occur;
» Timing and location of activities;
» Compliance/non-compliance with the Specifications; and
» Any other information deemed necessary by the Site Manager.

Specific method statements required may include:
» Site establishment;
» Preparation of the site;
» Soil management/stockpiling and erosion control;
» Excavations and backfilling procedure;
» Stipulate norms and standards for water supply and usage (i.e.: comply strictly to licence and legislation requirements and restrictions);
» Storm water management procedures;
» Wash bay for the construction vehicles and or machineries;
» Ablution facilities (placement, maintenance, management and servicing);
» Solid Waste Management;
» Liquid waste management;
» Dust and noise pollution;
» Hazardous substance storage (Ensure compliance with all national, regional and local legislation with regard to the storage of oils, fuels, lubricants, solvents, wood treatments, bitumen, cement, pesticides and any other harmful and hazardous substances and materials. South African National Standards apply);
» Fire prevention and management measures on site;
» Fauna and flora protection process on and off site (i.e. removal to reintroduction or replanting, if necessary);
» Incident and accident reporting protocol;
» General administration;
» Designate access road and the protocol on while roads are in use;
» Requirements on gate control protocols.

The Contractor may not commence the activity covered by the Method Statement until it has been approved by the Site Manager, except in the case of emergency

activities and then only with the consent of the Site Manager. Approval of the Method Statement will not absolve the Contractor from their obligations or responsibilities in terms of their contract.

Failure to submit a method statement may result in suspension of the activity concerned until such time as a method statement has been submitted and approved. The ECO should monitor the construction activities to ensure that these are undertaken in accordance with the approved Method Statement.

## 5.5. Awareness and Competence: Construction Phase

To achieve effective environmental management, it is important that Contractors are aware of the responsibilities in terms of the relevant environmental legislation and the contents of this EMP. The Contractor is responsible for informing employees and sub-contractors of their environmental obligations in terms of the environmental specifications, and for ensuring that employees are adequately experienced and properly trained in order to execute the works in a manner that will minimise environmental impacts.

The Contractors obligations in this regard include the following:

» Employees must have a basic understanding of the key environmental features of the construction site and the surrounding environment.
» Ensuring that a copy of the EMP is readily available on-site, and that all site employees are aware of the location and have access to the document.
» Employees shall be familiar with the requirements of the EMPr and the environmental specifications as they apply to the construction of the power line.
» Ensuring that, prior to commencing any site works, all employees and sub-contractors have attended an Environmental Awareness Training course.
» The course should be sufficient to provide the site staff with an appreciation of the project's environmental requirements, and how they are to be implemented.
» Awareness of any other relevant environmental matters, which are deemed necessary by the ECO.
» Ensuring that employee information posters, outlining the environmental "do's" and "don'ts" (as per the environmental awareness training course) are erected at prominent locations throughout the site.
» Ensure that construction workers have received basic training in environmental management, including the storage and handling of hazardous substances, minimisation of disturbance to sensitive areas, management of waste, and prevention of water pollution.
» Records must be kept of those that have completed the relevant training.
» Training should be done either in a written or verbal format but must be appropriate for the receiving audience.

### *5.5.1 Environmental Awareness Training*

Environmental Awareness Training must take the form of an on-site talk and demonstration by the ECO before the commencement of site establishment and construction on site. The education/awareness programme should be aimed at all levels of management and construction workers within the contractor team. A record of attendance of this training must be maintained by the ECO on site. Proof of awareness training should be kept on record.

### *5.5.2 Induction Training*

Environmental induction training must be presented to all persons who are to work on the site – be it for short or long durations; Contractor's or Engineer's staff; administrative or site staff; sub-contractors or visitors to site.

This induction training should include discussing the developer's environmental policy and values, the function of the EMPr and Contract Specifications and the importance and reasons for compliance to these. The induction training must highlight overall do's and don'ts on site and clarify the repercussions of not complying with these. The non-conformance reporting system must be explained during the induction as well. Opportunity for questions and clarifications must form part of this training. A record of attendance of this training must be maintained by the SHE Officer on site. Proof of induction training should be kept on record.

### *5.5.3 Toolbox Talks*

Toolbox talks should be held on a scheduled and regular basis (at least twice a month) where foremen, environmental and safety representatives of different components of the Works and sub-consultants hold talks relating to environmental practices and safety awareness on site. These talks should also include discussions on possible common incidents occurring on site and ones recommended by the onsite ECO and the prevention of reoccurrence thereof. Records of attendance and the awareness talk subject must be kept on file.

## 5.6. Monitoring Programme: Construction Phase

A monitoring programme must be in place not only to ensure conformance with the EMP, but also to monitor any environmental issues and impacts which have not been accounted for in the EMP that are, or could result in significant environmental impacts for which corrective action is required. The period and frequency of monitoring will be stipulated by the Environmental Authorisation

(once issued). The Project Manager will ensure that the monitoring is conducted and reported.

The aim of the monitoring and auditing process would be to monitor the implementation of the specified environmental specifications, in order to:

» Monitor and audit compliance with the prescriptive and procedural terms of the environmental specifications.
» Ensure adequate and appropriate interventions to address non-compliance.
» Ensure adequate and appropriate interventions to address environmental degradation.
» Provide a mechanism for the lodging and resolution of public complaints.
» Ensure appropriate and adequate record keeping related to environmental compliance.

### *5.6.1. Non-Conformance Reports*

All supervisory staff including Foremen, Engineers, and the ECO must be provided the means to be able to submit non-conformance reports to the Site Manager. Non-conformance reports will describe, in detail, the cause, nature and effects of any environmental non-conformance by the Contractor. Records of penalties imposed may be required by the relevant authority within 48 (forty eight) hours.

The non-conformance report will be updated on completion of the corrective measures indicated on the finding sheet. The report must indicate that the remediation measures have been implemented timeously and that the non-conformance can be closed-out to the satisfaction of the Site Manager and ECO.

### *5.6.2. Incident Reports*

According to Section 30 of National Environmental Management Act (NEMA), an "Incident" is defined as unexpected sudden occurrence, including a major emission, fire or explosion leading to serious danger to the public or potentially serious pollution of or detriment to the environment, whether immediate or delayed.

In terms of the requirements of NEMA, the responsible person must, within 14 days of the incident, report to the Director General, provincial head of department and municipality such information as is available to enable an initial evaluation of the incident, including:

(a) the nature of the incident;

(b) the substances involved and an estimation of the quantity released and their possible acute effect on persons and the environment and data needed to assess these effects;
(c) initial measures taken to minimise impacts;
(d) causes of the incident, whether direct or indirect, including equipment, technology, system, or management failure; and
(e) measures taken and to be taken to avoid a recurrence of such incident.

### *5.6.3. Monitoring Reports*

A monitoring report will be compiled by the ECO on a monthly basis and must be submitted to DEA for their records. This report should include details of the activities undertaken in the reporting period, any non-conformances or incidents recorded if any, corrective action required, and details of those non-conformances or incidents which have been closed out.

### *5.6.4. Final Audit Report*

A final environmental audit report must be compiled by an independent auditor and be submitted to DEA upon completion of the construction and rehabilitation activities (within 30 days of completion of the construction phase i.e. within 30 days of site handover) and within 30 days of completion of rehabilitation activities. This report must indicate the date of the audit, the name of the auditor and the outcome of the audit in terms of compliance with the environmental authorisation conditions and the requirements of the EMPr.

# MANAGEMENT PROGRAMME: REHABILITATION CHAPTER 6

**Overall Goal:** Undertake the rehabilitation measures in a way that:

» Ensures rehabilitation of disturbed areas following the execution of the works, such that residual environmental impacts are remediated or curtailed.

## 6.1. Objectives

In order to meet this goal, the following objective, actions and monitoring requirements are relevant:

***OBJECTIVE: To ensure rehabilitation of disturbed areas following the execution of the works, such that residual environmental impacts are remediated or curtailed***

Areas requiring rehabilitation will include all areas disturbed during the construction phase and that are not required for regular maintenance operations. The main areas requiring rehabilitation will be the construction camps, laydown areas adjacent to the servitudes, the centre line of the power line servitudes cleared for stringing purposes, access roads not required for maintenance purposes, and disturbed areas around the substation.

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| **Project component/s** | » Power line servitudes (including temporary access roads and laydown areas)<br>» Substation site |
| **Potential Impact** | » Environmental integrity of substation site and power line servitude undermined resulting in reduced visual aesthetics, erosion, compromised land capability and the requirement for on-going management intervention |
| **Activity/risk source** | » Temporary laydown areas alongside power line servitudes and substation site<br>» Temporary access roads/tracks<br>» Other disturbed areas/footprints |
| **Mitigation: Target/Objective** | » To ensure and encourage site rehabilitation of disturbed areas<br>» To ensure that the site is appropriately rehabilitated following the execution of the works, such that residual environmental impacts (including erosion) are remediated or curtailed |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| A site rehabilitation programme must be formulated following the specialist walk-though survey, and must | Contractor in consultation with | Duration of contract |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| be implemented as soon as possible after construction is completed in an area. | Specialist | |
| Ensure immediate surface restoration and re-sloping in order to prevent erosion, taking cognisance of local contours and landscaping. | Contractor | Following execution of the works |
| Use only local indigenous species in the rehabilitation/ re-vegetation process. | Contractor | Rehabilitation phase |
| All temporary facilities, equipment and waste materials must be removed from site. | Contractor | Following execution of the works |
| Compacted areas that are no longer needed post-construction (e.g. laydown areas, and the crane tracks) must be ripped and scarified. | Contractor | Following completion of construction activities in an area |
| Necessary drainage works and anti-erosion measures shall be installed, where required, to minimise loss of topsoil and control erosion. | Contractor | Following completion of construction activities in an area |
| Stockpiled topsoil shall be replaced in disturbed areas where rehabilitation is to be undertaken as a layer of at least 10 cm in thickness. | Contractor | Following completion of construction activities in an area |
| Disturbed areas must be rehabilitated/re-vegetated with appropriate natural vegetation and/or local seed mix in the appropriate season. | Contractor in consultation with rehabilitation specialist | Following completion of construction activities in an area |
| Rehabilitated areas must be monitored to ensure the establishment of re-vegetated areas to a ground of cover of at least 85% | Contractor in consultation with rehabilitation specialist | Following completion of construction activities in an area |

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| **Performance Indicator** | » Monitoring of all construction areas, including construction equipment camps and working areas, cleared of equipment and temporary facilities<br>» Topsoil replaced on all areas and stabilised<br>» Disturbed areas rehabilitated and acceptable plant cover achieved on rehabilitated sites<br>» Closed site free of erosion and alien invasive plants |
| **Monitoring** | » On-going inspection of rehabilitated areas in order to determine effectiveness of rehabilitation measures implemented |

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| | » On-going alien plant monitoring and removal should be undertaken on an annual basis |

# MANAGEMENT PROGRAMME: OPERATION CHAPTER 7

**Overall Goal:** To ensure that the operation of the power line do not have unforeseen impacts on the environment and to ensure that all impacts are monitored and the necessary corrective action taken in all cases. In order to address this goal, it is necessary to operate the line in a way that:

» Ensures that operation activities are properly managed in respect of environmental aspects and impacts.
» Enables operation and maintenance activities to be undertaken without significant disruption to other land uses in the area, in particular with regard to farming practices, traffic and road use, and effects on local residents.
» Minimises impacts on birds and other fauna in the area.

An environmental manager must ensure the implementation of the operational EMPr.

## 7.1. Roles and Responsibilities for Operation and Maintenance

### *7.1.1. Eskom Environmental Advisor*

Responsibilities include:

» To implement and integrate environmental management systems by ensuring compliance to ISO 14000 and monitoring performance
» Report environmental incidents
» Provides environmental training
» Ensures compliance to legislations and other legally binding documents

## 7.2. Objectives

In order to meet this goal, the following objectives have been identified, together with necessary actions and monitoring requirements.

### *OBJECTIVE 1: Protection of avifauna*

Bird interactions with the power lines can be anticipated during the operation phase of the power lines. These are, however, well researched in the South African context (through the EWT and Eskom partnership). The main impacts

expected are as a result of collisions with the earth-wire and disturbance of bird species in the area.

As a result of long-term monitoring, Eskom are in a position to make use of 'bird-friendly' towers and conductor configurations for their power lines. Exact spans requiring marking and towers requiring bird guards shall be determined by a suitably qualified specialist during an avifaunal walk-through survey to be conducted as part of the site-specific EMPr phase.

Electrocutions of certain bird species within the substation during its operation, could potentially have a negative impact on a variety of bird species, particularly those species that regularly utilise the electrical infrastructure within the substation yard on which to breed and nest (e.g. crows, herons, sparrows, owls and geese).

A number of mechanisms exist through which birds are able to cause electrical faults. These include:

» Bird streamer induced faulting, whereby the fault is caused by the bird releasing a "streamer" of faeces which can constitute an air gap intrusion between the conductor and the earthed structure.
» Bird pollution, whereby a flashover occurs when an insulator string gets coated with pollutant, which compromises the insulation properties of the string.
» Bird nests, which may cause faults through nest material protruding and constituting an air gap intrusion

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| **Project component/s** | » Power lines<br>» Substations |
| **Potential Impact** | » Loss of birds as a result of collision with the power line earth wire<br>» Electrocution in the proposed substation HV yard<br>» Disturbance to bird species in the area as a result of maintenance activities<br>» Impact of birds on quality of supply |
| **Activity/risk source** | » Overhead power lines<br>» Substation HV yard |
| **Mitigation: Target/Objective** | » More accurately determine the impact of the operating substation and power lines on priority bird species<br>» To minimise the number of bird collisions on the power lines<br>» To minimise the number of electrical faults caused by birds |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| Anti-collision marking devices installed during | Eskom | Operation |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| construction must be maintained throughout the operational phase. | | |
| Bird Guards installed during construction must be maintained throughout the operational phase. | Eskom | Operation |

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| **Performance Indicator** | » No bird collisions on the power line once built – this will be monitored by standard Eskom line patrols, and random public detection of carcasses.<br>» No bird related faulting on line once built – this will be monitored by Eskom's line performance management systems. |
| **Monitoring** | » Eskom's standard line patrols will detect any bird collisions that occur. Landowners are also likely to detect and report any collisions that occur<br>» Eskom's standard line performance monitoring will detect whether any bird related faulting occurs on this power line once operational. |

### *OBJECTIVE 2: Protection of vegetation and faunal habitats*

Indirect impacts on vegetation and habitats during operation and maintenance activities could result from maintenance activities and the movement of people and vehicles on site.

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| **Project component/s** | » Power line servitudes and associated access roads<br>» Substation and access to substations |
| **Potential Impact** | » Disturbance to or loss of vegetation and/or habitats |
| **Activity/risk source** | » Movement of employee and visitor vehicles within and around site |
| **Mitigation: Target/Objective** | » To minimise impacts on flora and faunal habitats<br>» To ensure and encourage plant regrowth in areas of post-construction rehabilitation |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| Vehicle movements must be restricted to designated roadways. | Eskom | Operation |
| Impacts on any surface water as a result of hazardous materials, contamination, unnecessary crossing by vehicles or personnel, extraction, drinking or other human uses and maintenance activities must be prohibited. | Eskom | Operation |
| No new roads shall be created. | Eskom | Operation |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| Existing roads shall be maintained to ensure limited erosion and impact on areas adjacent to roadways. | Eskom | Operation |
| During maintenance activities, unnecessary disturbance to habitats shall be strictly controlled. Avoiding any sensitive habitats with maintenance vehicles must be ensured. | Eskom | Duration of contract |
| An on-going weed eradication programme must be implemented. | Eskom | Operation |

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| **Performance Indicator** | » No disturbance to vegetation or faunal habitats<br>» Continued improvement of rehabilitation efforts |
| **Monitoring** | » Observation of vegetation on-site by Site Manager<br>» Regular inspections to monitor plant regrowth/performance of rehabilitation efforts and weed infestation (6-12 monthly) compared to natural/undisturbed areas |

## *OBJECTIVE 3: Management of Power Line Servitude*

Poor vegetation management under and in close proximity to power lines is one of the main causes of loss of biodiversity associated with power lines. Vegetation is often brush cut or mowed unnecessarily resulting in a loss of diversity over time. In order to ensure the long-term environmental integrity of the servitude, maintenance of the servitude must be appropriately undertaken to minimse impacts on vegetation.

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| **Project component/s** | » power line servitude<br>» access roads |
| **Potential Impact** | » Disturbance to or loss of flora and/or habitat within listed ecosystems<br>» Increased erosion |
| **Activity/risk source** | » Maintenance activities such as alien plant clearing<br>» Management of power line servitude area |
| **Mitigation: Target/Objective** | » To minimise disturbance of natural vegetation/habitats within the servitude<br>» To minimise erosion<br>» To ensure the servitude is free of woody aliens and contains indigenous vegetation in good condition. |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| Vegetation at any site must not be brush cut in two consecutive years. Time should be allowed for seed set and seed bank accumulation (e.g. no heavy cutting of sensitive species for three to four | Eskom and contractors | Operation |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| years since certain species retain seeds for this long). A botanical specialist should be consulted prior to clearing of indigenous vegetation. | | |
| Pruning of old stems to be AVOIDED wherever possible. | Eskom and contractors | Operation |
| Any ancient trees found must not be pruned down. | Eskom and contractors | Operation |
| Species with short-lived seed banks should be lightly pruned. | Eskom and contractors | Operation |
| No herbicides to be used on natural vegetation. Restrict application to alien and invasive vegetation. | Eskom and contractors | Operation |
| Pruned branches of tall vegetation with seed heads must not be removed from the site and must not be chipped. Instead these are to be dispersed from the point of trimming. Where Environmental Control Officers are not part of Eskom's vegetation management program, such personnel should be incorporated into the vegetation site control monitoring teams. | Eskom and contractors | Operation |
| Target of 40cm minimum height for cleared vegetation when clearing is required. | Eskom and contractors | Operation |
| Clear servitude of alien vegetation and implement an appropriate alien plant management plan. | Eskom | Operation |
| Rehabilitate disturbance areas should the previous attempt be unsuccessful. | Eskom and contractors | Operation |
| Maintain erosion control measures implemented during the construction phase. | Eskom and contractors | Operation |
| Implement appropriate erosion management measures within the servitude area. The servitude and its access route must be monitored for signs of erosion, and signs of erosion remedied immediately | Eskom and contractors | Operation |

| | |
|---|---|
| **Performance Indicator** | » Limited disturbance to natural vegetation/habitats within the servitude area.<br>» Limited erosion within servitude area.<br>» Servitude free of alien species.<br>» No clearing of indigenous species required. |
| **Monitoring** | » Annual monitoring must be carried out together with monitoring of the remainder of the development to detect and eradicate new infestations of alien plant species before they become well established and may spread. This will inform the clearing program.<br>» Monitoring of erosion within servitude. |

## *OBJECTIVE 4: Appropriate handling and management of hazardous substances and waste at the substation site*

The operation and maintenance of the substation and power lines will involve the generation of limited waste products. The main wastes expected to be generated by the operation and maintenance activities include:

» general solid waste
» hazardous waste
» liquid waste

| | |
|---|---|
| **Project component/s** | » Power lines<br>» Substations |
| **Potential Impact** | » Inefficient use of resources resulting in excessive waste generation<br>» Litter or contamination of the site or water through poor waste management practices |
| **Activity/risk source** | » Office and workshop facilities at the substation<br>» Transformers and switchgear - substation<br>» Fuel and oil storage |
| **Mitigation: Target/Objective** | » To comply with waste management guidelines<br>» To minimise production of waste<br>» To ensure appropriate waste disposal<br>» To avoid environmental harm from waste disposal |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| Hazardous substances must be stored in sealed containers within a clearly demarcated designated area. | Eskom | Operation |
| Storage areas for hazardous substances must be appropriately sealed and bunded. | Eskom | Operation |
| All structures and/or components replaced during maintenance activities shall be appropriately disposed of at an appropriately licensed waste disposal site or sold to a recycling merchant for recycling. | Eskom | Operation |
| Care shall be taken to ensure that spillage of oils and other hazardous substances are limited during maintenance. Handling of these materials should take place within an appropriately sealed and bunded area. Should any accidental spillage take place, it shall be cleaned up according to specified standards regarding bioremediation. | Eskom | Operation and maintenance |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| Waste handling, collection and disposal operations shall be managed and controlled by a waste management contractor. | Eskom/waste management contractor | Operation |
| Wastewater: Water from bunds and oily water from oil/water separator shall be removed by a licensed contractor. | Eskom/waste contractor | Operation |
| Used oils and chemicals:<br>» Appropriate disposal shall be arranged with a licensed facility in consultation with the administering authority.<br>» Waste shall be stored and handled according to the relevant legislation and regulations. | Eskom/waste management contractor | Operation |
| General waste shall be recycled where possible or disposed of at an appropriately licensed landfill. | Eskom/waste management contractor | Operation |
| Hazardous waste (including hydrocarbons) shall be stored and disposed of separately. | Eskom/waste management contractor | Operation |
| Disposal of waste shall be in accordance with relevant legislative requirements, including the use of licensed contractors. | Eskom | Operation |
| In the event of a major incident (including a major emission, fire or explosion leading to serious danger to the public or potentially serious pollution of or detriment to the environment, whether immediate or delayed), the responsible person must, as soon as reasonably practicable after knowledge of the incident:<br><br>(a) take all reasonable measures to contain and minimise the effects of the incident, including its effects on the environment and any risks posed by the incident to the health, safety and property of persons;<br>(b) undertake clean-up procedures;<br>(c) remedy the effects of the incident;<br>(d) assess the immediate and long-term effects of the incident on the environment and public health.<br><br>In terms of the requirements of NEMA, the responsible person must, within 14 days of the incident, report to the Director General, provincial head of department and municipality such information as is available to enable an initial evaluation of the incident, including:<br><br>(a) the nature of the incident; | Eskom | Operation |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| (b) the substances involved and an estimation of the quantity released and their possible acute effect on persons and the environment and data needed to assess these effects;<br>(c) initial measures taken to minimise impacts;<br>(d) causes of the incident, whether direct or indirect, including equipment, technology, system, or management failure; and<br>(e) measures taken and to be taken to avoid a recurrence of such incident. | | |

| | |
|---|---|
| **Performance Indicator** | » No complaints received regarding waste on site or indiscriminate dumping<br>» Internal site audits identifying that waste segregation recycling and reuse is occurring appropriately<br>» Provision of all appropriate waste manifests<br>» No contamination of soil or water |
| **Monitoring** | » Waste collection must be monitored on a regular basis·<br>» Waste documentation must be completed and available for inspection on request<br>» An incidents/complaints register must be maintained, in which any complaints from the community must be logged. Complaints must be investigated and, if appropriate, acted upon<br>» Regular reports on exact quantities of all waste streams exiting the site must be compiled by the waste management contractor and monitored by the SHE Representative. All appropriate waste disposal certificates accompany the monthly reports. |

***OBJECTIVE 5: To ensure adequate regard is taken of landowner / stakeholder concerns and that these are appropriately addressed***

| | |
|---|---|
| **Project component/s** | » Power lines<br>» Substations |
| **Potential Impact** | » Stakeholder concerns not addressed with regard to maintenance |
| **Activity/risk source** | » Maintenance of substation<br>» Maintenance of transmission lines |
| **Mitigation: Target/Objective** | » To ensure adequate regard is taken of landowner / stakeholder concerns and that these are appropriately addressed |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| Eskom maintenance personnel should be in possession of the required identification documents when undertaking maintenance work | Contractor | Duration of contract |
| Sound servitude management measures should be implemented. The implementation of the servitude management measures should be monitored on an ongoing basis | Contractor | Duration of contract |
| Eskom personnel should not access private properties without prior notification of the property owners | Contractor | Duration of contract |

| | |
|---|---|
| **Performance Indicator** | » No additional disturbance to avifaunal populations along the length of the power line routes<br>» Continued improvement of avifaunal protection efforts |
| **Monitoring** | » Observation of avifaunal populations and incidence of injuries/death from collisions with the power line<br>» Regular inspections to monitor casualties from collisions - delegate a suitable on-site monitor to assess avian mortality associated with the power lines. |

It is most likely that decommissioning activities of the infrastructure would comprise the disassembly and removal of the power line and substation components from the site. This would be applicable to the decommissioning of the Blouwater Substation planned as part of the Saldanha Network Strengthening Project.

The EMPr for Construction (Chapter 5) and Rehabilitation (Chapter 6) is also relevant to the decommissioning of sections of the proposed distribution line and must be adhered to.

The relevant mitigation measures contained under the construction section should be applied during decommissioning and therefore is not repeated in this section. It must be noted that decommissioning activities will need to be undertaken in accordance with the legislation applicable at that time, which may require this section of the EMPr to be revisited and amended.

## 8.1. Objectives

The overall objective of the decommissioning phase is to leave the project area in a condition that minimises adverse impacts on the socio-economic and biophysical environment, with a legacy that contributes to sustainable development.

The objectives of the decommissioning phase of the proposed project are to:

» Follow a process of decommissioning that is progressive and integrated into the short- and long-term project plans that will assess the closure impacts proactively at regular intervals throughout project life.
» Implement progressive rehabilitation measures, beginning during the construction phase.
» Leave a safe and stable environment for both humans and animals and make their condition sustainable.
» Return rehabilitated land-use to a standard that can be useful to the post-project land user.
» Where applicable, prevent any further soil and surface water contamination by maintaining suitable storm water management systems.
» Maintain and monitor all rehabilitated areas following re-vegetation, and if monitoring shows that the objectives have been met, apply for closure.

## 8.2. Approach to the decommissioning phase

In order to minimise the extent of rehabilitation activities required during the decommissioning phase, Eskom shall ensure that constant effort is applied to rehabilitation activities throughout the construction, operation and maintenance phases of the project.

In decommissioning the power line and/or the substation, Eskom shall ensure that:

» All sites not already vegetated are vegetated as soon as possible after operation ceases with species appropriate to the area.
» All structures, foundations and sealed areas are demolished, removed and waste material disposed of at an appropriately licensed waste disposal site.
» All access/service roads not required to be retained by landowners are closed and fully rehabilitated.
» All disturbed areas are compacted, sloped and contoured to ensure drainage and runoff and to minimise the risk of erosion.
» All rehabilitated areas are monitored for erosion.
» Components of the power lines and/or substation are removed from the site and disposed of appropriately. Equipment that is to be reused must be stored on Eskom property and equipment to be disposed of must be done so according to the manufacturer's recommendations.

It is recommended that planning of the decommissioning of the project and rehabilitation of the site should take place well in advance (at least two years) of the planned decommissioning activities. Important factors that need to be taken into consideration are detailed below.

### *8.2.1. Identification of structures for post-closure use*

Access roads should be assessed in conjunction with the ultimate land users to determine if these could be used in future. Where not required, these access roads should be decommissioned and rehabilitated.

### *8.2.2. Removal of infrastructure*

All infrastructure must be dismantled and removed. Inert material must be removed from site and disposed of at a registered landfill site. All foundations must be removed to a depth of 1m. Hard surfaced must be ripped to a depth of 1m and vegetated.

### *8.2.3. Soil amelioration*

The steps that should be taken during the amelioration of soils are as follows:

» The deposited soils must be ripped to ensure reduced compaction;
» An acceptable seed bed should be produced by surface tillage;
» Restore soil fertility;
» Incorporate the immobile fertilisers in to the plant rooting zone before ripping; and
» Apply maintenance dressing of fertilisers on an annual basis until the soil fertility cycle has been restored.

### *8.2.4. Establishment of vegetation*

The objective is to restore the project site to a self-sustaining cycle, i.e. to realise the re-establishment of the natural nutrient cycle with ecological succession initiated.

The objectives for the re-vegetation of reshaped and top-soiled land are to:

» Prevent erosion;
» Restore the land to the agreed land capability;
» Re-establish eco-system processes to ensure that a sustainable land use can be established without requiring fertilizer additions; and
» Restore the biodiversity of the area as far as possible.

### *8.2.5. Maintenance*

Established vegetation requires regular maintenance. If the growth medium consists of low-fertility soils, then regular maintenance will be required until the natural fertility cycle has been restored.

### *8.2.6. Monitoring*

The purpose of monitoring is to ensure that the objectives of rehabilitation are met and that the rehabilitation process is followed. The physical aspects of rehabilitation should be carefully monitored during the progress of establishment of desired final ecosystems.

The following items should be monitored continuously:
» Erosion status;
» Surface drainage systems and surface water quality;
» Vegetation species diversity; and
» Faunal re-colonisation.

# FINALISATION OF THE EMPR CHAPTER 9

The EMPr is a dynamic document, which must be updated when required. It is considered critical that this draft EMPr be updated to include site specific information and specifications following the final walk-through survey by specialists following the negotiation process and surveying of the power lines. This will ensure that the construction and operation activities are planned and implemented taking sensitive environmental features into account.

# APPENDIX A:
# LEGISLATIVE REQUIREMENTS

Review of relevant policies, legislation, guidelines and standards applicable to the proposed Saldanha Bay Network Strengthening Project

| Legislation | Applicable Requirements | Authority | Compliance Requirements |
|---|---|---|---|
| | ***National Legislation*** | | |
| National Environmental Management Act (Act No 107 of 1998) | The EIA Regulations have been promulgated in terms of Chapter 5 of the Act. Listed activities which may not commence without an environmental authorisation are identified within these Regulations.<br><br>In terms of S24(1) of NEMA, the potential impact on the environment associated with these listed activities must be assessed and reported on to the competent authority charged by NEMA with granting of the relevant environmental authorisation.<br><br>In terms of GN R982, R983, R984 and R985 of December 2014, a Scoping and EIA Process is required to be undertaken for the proposed project. | National Department of Environmental Affairs – lead authority.<br>DEA&DP– commenting authority | This EIA report is to be submitted to DEA and DEA&DP in support of the application for authorisation submitted in April 2016 |
| National Environmental Management Act (Act No 107 of 1998) | In terms of the Duty of Care Provision in S28(1) the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to ensure that any pollution or degradation of the environment associated with this project is avoided, stopped or minimised.<br><br>In terms of NEMA, it has become the legal duty of a project proponent to consider a project holistically, and to consider the cumulative effect of a variety of impacts. | National Department of Environmental Affairs (as regulator of NEMA). | While no permitting or licensing requirements arise directly by virtue of the proposed project, this section will find application during the EIA phase and will continue to apply throughout the life cycle of the project. |
| Environment Conservation Act (Act No 73 of 1989) | National Noise Control Regulations (GN R154 dated 10 January 1992) | DEA&DP | While no permitting or licensing requirements arise directly by virtue of the proposed project, this section |

| Legislation | Applicable Requirements | Authority | Compliance Requirements |
|---|---|---|---|
| | | | will find application throughout the life cycle of the project. |
| National Water Act (Act No 36 of 1998) | Water uses under S21 of the Act must be licensed, unless such water use falls into one of the categories listed in S22 of the Act or falls under the general authorisation (and then registration of the water use is required).<br><br>Consumptive water uses may include the taking of water from a water resource and storage - Sections 21a and b.<br><br>Non-consumptive water uses may include impeding or diverting of flow in a water course - Section 21c; and altering of bed, banks or characteristics of a watercourse - Section 21i. | Department of Water and Sanitation | A General Authorisation will be applicable in terms of Notice 509 OF 2016. This GA will be registered once the final design of the project is completed and the location of infrastructure defined. |
| Minerals and Petroleum Resources Development Act (Act No 28 of 2002) | A mining permit or mining right may be required where a mineral in question is to be mined (e.g. materials from a borrow pit) in accordance with the provisions of the Act.<br><br>S53 Department of Mineral Resources: Approval from the Department of Mineral Resources (DMR) may be required to use land surface contrary to the objects of the Act in terms of section 53 of the Mineral and Petroleum Resources Development Act, (Act No 28 of 2002): In terms of the Act approval from the Minister of Mineral Resources is required to ensure that proposed activities do not sterilise a mineral resource that might occur on site. | Department of Mineral Resources | No permit is required as no borrow pits are expected to be required.<br><br>A S53 approval will be required to be obtained for the project. |

| Legislation | Applicable Requirements | Authority | Compliance Requirements |
|---|---|---|---|
| National Environmental Management: Air Quality Act (Act No 39 of 2004) | Measures in respect of dust control (S32) and National Dust Control Regulations of November 2013.<br><br>Measures to control noise (S34) - no regulations promulgated as yet. | Local Municipality | No permitting or licensing requirements applicable for air quality aspects.<br><br>The section of the Act regarding noise control is in force, but no standards have yet been promulgated. Draft regulations have however, been promulgated for adoption by Local Authorities.<br><br>The Act provides that an air quality officer may require any person to submit an atmospheric impact report if there is reasonable suspicion that the person has failed to comply with the Act. |
| National Heritage Resources Act (Act No 25 of 1999) | » Stipulates assessment criteria and categories of heritage resources according to their significance (S7).<br>» Provides for the protection of all archaeological and palaeontological sites, and meteorites (S35).<br>» Provides for the conservation and care of cemeteries and graves by SAHRA where this is not the responsibility of any other authority (S36).<br>» Lists activities which require developers any person who intends to undertake to notify the responsible heritage resources authority and furnish it with details regarding the location, nature, and extent of the proposed development | Heritage Western Cape | A Phase I Heritage Impact Assessment was undertaken in the EIA phase of the process and provides a synthesis of the results achieved by the scoping study and the Phase I survey as well as describing the status quo of the project area with regard to its pre-historical, historical and cultural context (Refer to Appendix G).<br><br>A permit may be required should any cultural/heritage sites of |

| Legislation | Applicable Requirements | Authority | Compliance Requirements |
|---|---|---|---|
| | (S38).<br>» Requires the compilation of a Conservation Management Plan as well as a permit from SAHRA for the presentation of archaeological sites as part of tourism attraction (S44). | | significance be unearthed during the construction phase of the project. |
| National Environmental Management: Biodiversity Act (Act No 10 of 2004) | » Provides for the MEC/Minister to identify any process or activity in such a listed ecosystem as a threatening process (S53)<br>» A list of threatened and protected species has been published in terms of S 56(1) - Government Gazette 29657.<br>» Three government notices have been published, i.e. GN R 150 (Commencement of Threatened and Protected Species Regulations, 2007), GN R 151 (Lists of critically endangered, vulnerable and protected species) and GN R 152 (Threatened or Protected Species Regulations).<br>» Provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. The first national list of threatened terrestrial ecosystems has been gazetted, together with supporting information on the listing process including the purpose and rationale for listing ecosystems, the criteria used to identify listed ecosystems, the implications of listing ecosystems, and summary statistics and national maps of listed ecosystems (National Environmental Management: Biodiversity Act: National list of ecosystems that are threatened | Department of Environmental Affairs<br><br>Cape Nature | As Eskom will not carry on any restricted activity, as is defined in Section 1 of the Act, no permit is required to be obtained in this regard.<br><br>Specialist flora and fauna studies are required to be undertaken as part of the EIA process. A specialist ecological assessment has been undertaken for the proposed project (refer to Appendix D).<br><br>A permit may be required should any protected plant species within the power line corridor or at the substation sites be disturbed or destroyed as a result of the proposed development. |

| Legislation | Applicable Requirements | Authority | Compliance Requirements |
|---|---|---|---|
| | and in need of protection, (G 34809, GN 1002), 9 December 2011).<br>» This Act also regulates alien and invader species. | | |
| Conservation of Agricultural Resources Act (Act No 43 of 1983) | » Prohibition of the spreading of weeds (S5)<br>» Classification of categories of weeds & invader plants (Regulation 15 of GN R1048) & restrictions in terms of where these species may occur.<br>» Requirement & methods to implement control measures for alien and invasive plant species (Regulation 15E of GN R1048). | Department of Agriculture, Forestry and Fisheries | While no permitting or licensing requirements arise from this legislation, this Act will find application during the EIA phase and will continue to apply throughout the life cycle of the project. In this regard, soil erosion prevention and soil conservation strategies must be developed and implemented. In addition, a weed control and management plan must be implemented. |
| National Forests Act (Act No. 84 of 1998) | According to this Act, the Minister may declare a tree, group of trees, woodland or a species of trees as protected. The prohibitions provide that 'no person may cut, damage, disturb, destroy or remove any protected tree, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister'. | Department of Agriculture, Forestry and Fisheries | A permit or license is required for the destruction of protected tree species and/or indigenous tree species within a natural forest. No protected tree species were observed within or near the study area and it is highly unlikely that any protected tree species would be impacted by the development. |
| National Veld and Forest Fire Act (Act 101 of 1998) | In terms of S12 the applicant must ensure that the firebreak is wide and long enough to have a reasonable chance of preventing the fire from spreading, not causing erosion, and is reasonably free of inflammable material. | Department of Agriculture, Forestry and Fisheries | While no permitting or licensing requirements arise from this legislation, this act will find application during the operational phase of the project. Due to the fire prone nature of the area, it must be |

| Legislation | Applicable Requirements | Authority | Compliance Requirements |
|---|---|---|---|
| | In terms of S17, the applicant must have such equipment, protective clothing, and trained personnel for extinguishing fires. | | ensured that the landowner and developer proactively manage risks associated with veld fires and provide cooperation to the local Fire Protection Agency. |
| Hazardous Substances Act (Act No 15 of 1973) | This Act regulates the control of substances that may cause injury, or ill health, or death due to their toxic, corrosive, irritant, strongly sensitising or inflammable nature or the generation of pressure thereby in certain instances and for the control of certain electronic products. To provide for the rating of such substances or products in relation to the degree of danger; to provide for the prohibition and control of the importation, manufacture, sale, use, operation, modification, disposal or dumping of such substances and products.<br><br>Group I and II: Any substance or mixture of a substance that might by reason of its toxic, corrosive etc., nature or because it generates pressure through decomposition, heat or other means, cause extreme risk of injury etc., can be declared as Group I or Group II substance<br>• Group IV: any electronic product; and<br>• Group V: any radioactive material.<br><br>The use, conveyance, or storage of any hazardous substance (such as distillate fuel) is prohibited without an appropriate license being in force. | Department of Health | It is necessary to identify and list all the Group I, II, III and IV hazardous substances that may be on the substation site and in what operational context they are used, stored or handled. If applicable, a license is required to be obtained from the Department of Health. |
| National Environmental | The Minister may by notice in the Gazette publish a | Hazardous Waste – | As no waste disposal site is to be |

| Legislation | Applicable Requirements | Authority | Compliance Requirements |
|---|---|---|---|
| Management: Waste Act, 2008 (Act No. 59 of 2008) | list of waste management activities that have, or are likely to have, a detrimental effect on the environment.<br><br>The Minister may amend the list by –<br><br>» Adding other waste management activities to the list.<br>» Removing waste management activities from the list.<br>» Making other changes to the particulars on the list.<br><br>In terms of the Regulations published in terms of this Act (GN 921), a Basic Assessment or Environmental Impact Assessment is required to be undertaken for identified listed activities.<br><br>Any person who stores waste must at least take steps, unless otherwise provided by this Act, to ensure that:<br>» The containers in which any waste is stored, are intact and not corroded or in any other way rendered unlit for the safe storage of waste.<br>» Adequate measures are taken to prevent accidental spillage or leaking.<br>» The waste cannot be blown away.<br>» Nuisances such as odour, visual impacts and breeding of vectors do not arise; and<br>» Pollution of the environment and harm to health are prevented. | National DEA<br><br>General Waste – DEA&DP | associated with the proposed project, no permit is required in this regard.<br><br>Waste handling, storage and disposal during construction and operation is required to be undertaken in accordance with the requirements of this Act, as detailed in the EMPr (refer to Appendix L) |

| Legislation | Applicable Requirements | Authority | Compliance Requirements |
|---|---|---|---|
| National Road Traffic Act (Act No 93 of 1996) | » The technical recommendations for highways (TRH 11): "Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads" outline the rules and conditions which apply to the transport of abnormal loads and vehicles on public roads and the detailed procedures to be followed in applying for exemption permits are described and discussed.<br>» Legal axle load limits and the restrictions imposed on abnormally heavy loads are discussed in relation to the damaging effect on road pavements, bridges, and culverts.<br>» The general conditions, limitations, and escort requirements for abnormally dimensioned loads and vehicles are also discussed and reference is made to speed restrictions, power/mass ratio, mass distribution, and general operating conditions for abnormal loads and vehicles. Provision is also made for the granting of permits for all other exemptions from the requirements of the National Road Traffic Act and the relevant Regulations. | Western Cape Department of Roads (provincial roads)<br>South African National Roads Agency Limited (national roads) | **An** abnormal load/vehicle permit **may be required to transport the various power line and substation components to site for construction. These include:**<br>» Route clearances and permits will be required for vehicles carrying abnormally heavy or abnormally dimensioned loads.<br>» Transport vehicles exceeding the dimensional limitations (length) of 22m. |
| ***Provincial Policies / Legislation*** | | | |
| Western Cape Noise Control Regulations: PN 627 of 1998 | » The control of noise in the Western Cape Province is legislated in the form of Noise Control Regulations promulgated in terms of section 25 of the Environment Conservation Act No. 73 of 1989.<br><br>In terms of Regulation 4 of the Noise Control | DEA&DP and West Coast District Municipality | In terms of Regulation 4 of the Noise Control Regulations: "No person shall make, produce or cause a disturbing noise (greater than 5 dBA), or allow it to be made, produced or caused by any person, |

| Legislation | Applicable Requirements | Authority | Compliance Requirements |
|---|---|---|---|
| | Regulations: "No person shall make, produce or cause a disturbing noise (greater than 5 dBA), or allow it to be made, produced or caused by any person, animal, machine, device or apparatus or any combination thereof". | | animal, machine, device or apparatus or any combination thereof". The NCR is not triggered by the proposed project. |
| The Nature and Environmental Ordinance 19 of 1974, (as amended by the Western Cape Nature Conservation Laws Amendment Act, Act 2 of 2000 | The Nature and Environmental Ordinance 19 of 1974, (as amended by the Western Cape Nature Conservation Laws Amendment Act, Act 2 of 2000) defines the protection status of plants as follows:<br>* ''endangered flora'' means flora of any species which is in danger of extinction and is specified in Schedule 3 or Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora, Washington, 1973; provided that it shall not include flora of any species specified in such Appendix and Schedule 4; (thus all Schedule 3 species)<br>* ''protected flora'' means any species of flora specified in Schedule 4 or Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora, Washington, 1973; provided that it shall not include any species of flora specified in such Appendix and Schedule 3<br>* ''indigenous unprotected flora'' means any species of indigenous flora not specified in Schedule 3 or 4; | Cape Nature | Permitting or licensing requirements arise from this legislation for the proposed activities to be undertaken for the proposed project as there are a succulent plants species on the proposed development site. A permit is required to remove the plants. |
| Western Cape Transportation Amendment Act of 1996 | The provincial MEC may grant permit to undertake works within 200m of the published route upon receipt of the report assessing the potential impacts thereof. | Western Cape Department of Public Transport and Public | Any application for authorisation contemplated in the ECA and NEMA in respect of a 200m area on either |

| Legislation | Applicable Requirements | Authority | Compliance Requirements |
|---|---|---|---|
| | | Works | side of a published route determination for a provincial road must be accompanied by a report that addresses the issues listed in that section of the Act. |

# APPENDIX B:
# ESKOM GUIDELINES FOR PLACEMENT OF BIRD GUARDS

| Eskom Transmission | Guideline | Document Classification : [TYPE CLASS] |
|---|---|---|

Title: **TRANSMISSION BIRD PERCH GUIDELINES**

| | |
|---|---|
| Reference: | **[TRMNUMBER]** |
| Revision: | **0** |
| Effective date: | **November 2006** |
| Total pages: | **1 Of 12** |
| Revision date: | **November 2009** |

| COMPILED BY | FUNCTIONAL RESP. | AUTHORIZED BY |
|---|---|---|
| ……. | ……. | ……. |
| **H.F.VOSLOO**<br>**CORPORATE CONSULTANT SERVITUDES,**<br>**C V ROOYEN**<br>**EWT** | **ERIC SHUNMAGUM**<br>**PPS MANAGER** | **GAVIN BRUCE**<br>**TRANSMISSION TECHNOLOGY MANAGER** |
| DATE:……. | DATE:……. | DATE:……. |

## Content

## 1. Introduction

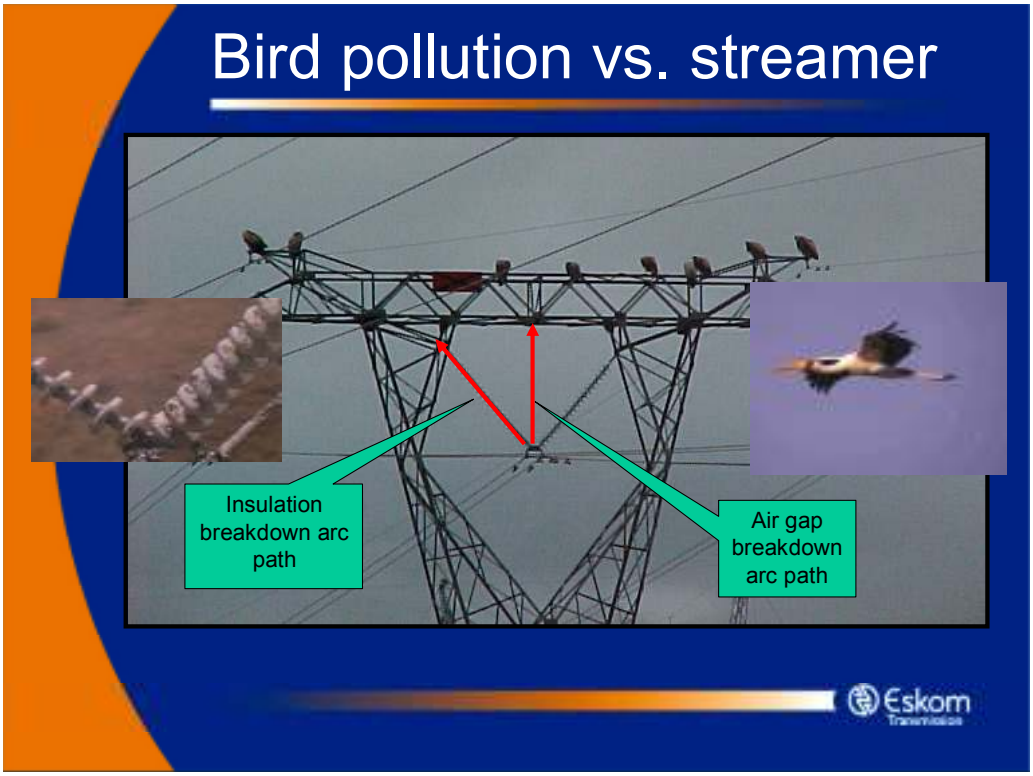
Birds of all descriptions use power line structures for perching and nesting purposes. These structures often are the only (or superior) substrate.

The principle to be followed in perch management is not to prevent birds from roosting on towers, but rather to prevent them from roosting on critical parts of the tower only. The provision of adequate alternative roosting space on the tower will enhance the success of the intervention.

## 2. Recognizing bird induced faulting: pollution vs. streamers

In generic terms, an electrical fault is caused by pollution, coupled with appropriate moisture, when pollutant build-up takes place on the insulator disks. The coating of pollutant (which could range from marine, agricultural or industrial pollution or to bird droppings) compromises the insulation properties of the insulator and under appropriate wet conditions, a phase-earth flashover may result ***across the insulator string.***

In the case of a bird streamer induced fault, the fault normally initiates on the live hardware and it propagates vertically towards the tower. The fault appears to flash across the air gap and ***does not*** follow an insulator creepage path as observed on pollution faults.



# 3. Typical indicators of a bird streamer faulting problem

## 3.1. Position of flash marks

The flash marks of a bird streamer fault is highly characteristic, but difficult to spot. Typically, the flash marks will be situated on the steelwork directly above the live hardware and at the live end of the insulator string, i.e. on the yoke plate, first insulator disk or corona ring. ***There are no burn marks at the dead end of the insulator as would be the case with a pollution-induced fault.*** In the case of strain towers, the burn marks are similarly situated on the jumper cable and on the tower steelwork directly above.



## 3.2. Time of faults

Bird streamer faults follow a highly distinctive bimodal, temporal pattern with ***peaks usually occurring in the early evening between 18h00 and 23h00 and again in the morning, between 04h00 and 08h00.*** A possible explanation for this lies in the natural foraging behaviour of birds, in that they tend to forage away from the line during the day, returning in the early evening to roost until the next morning. It is important to note that the provision of artificial food sources, e.g. vulture feeding stations, could change the roosting behaviour of the birds and result in a changed pattern of faulting.

## 3.3. Window size

The window size determines the ***size of the air gap, which in turn influences the probability of a streamer induced flashover***. In one instance, excessive faulting was experienced on of two parallel 400kV lines of similar design, with the only difference being that of 3.2m vs. 4.2m window size. Despite vultures utilizing both lines, faulting happened only on the line with the smaller air gap. The most likely explanation for this is that the streamer could not bridge the larger air gap.

## 3.4. Faulting phase

A dominant faulting phase is a strong indication of bird streamer related faulting. **Bird streamer related faults tend to be prevalent on the phase which is situated below the *highest and/or most convenient perching* space on the tower.** On vertically configured designs, this usually results in the top phase (or phases in the case of double circuit towers) faulting disproportionately to the other phases , as the birds tend to roost on the highest cross-arm. With horizontally configured designs, the middle phase is usually the dominant faulting phase. In South Africa, the middle phase on 275kV self-supporting towers is the dominant bird streamer related faulting phase due to the tower design which makes is difficult for birds to roost above the outside phases.

### 3.5. Presence of certain bird species

Large predatory birds tend to create the biggest risk of flashovers. Species such as ***vultures, herons, certain ibises and stork species, eagles and large hawks*** are high risk species. The presence of these birds on the towers is a strong indicator that bird streamers faults could be present.

Black Eagle

Cape Vulture

Martial Eagle

Grey Heron

### 3.6. Presence of dead birds under the towers

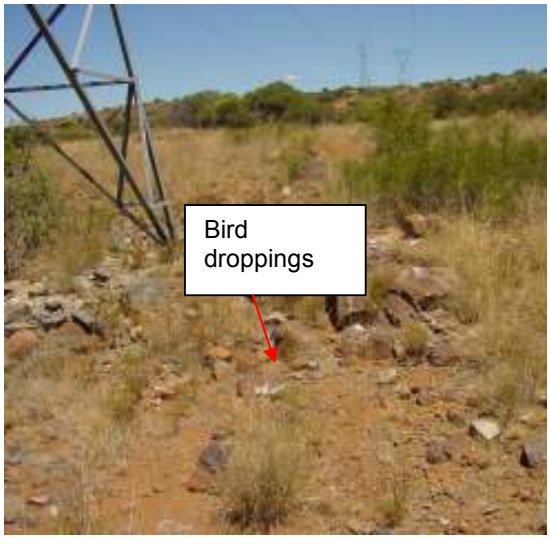
Although electrocution as a result of a bird streamer induced fault is a rare occurrence, it does occur. If dead birds with burn marks are found under structures ***with sufficient clearances to preclude any possibility of the bird having physically bridged the air gap with its body or wings***, it is a strong indication that it was electrocuted via a bird streamer flashover.

### 3.7. Clustering of faults in certain areas

The clustering of streamer faults in certain areas could point to birds being attracted to certain sections of the line. This could be related to ***food*** e.g. vulture feeding stations or recently burnt veld (herons), ***wetlands*** and/or ***agricultural activity*** or irruptions of insects or rodents. It could also be related to ***nesting*** activity on the towers e.g. heronries or large raptor nests or ***topography*** – vultures prefer to roost on towers that are situated on high topographical features such as hills and mountain ridges.

### 3.8. Bird droppings and pellets

The presence of ***bird droppings*** on electrical infrastructure is an indication that it is being used by birds for roosting purposes. Careful examination of the locality of the heaviest pollution could give an indication of where the favourite roosting spots are. The presence of ***regurgitated pellets and prey remains*** under transmission towers is also evidence that the structure is used by large birds for roosting. Analysis of the pellets can aid in the identification of the species.




### 3.9. Seasonality of faults

Seasonal upsurges in faults are often related to an influx of migratory or nomadic birds into an area. In South Africa, with a temperate climate, the ***onset of summer (the rainy season for most of the country) is associated with a significant increase in bird numbers and bird streamer faults.*** As a result of the highly dynamic nature of the presence of bird in the vicinity of power lines, it is recommended that a stock of bird guards be kept by the Region to permit fast response when bird faults present themselves on lines not fitted with bird guards.

## 4. Fitting strategies

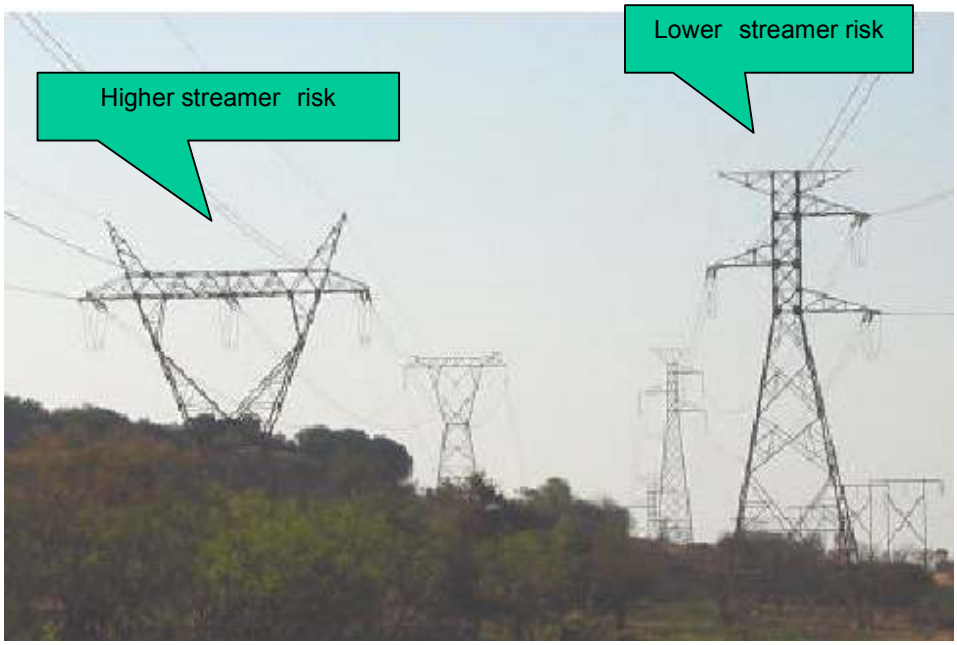
### 4.1. Micro fitting strategy

The tower configuration and design will determine the placement of bird guards. Care must be taken not to create new perches for birds during the installation process. Bird guards installed on near vertical tower members will result in this situation.

#### 4.1.1. Tower design

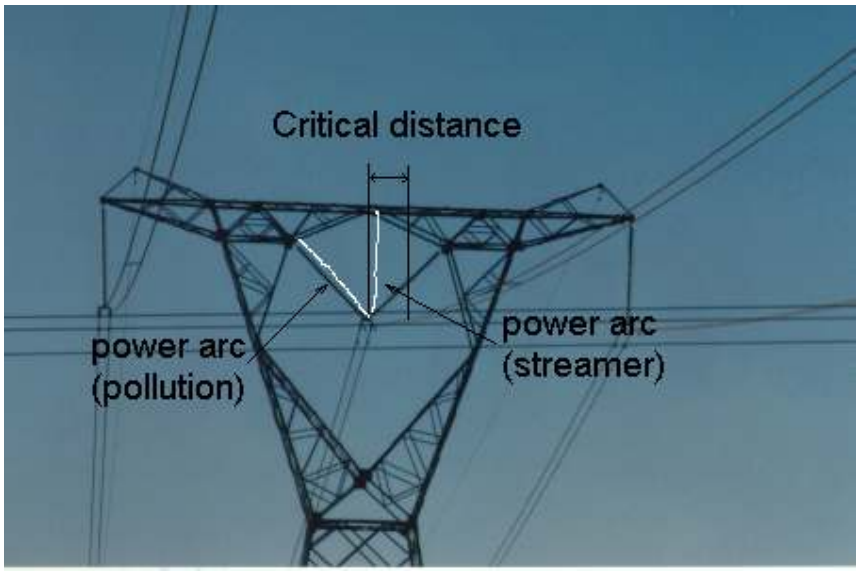
The tower design plays a major role with respect to bird streamer related faults. Vertically configured designs with ***ample perching space on top of the tower away from the cross-arms***, experience fewer faults than horizontally configured designs. The reason for this is that with the latter, the birds roost relatively closer to the conductors, therefore increasing the risk of flashovers. With the former, depending on the design, the birds first utilize the available space on top of the tower, thereby reducing the risk of flashovers. Similarly, almost ***no bird streamer faulting is experienced on the cross-rope suspension type towers***, presumably due to the unavailability of convenient perching space for birds above the conductors.

Transmission uses a variety of tower designs, with each design having as much as ten variations. As a result, broad guidelines will be given in this document. Final fitting strategies will have to be confirmed with subject specialist for final vetting.




Horizontal strain towers are the most vulnerable to streamer faults, followed by horizontal suspension towers. Delta towers are generally much less vulnerable with suspension towers being the least vulnerable.

Initial research showed that air gaps of just under one-meter, on either side of the conductor would need to be protected from potential bird streamers. Because bird guards are made in lengths of 500mm, 750mm and 1000mm for practical reasons, fitting them **one meter** on both sides of the centerline of the conductor has become the standard at all voltages. (Refer to **critical distance** in picture below). No gap of greater than 150mm should be left between two adjacent bird guards.




A distance of one meter either side of the conductor is regarded as critical in protection against streamer faults.

#### 4.1.2. Fitting on Outer Phases

Experience revealed that faults occurred on the outer phases where the landing plates were not fully protected, which left roosting space for birds. Care must be taken not to leave any roosting space at the outer phase extremes of towers.

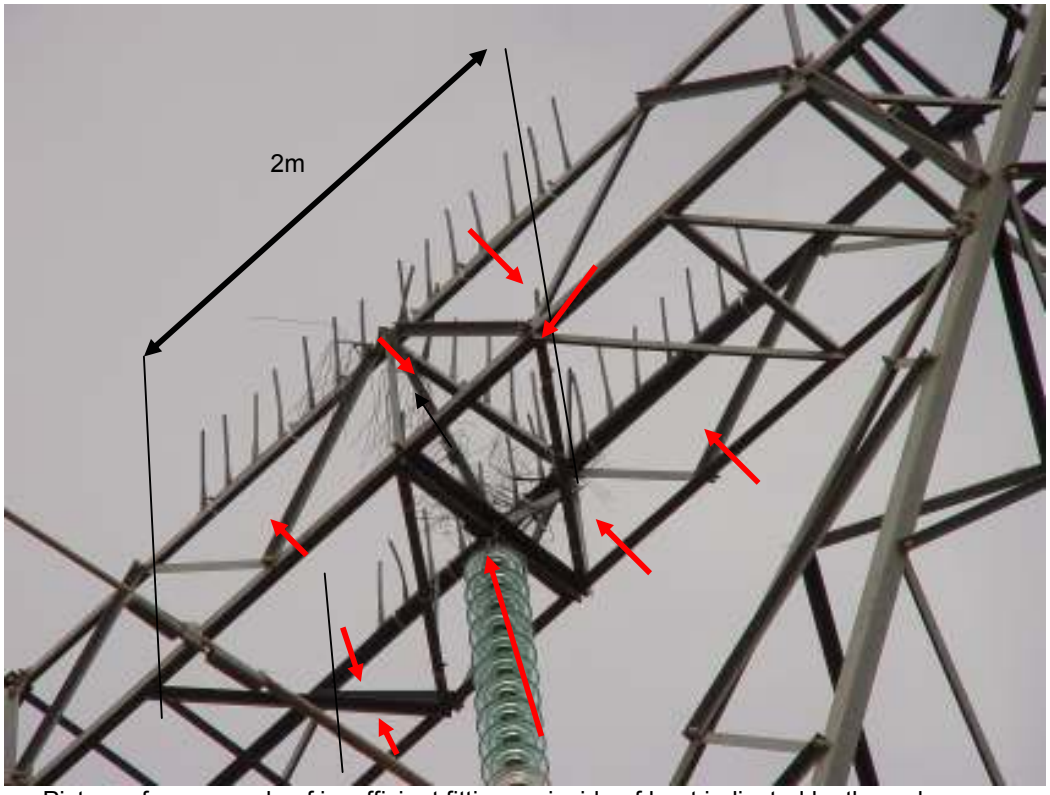
Picture of incorrect fitting leaving the landing plates exposed

#### 4.1.3. V-strings and I-strings

Although V-strings on centre phases were originally thought of as more vulnerable to streamer faults than the I-strings, experience has now shown that the latter are equally vulnerable and should also be protected with bird guards.

### 4.1.4. Protecting the inside of the boat

Faults have also occurred where birds had entered and roosted inside the boat of the tower. Hadeda Ibis and Black Eagle in particular have been observed exploiting the inside of the boat or lattice member within the critical area, which was not fitted with bird guards.




Picture of an example of insufficient fitting on inside of boat indicated by the red arrows

Comprehensive fitting strategy as implemented on the Hendrina-Kriel 400kV line

### 4.2. Macro fitting strategy

Whilst a comprehensive fitting strategy is the safest, it also carries a high cost. Results from partial fitting were generally good when comparing risk of streamer fault with cost of installation. It must be pointed out that dependable knowledge of the habitat through which the line runs is critical when partial fitting of a line is contemplated.

The decision to fit bird guards to a line is in the first instance an economical one. It is based on

- the dip sensitive load that the line carries and the effect that these faults are having on the customers and
- the number of bird faults that it experiences (determined from its fault history) ,

Secondly, the habitat through which the line passes and the bird species present in that habitat, and more specifically their behaviour, influences the macro fitting strategy. Bird behaviour refers to aspects such as migration, feeding and roosting habits. Habitat refers to topography, land use, and type and availability of food sources. The help of subject specialist should be used in this regard.

#### 4.2.1. Consideration of adjacent lines

It has been reported that where bird guards resulted in a decrease of roosting space, birds have moved to adjacent lines and streamer faults have occurred there. The increase in bird (and streamer faults) must however also be seen against the influence of wet weather cycles or other phenomena and the general increase in bird population numbers for an area. It is recommended that these factors be considered where unfitted lines run adjacent to the targeted line.

### 4.3. Special circumstances

Results to date on lines that have been fitted with bird guards have resulted in an average of 80% reduction in bird faulting, and some lines have had a 100% reduction in bird related faulting. It is important to note though that bird guards are not a 100% solution under all circumstances. Isolated instances have been recorded where birds have managed to wedge themselves between bird guards. These incidents are always associated with extreme densities of birds on a particular tower or towers, and are often associated with super-abundance of food. To date the following examples have been recorded:

- Cape Vultures roosting in large numbers on towers at a vulture restaurant. The birds are very large and if they repeatedly force themselves between the bird guards, it will eventually result in bird guards collapsing.
- Large concentrations of Black-headed Herons have been observed on the Nyl River floodplain after the annual flooding. These birds roost in large numbers on the towers during this period, and individuals have managed to wedge themselves between the bird guards when many birds are roosting on one tower.
- One incident has been recorded where a Bald Ibis roosted in a steel bird guard. These birds habitually roost on transmission towers in large numbers and it must be assumed that that could happen, especially as the steel bird guards have bigger gaps between the rods than the plastic bird guards. It is not clear at this stage whether the same will happen with the standard plastic bird guards.

Special circumstances require special solutions, and each incident must be investigated with the help of an ornithologist to arrive at a solution. In doing so it must also be considered whether the level of faulting caused by these "special events" justifies the cost and effort to device a solution that will result in a 100% elimination of faults, especially if the faulting levels are very low and restricted to a short period of time each year."

# 5. Bird guard Specifications

## 5.1. Types of bird guard

The types of devices to be used will prevent birds from perching on transmission structures by forming a barrier to birds on the affected parts of the structure. The device will consist of a base with upright shafts as described below and will have no moving parts or anything else that will harm birds.
Three devices have been used successfully as part of the National bird guard project and are recommended for future use. These are:

- BeeTee bird guard.
- Mission Bird guard
- Naledi Bird guard

The latter company no longer manufactures bird guards.

## 5.2. General aspects

The device required is intended to prevent birds from perching on designated areas of power pylons. It should consist of a square base with upright prongs and should be made from a long life, non-conductive material and should not pose any danger to live line workers or birds. An organic polymer such as high-density polyethylene should be used. These polymers should be treated to enable it to withstand typical environmental conditions found in South Africa for a period in excess of 15 years.

## 5.3. Dimensions

The device should come in three lengths: 500mm, 750mm and 1000mm. The vertical rods should be about 500mm high, with a spacing of between 125-190mm and an outside diameter of about 20mm. The base should have dimensions of 40mmx40mm.

## 5.4. Materials to be used

The raw materials used by the manufacturer of bird guards should be sourced from a reputable supplier who shall issue a guarantee with regards to:

- the chemical composition of the materials (DOW HDPE M5010 or similar)
- the additives for ensuring suitable life of the product and estimated life. (The Ciba stabilizing system consisting of 2% minimum level of pigment type carbon black, Irganox B225 @ 0,1% and Tinuvin T783 @ 0,4% or similar system should be used. Eskom will have to approve the stabilizing system before production starts.)
- the proper blending of the raw material with UV inhibitors and other additives, that they supply.
- the manufacturing process that is followed must be sanctioned by the Supplier and Eskom to ensure quality of the product. This includes the adding of any non-virgin material. Not more than 10% of own reground material will be permitted.

## 5.5. Quality assurance.

All devices shall carry a batch number and date. Eskom must be able to determine the materials used for the manufacture of the particular batch.

Unannounced, random samples of the materials may be taken during the processing for testing. Contracts will be terminated with any manufacturer that does not comply with the quality standards, and costs will be recovered for the removal and refitting of bird guards of a suitable quality. Ciba can do analysis of samples.

Rapid aging and other tests will be required that will indicate the specific properties of the device. Refer to details below. The device should be mechanically sound.

An ongoing programme should be followed to observe and track any deterioration of bird guards

## 6. Attachment Methods

The preferred method of fitting bird guards is by means of stainless steel straps 12,74mm x 0,7mm. This method is effective but has the disadvantage that the guards can only be removed during live line work by cutting the strap. This results in a situation where in some instances bird guards are removed and not replaced by live line teams (damage to bird guards caused during the installation of optical fibre cables have been reported). Poor attachment has been observed as the single biggest reason for failure of bird guards.

In order to facilitating live-line work, quick release straps were designed and manufactured by a number of suppliers.

The number of straps per bird guard varies depending on the specific tower, size of the member and the position on the tower. Installers should ensure that the bird guard is securely attached to the tower member. As a general rule the following guidelines may be used:

| Length | Number of straps |
|---|---|
| One meter | 3 |
| 750 mm | 2 |
| 500mm | 2 |

One example of a quick release strap

These straps permit the partial removal of the bird guard by relaxing the tension on the strap and by pushing the guard out of the way but without causing it to fall from the tower. Upon completion of the work, the bird guard is returned into position and the strap is re-tensioned.

Bird guards may selectively be attached by means of a quick release mechanism in areas where live line work is anticipated. This mechanism should enable live line workers to move the bird guard out of the way but without the device being able to drop from the top of the tower or onto the conductors.

Alternative UV protected polymer straps are also used by overseas companies.

## 7. Supporting Clauses

NOT APPLICABLE.

## 8. Index of Supporting Clauses



### 8.1. Scope

This document serves as a guideline with regards to the management of perching and roosting behaviour of large birds on Transmission lines. The presence of large birds and the associated streamer activity has a profound impact on quality of supply.

#### 8.1.1. Purpose

The document helps the reader to identify streamer problems and suggests mitigation measures. It also specifies dimensions, materials and the attachment methods of bird guards.

#### 8.1.2. Applicability

This document shall apply to all Transmission power line structures.

### 8.2. Normative/Informative References

Parties using this guideline shall apply the most recent edition of the documents listed below :

#### 8.2.1. Normative

ISO 9001:2000 Quality Management Systems

#### 8.2.2. Informative

Refer to the latest research report publisher by ERID.

### 8.3. Definitions

**Perch management**
This term refers to the method of managing the roosting and perching behaviour of large birds on transmission and other structures. It is applied to prevent streamer faults and electrocutions on smaller lines. It is also used in conjunction with the management of nests on power lines. Whilst not intended, perch management also results in reduced pollution of insulators. Perch management is also used to prevent birds such as vultures from causing damage to fibre optic cables.

**Micro fitting strategy**

This term refers to the positioning of bird guards on specific parts of the tower.
This decision will be based on the particular design of the tower as well as the bird species that are targeted.

**Macro fitting strategy**
This term refers to the determination of which towers to fit with bird guards on a particular transmission line. During the National Bird guard project, both comprehensive as well as partial fitting strategies were followed.

### 8.4. Abbreviations

none

### 8.5. Roles and Responsibilities

The Line and Servitude Managers for each Grid shall be responsible for the installation of any bird guards in their respective Grids.

### 8.6. Implementation date

The implementation date is November 2006.

### 8.7. Process for monitoring

The Line and Servitude Managers for each Grid shall be responsible for the monitoring of the adherence to this guideline.

## 9. Authorisation

This document has been seen and accepted by:

| Name | Designation |
|---|---|
| W Majola | GM (Services) |
| J Machinjike | GM (Grids) |

## 10. Revisions

| Date | Rev. | Remarks |
|---|---|---|
| November 2006 | 1 | Review document as per review period<br>. |

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## Content

## 1. Introduction

A bird collision incident happens when a bird physically strikes either the overhead conductor or the overhead ground wire of a power line. In the case of transmission lines, the overhead ground wire is usually involved. It is generally accepted that birds can usually avoid the highly visible bundled conductors but often fail to see the thin ground wire. In South Africa, bird collisions with transmission lines are a major form of unnatural mortality among several threatened species. Research is ongoing to attempt to gauge the effect of this form of mortality on these species, especially cranes. Preliminary results indicate that the mortality could be unsustainable for regional populations of species such as Blue Cranes in the central Karoo.

## 2. Background and extent of the problem of bird collisions

Collisions are the biggest single threat posed by transmission lines to birds in southern Africa (van Rooyen 2004). Most heavily impacted upon are bustards, storks, cranes and various species of water birds. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines (van Rooyen 2004, Anderson 2001).

Unfortunately, many of the collision sensitive species are considered threatened in southern Africa. The graph below shows the number of collisions reported per species on transmission lines from August 1996 to present (EWT unpublished data). Most of the heavily affected species are Red Data species. It should be noted that these are only the reported mortalities, it is suspected that a large number of mortalities go unreported. It is also important to note that the mortalities recorded by Anderson (2001) as discussed below are not included in the graph below.

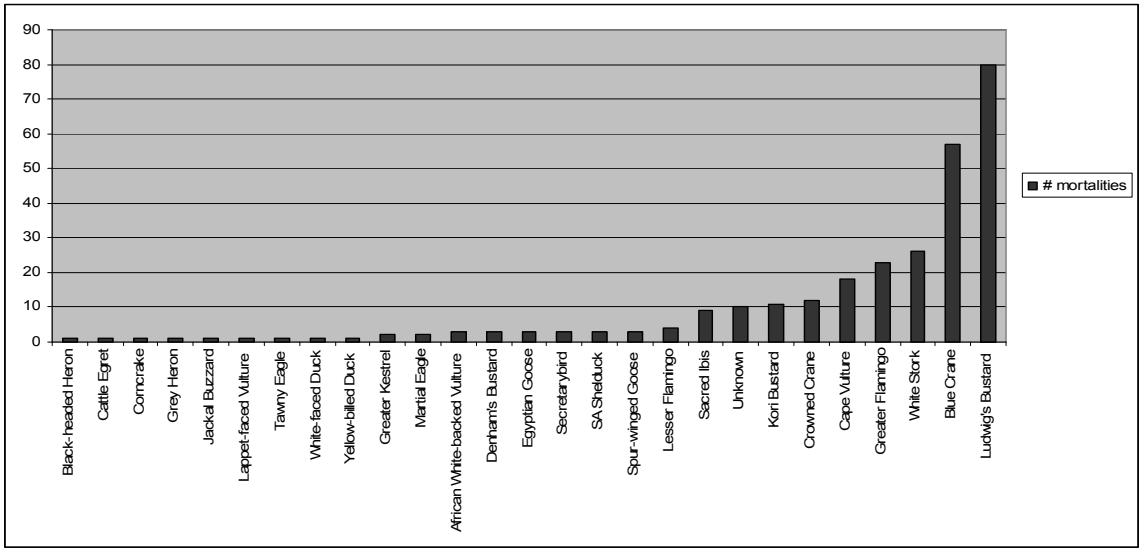



**Figure 1: Number of reported collisions per species on transmission lines from August 1996 to the present** (EWT unpublished data).

Although significant in itself, figure 2 is not a true reflection of the extent of the problem, because few of the collision localities were closely monitored over a substantial period of time. Where long term monitoring did happen, the picture is disturbing. In one instance, where bi-monthly monitoring did take place, a single 10 km section of 132kV distribution line killed 59 Blue Cranes, 29 Ludwig's Bustard, and 13 White Storks in a three year period (van Rooyen unpubl. data). In 2004, fifty-four Blue Crane carcasses were discovered near Graaf-Reinett in the Northern Cape province under 3.7km of distribution line.

Data collected in the Northern Cape province between 1997 and 1999 provides further evidence of the gravity of the problem. During an initial clearing of transects, a total of 194 large bird carcasses were found under 40km of Transmission line (220 and 400kV) near De Aar in the Northern Cape. Subsequent monitoring of 140 km of power lines (transects of 10km each from 22kV up to 400kV) in the same area over a period of 12 months produced another 196 carcasses (mostly cranes and bustards) the majority under transmission lines (Anderson 2001).

The Red Data species vulnerable to power line collisions are generally long-lived, slow reproducing species under natural conditions. Some require very specific conditions for breeding, resulting in very few successful breeding attempts, or breeding might be restricted to very small areas. A good example of this is the two flamingo species that occur in southern Africa, which have experienced hardly any successful breeding attempts at Etosha Pan in Namibia for several decades. Another example is the Great White Pelican that only breeds successfully at Dassen Island in the Western Cape. These species have not evolved to cope with high adult mortality, with the results that consistent high adult mortality over an extensive period could have a serious effect on a population's ability to sustain itself in the long or even medium term. Many of the anthropogenic threats to these species are non-discriminatory as far as age is concerned (e.g. habitat destruction, disturbance and power lines) and therefore contribute to adult mortality, and it is not known what the cumulative effect of these impacts could be over the long term.

**Using Vortex computer modelling, the South African Crane Working Group estimated that an annual mortality rate of 150 adult Blue Cranes could reduce the eastern population of Blue Cranes (app. 2000 individuals in Mpumalanga and KwaZulu-Natal) by 90% by the end of the 21st century (McCann *et.al.* 2001). At that stage the population would be functionally extinct.**

From the figures quoted above, it is clear that power lines are a major cause of avian mortality among power line sensitive species, especially Red Data species. Furthermore, the cumulative effects of power lines and other sources of unnatural mortality might only manifest itself decades later, when it might be too late to reverse the trend. It is therefore imperative to reduce any form of unnatural mortality in these species, regardless of how insignificant it might seem at the present moment in time.

# 3. Solutions to the problem of bird collisions.

## 3.1. Background

A measure that has been proved to be reasonably successful in reducing collisions is to fit the earth wire with anti-collision devices.

**Figure 2: The installation of flappers on the shield wire from a helicopter.**

Success rates of up to 60% reduction in mortality and even more have been documented (Ferrer and Janns, 1999). There are several devices available in southern Africa for the marking of power lines. These devices will be described below and the advantages and disadvantages discussed. The fitting of the marking devices are typically done from a helicopter, which adds considerably to the cost of any project.

### 3.2. Static devices

Static devices are mechanically more durable than dynamic devices because they lack the element of wear and tear that moving parts inevitably have. However, in South Africa, static devices, particularly the so called Bird Flight Diverter (also known as the pigtail) has had limited success (Anderson 2001). The most obvious reason seems to be that they are simply less visible, especially the small ones (see figure 5). A better option would be to use the bigger pigtail (see figure 5, right), although it is still not the preferred option.

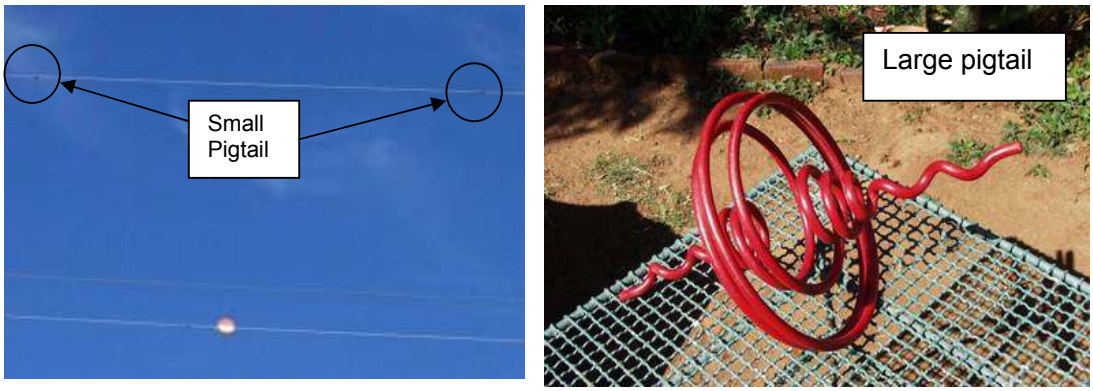



**Figure 3: Example of static devices.**

### 3.3. Dynamic devices

Dynamic devices (usually called bird flappers), have moving parts as opposed to static devices where there are none.. Dynamic devices are very effective in reducing collisions as the birds seem to see them very well (van Rooyen unp. data) probably because of the movement that attracts attention. The disadvantage of dynamic devices is that they are subject to extensive wear and tear, inevitably limiting the lifespan of the device. Wear could result on the device itself as well as on the cable to which it is attached.

**Figure 4: Examples of the dynamic bird flapper devices**

This has obvious cost implications if a line needs to be re-marked at intervals of a few years. No solution to that problem has been found to date and it must be accepted as a constraint. Figure 4 shows examples of bird flappers currently available on the market.

### 3.4. Reflective devices

A new product that shows great potential is the Inotec BFD88, a reflective stainless steel sphere of 70mm diameter. Experiments have shown the visibility of this device to be superior to coloured (red, yellow, white, black) objects especially during the low light conditions at dawn and dusk when birds may be flying from roosting areas to feeding areas and back. Due to the spherical shape, the device reflects any available light in all directions and is therefore visible from all directions including above or below the diverter. The diverter does not require direct sunlight and is effective during overcast conditions and the low light conditions before sunrise and after sunset (Van Rooyen, pers obs.) When viewed during these low light conditions the device is particularly visible against dark backgrounds such as the ground, trees or high ground. It is also particularly visible against bright cloud when viewed from below.

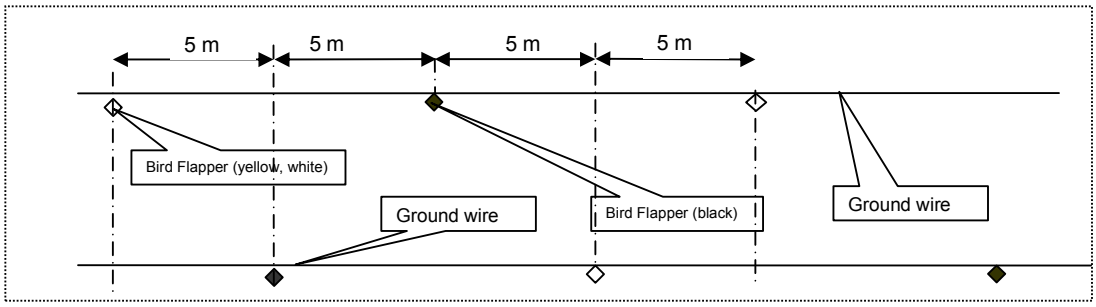
**Figure 5: A Reflective Bird Diverter (left) installed on a line with conventional bird flappers (right).**

**Figure 6: An example of reflective diverters on a test line at dusk with white conventional bird flappers in between**

An option could be to string the Inotec NFD88 diverters close enough to form a dotted line on each earth wire on those spans crossing the river (see figure 6). **Due to the relatively small size of the spheres, it would need to be spaced very close together to make it effective, maximum 5 metres apart on both earth wires.**

### 3.5. Spacing intervals

Research in the Netherlands has shown that spacing intervals have a major influence on the effectiveness of anti-collision devices. In South Africa, the same has been found. See Figure 7 for a suggested marking method with Bird Flappers. In the case of the Inotec BFD88 diverters, a similar 5 metre interval is suggested.

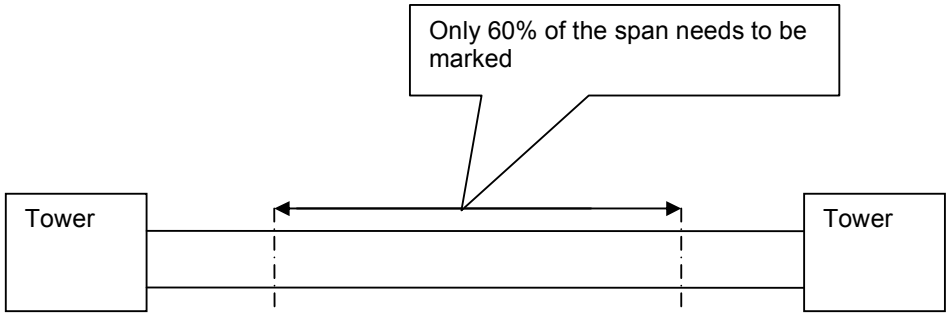



## Figure 7: Marking method with Bird Flappers on overhead ground wires (viewed from above)

*NB. It is important to alternate the colours (yellow-white) in order for maximum contrast.*

### 3.6. Portion of span to be marked.

Only the middle 60% of each span needs to be marked as this is where most of the collisions occur.




## Figure 8: The section that needs to be marked

### 3.7. Illuminated devices.

A specific problem is posed by birds that fly at night, for example flamingos that migrate great distances at night. A device is available for this problem, namely the Mace Bird Lite, which is a Perspex tube with a fluorescent tube inside.

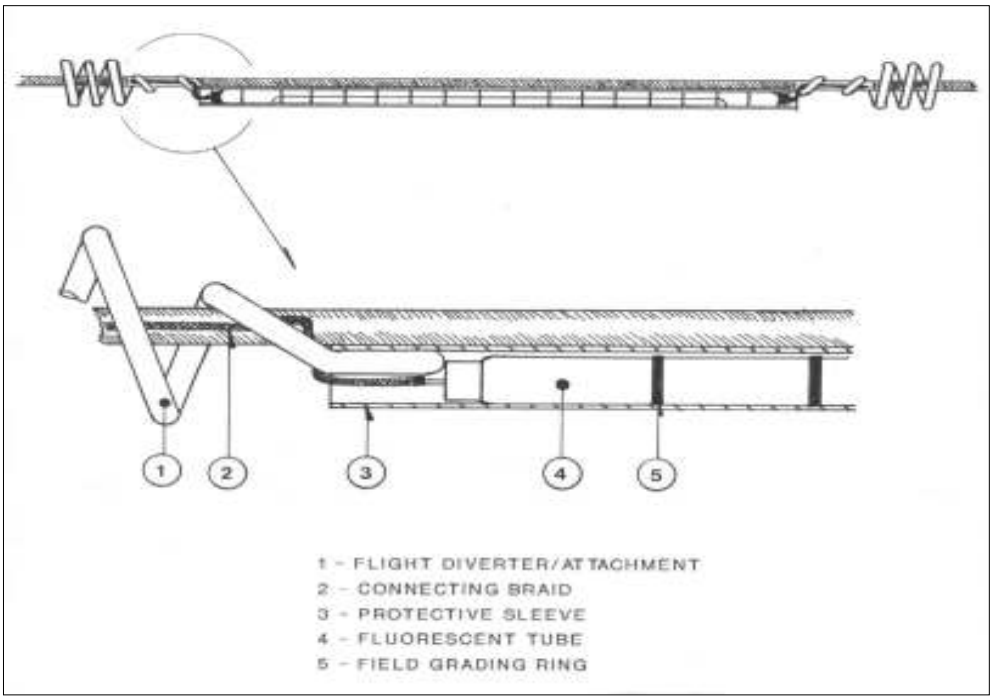



**Figure 9: The Mace Bird Lite**

It is mounted on the overhead ground wire and the light is energized by the ambient electrical field generated by the conductors. It has been used in South Africa and Botswana and is reported to have worked well for curbing flamingo mortality on power lines. No scientific data is available on the effectiveness but it is generally claimed to be effective.

# 3 Supporting Clauses

## Index of Supporting Clauses



## 3.1 Scope

This document covers the subject of bird colliding with Transmission lines.

### 3.1.1 Purpose

The purpose of this document is to describe the problem of bird collisions with transmission lines and to indicate which mitigation methods are available to address the problem.

### .1.2 Applicability

This guideline shall apply throughout Transmission Division.

## 3.2 Normative/Informative References

Parties using this guideline shall apply the most recent edition of the documents listed below

### 3.2.1 Normative

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### 3.3 Definitions

N/A

### 3.4 Abbreviations

**EWT**: Endangered Wildlife Trust

### 3.5 Roles and Responsibilities

The Line and Servitude managers of each Grid shall be responsible to ensure compliance with this document.

### 3.6 Implementation Date

The implementation date is November 2006.

### 3.7 Process for monitoring

The line and Servitude managers of each grids shall monitor servitudes for evidence of bird collisions and inform the EWT accordingly.

### 3.8 Related/Supporting Documents

n/a

## 4 Authorisation

This document has been seen and accepted by:

| Name | Designation |
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| J. Machinjike | GM (Grids) |

## 5 Revisions

| Date | Rev. | Remarks |
|---|---|---|
| November 2006 | 1 | Review document. Add latest equipment available |

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| Eskom Transmission | Guideline | Document Classification : PUBLIC |
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Title: **TRANSMISSION BIRD COLLISION PREVENTION GUIDELINE**

Reference: **TGL41-335**

Revision: **0**

Effective date: **November 2006**

Total pages: **1 Of 10**

Revision date: **November 2009**

| COMPILED BY | FUNCTIONAL RESP. | AUTHORIZED BY |
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| DATE: 30/11/06 | DATE: 30.11.2006 | DATE: 30/11/06 |

## Content

## 1. Introduction

A bird collision incident happens when a bird physically strikes either the overhead conductor or the overhead ground wire of a power line. In the case of transmission lines, the overhead ground wire is usually involved. It is generally accepted that birds can usually avoid the highly visible bundled conductors but often fail to see the thin ground wire. In South Africa, bird collisions with transmission lines are a major form of unnatural mortality among several threatened species. Research is ongoing to attempt to gauge the effect of this form of mortality on these species, especially cranes. Preliminary results indicate that the mortality could be unsustainable for regional populations of species such as Blue Cranes in the central Karoo.

## 2. Background and extent of the problem of bird collisions

Collisions are the biggest single threat posed by transmission lines to birds in southern Africa (van Rooyen 2004). Most heavily impacted upon are bustards, storks, cranes and various species of water birds. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines (van Rooyen 2004, Anderson 2001).

Unfortunately, many of the collision sensitive species are considered threatened in southern Africa. The graph below shows the number of collisions reported per species on transmission lines from August 1996 to present (EWT unpublished data). Most of the heavily affected species are Red Data species. It should be noted that these are only the reported mortalities, it is suspected that a large number of mortalities go unreported. It is also important to note that the mortalities recorded by Anderson (2001) as discussed below are not included in the graph below.

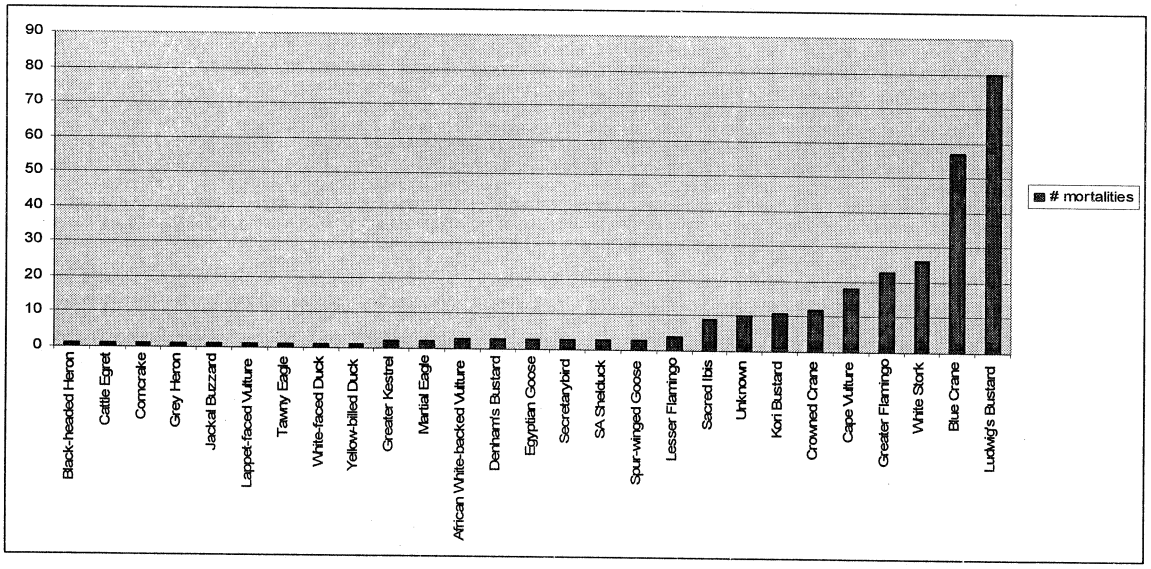



**Figure 1: Number of reported collisions per species on transmission lines from August 1996 to the present** (EWT unpublished data).

Although significant in itself, figure 2 is not a true reflection of the extent of the problem, because few of the collision localities were closely monitored over a substantial period of time. Where long term monitoring did happen, the picture is disturbing. In one instance, where bi-monthly monitoring did take place, a single 10 km section of 132kV distribution line killed 59 Blue Cranes, 29 Ludwig's Bustard, and 13 White Storks in a three year period (van Rooyen unpubl. data). In 2004, fifty-four Blue Crane carcasses were discovered near Graaf-Reinett in the Northern Cape province under 3.7km of distribution line.

Data collected in the Northern Cape province between 1997 and 1999 provides further evidence of the gravity of the problem. During an initial clearing of transects, a total of 194 large bird carcasses were found under 40km of Transmission line (220 and 400kV) near De Aar in the Northern Cape. Subsequent monitoring of 140 km of power lines (transects of 10km each from 22kV up to 400kV) in the same area over a period of 12 months produced another 196 carcasses (mostly cranes and bustards) the majority under transmission lines (Anderson 2001).

The Red Data species vulnerable to power line collisions are generally long-lived, slow reproducing species under natural conditions. Some require very specific conditions for breeding, resulting in very few successful breeding attempts, or breeding might be restricted to very small areas. A good example of this is the two flamingo species that occur in southern Africa, which have experienced hardly any successful breeding attempts at Etosha Pan in Namibia for several decades. Another example is the Great White Pelican that only breeds successfully at Dassen Island in the Western Cape. These species have not evolved to cope with high adult mortality, with the results that consistent high adult mortality over an extensive period could have a serious effect on a population's ability to sustain itself in the long or even medium term. Many of the anthropogenic threats to these species are non-discriminatory as far as age is concerned (e.g. habitat destruction, disturbance and power lines) and therefore contribute to adult mortality, and it is not known what the cumulative effect of these impacts could be over the long term.

**Using Vortex computer modelling, the South African Crane Working Group estimated that an annual mortality rate of 150 adult Blue Cranes could reduce the eastern population of Blue Cranes (app. 2000 individuals in Mpumalanga and KwaZulu-Natal) by 90% by the end of the 21st century (McCann *et.al.* 2001). At that stage the population would be functionally extinct.**

From the figures quoted above, it is clear that power lines are a major cause of avian mortality among power line sensitive species, especially Red Data species. Furthermore, the cumulative effects of power lines and other sources of unnatural mortality might only manifest itself decades later, when it might be too late to reverse the trend. It is therefore imperative to reduce any form of unnatural mortality in these species, regardless of how insignificant it might seem at the present moment in time.

## 3. Solutions to the problem of bird collisions.

### 3.1. Background

A measure that has been proved to be reasonably successful in reducing collisions is to fit the earth wire with anti-collision devices.

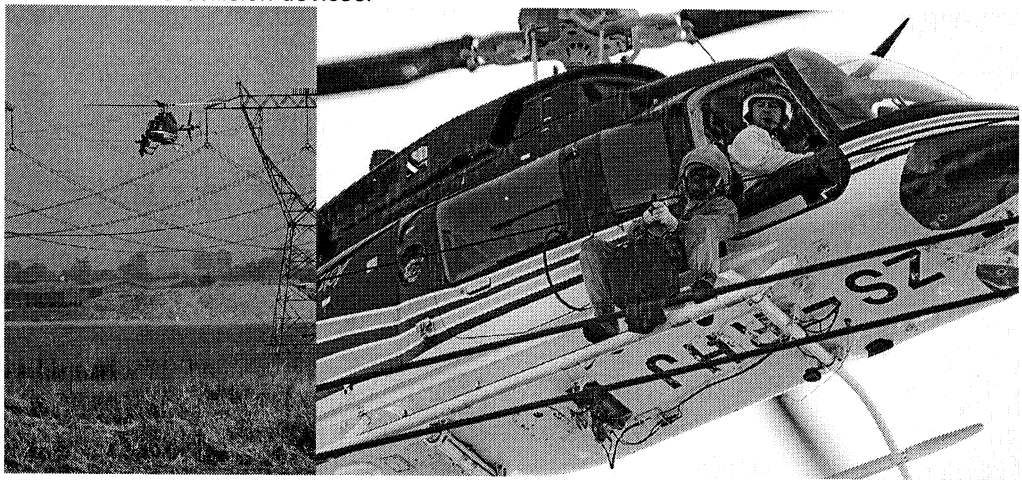


**Figure 2: The installation of flappers on the shield wire from a helicopter.**

Success rates of up to 60% reduction in mortality and even more have been documented (Ferrer and Janns, 1999). There are several devices available in southern Africa for the marking of power lines. These devices will be described below and the advantages and disadvantages discussed. The fitting of the marking devices are typically done from a helicopter, which adds considerably to the cost of any project.

### 3.2. Static devices

Static devices are mechanically more durable than dynamic devices because they lack the element of wear and tear that moving parts inevitably have. However, in South Africa, static devices, particularly the so called Bird Flight Diverter (also known as the pigtail) has had limited success (Anderson 2001). The most obvious reason seems to be that they are simply less visible, especially the small ones (see figure 5). A better option would be to use the bigger pigtail (see figure 5, right), although it is still not the preferred option.

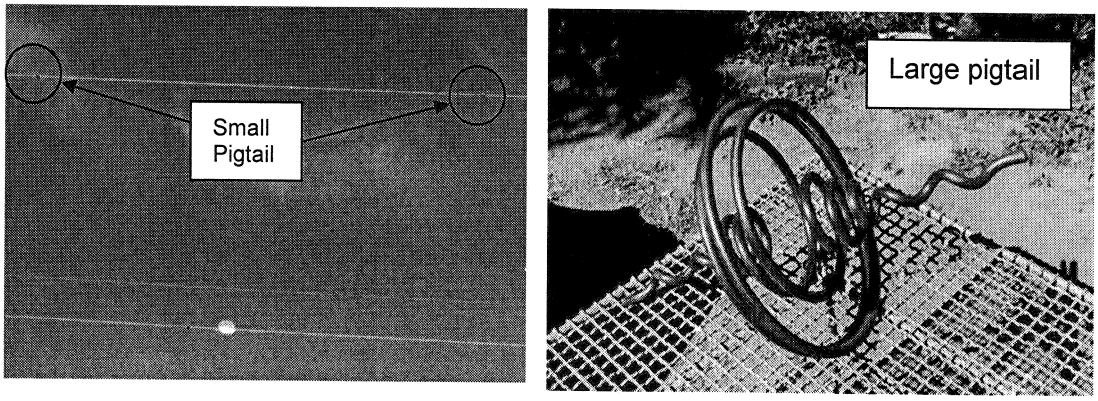



**Figure 3: Example of static devices.**

### 3.3. Dynamic devices

Dynamic devices (usually called bird flappers), have moving parts as opposed to static devices where there are none.. Dynamic devices are very effective in reducing collisions as the birds seem to see them very well (van Rooyen unp. data) probably because of the movement that attracts attention. The disadvantage of dynamic devices is that they are subject to extensive wear and tear, inevitably limiting the lifespan of the device. Wear could result on the device itself as well as on the cable to which it is attached.

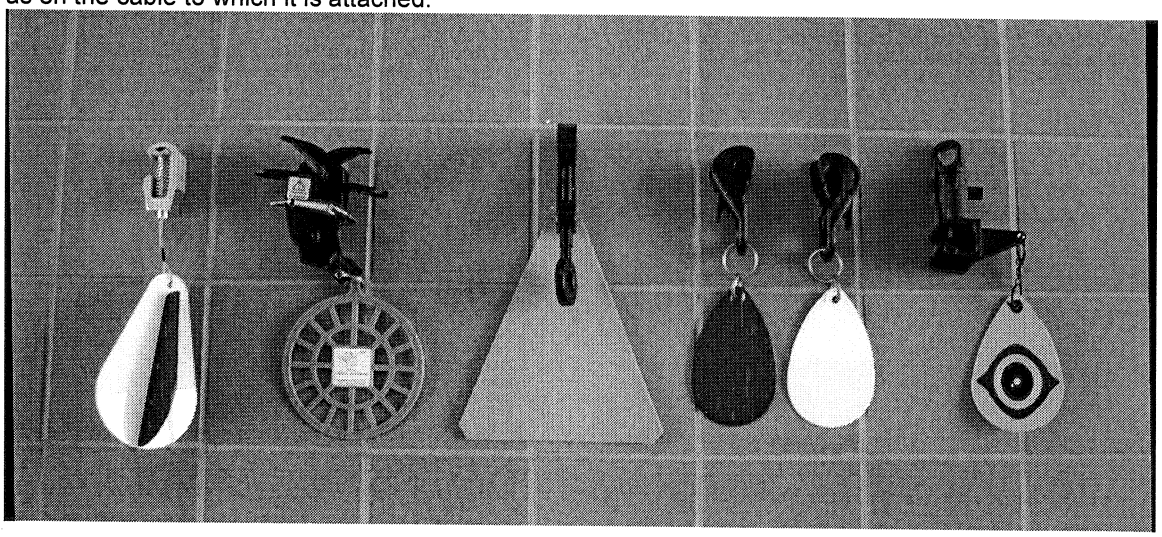


**Figure 4: Examples of the dynamic bird flapper devices**

This has obvious cost implications if a line needs to be re-marked at intervals of a few years. No solution to that problem has been found to date and it must be accepted as a constraint. Figure 4 shows examples of bird flappers currently available on the market.

### 3.4. Reflective devices

A new product that shows great potential is the Inotec BFD88, a reflective stainless steel sphere of 70mm diameter. Experiments have shown the visibility of this device to be superior to coloured (red, yellow, white, black) objects especially during the low light conditions at dawn and dusk when birds may be flying from roosting areas to feeding areas and back. Due to the spherical shape, the device reflects any available light in all directions and is therefore visible from all directions including above or below the diverter. The diverter does not require direct sunlight and is effective during overcast conditions and the low light conditions before sunrise and after sunset (Van Rooyen, pers obs.) When viewed during these low light conditions the device is particularly visible against dark backgrounds such as the ground, trees or high ground. It is also particularly visible against bright cloud when viewed from below.

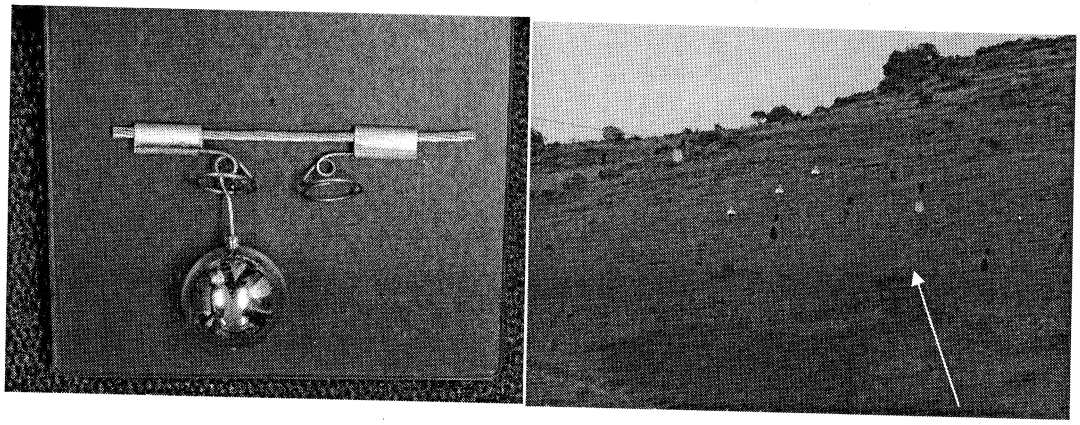


**Figure 5: A Reflective Bird Diverter (left) installed on a line with conventional bird flappers (right).**

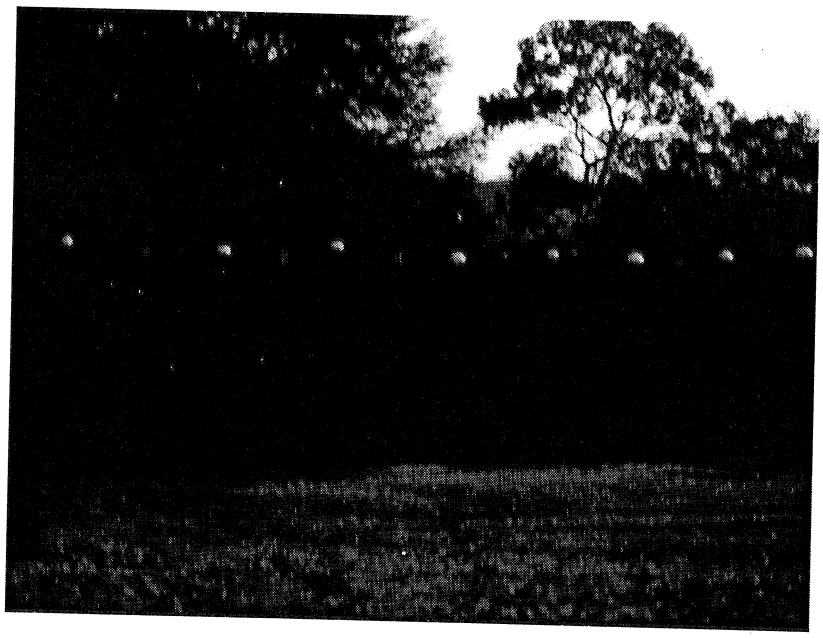


**Figure 6: An example of reflective diverters on a test line at dusk with white conventional bird flappers in between**

An option could be to string the Inotec NFD88 diverters close enough to form a dotted line on each earth wire on those spans crossing the river (see figure 6). **Due to the relatively small size of the spheres, it would need to be spaced very close together to make it effective, maximum 5 metres apart on both earth wires.**

### 3.5. Spacing intervals

Research in the Netherlands has shown that spacing intervals have a major influence on the effectiveness of anti-collision devices. In South Africa, the same has been found. See Figure 7 for a suggested marking method with Bird Flappers. In the case of the Inotec BFD88 diverters, a similar 5 metre interval is suggested.

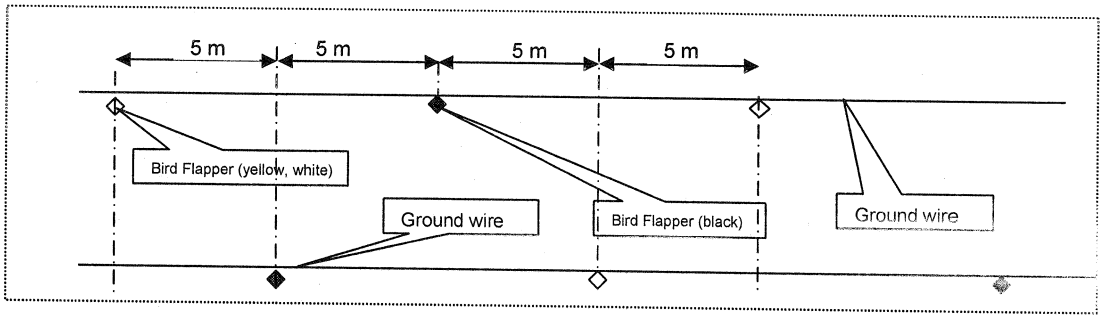



**Figure 7: Marking method with Bird Flappers on overhead ground wires (viewed from above)**

*NB. It is important to alternate the colours (yellow-white) in order for maximum contrast.*

### 3.6. Portion of span to be marked.

Only the middle 60% of each span needs to be marked as this is where most of the collisions occur.

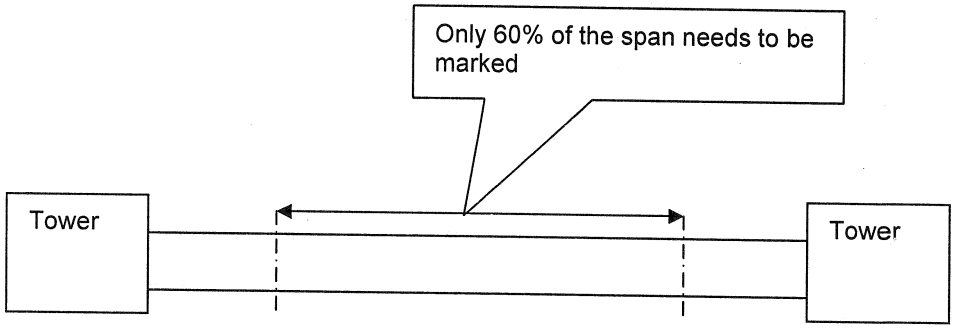
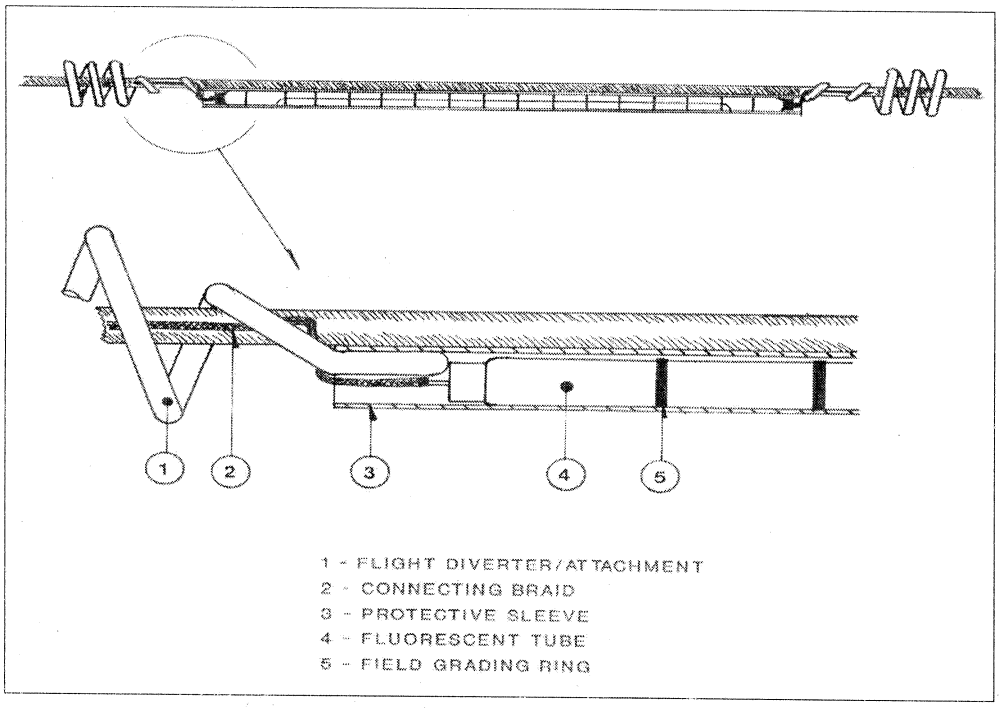



**Figure 8: The section that needs to be marked**

### 3.7. Illuminated devices.

A specific problem is posed by birds that fly at night, for example flamingos that migrate great distances at night. A device is available for this problem, namely the Mace Bird Lite, which is a Perspex tube with a fluorescent tube inside.




## Figure 9: The Mace Bird Lite

It is mounted on the overhead ground wire and the light is energized by the ambient electrical field generated by the conductors. It has been used in South Africa and Botswana and is reported to have worked well for curbing flamingo mortality on power lines. No scientific data is available on the effectiveness but it is generally claimed to be effective.

# 3 Supporting Clauses

## Index of Supporting Clauses



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### 3.3 Definitions

N/A

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### 3.5 Roles and Responsibilities

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### 3.6 Implementation Date

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### 3.8 Related/Supporting Documents

n/a

## 4 Authorisation

This document has been seen and accepted by:

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| J. Machinjike | GM (Grids) |

## 5 Revisions

| Date | Rev. | Remarks |
|---|---|---|
| November 2006 | 0 | Review document. Add latest equipment available - remain Rev. 0 because of the new reference number. |

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