SCOPING OF ISSUES ASSOCIATED WITH THE PROPOSED OF MOKOPANE SUBSTATION AND TURN-IN LINES CHAPTER 5

This Environmental Scoping Study identifies the potential positive and negative environmental (biophysical and social) impacts associated with the proposed Mokopane Substation and turn-in power lines. A number of issues for consideration were identified by the environmental team and/or raised by I&APs during the consultation process. This section serves to evaluate the potential environmental impacts associated with the proposed project and to make recommendations for further studies required within the EIA phase.

5.1. Potential Impacts on Topography

An analysis of the topography and landform revealed that the proposed substation options are situated within landform types ranging from lowlands with mountains in the west to low mountains in the east.

The proposed substation site alternatives are generally flat, with slight slopes of less than 9°. Potential impacts on topography associated with the establishment of the proposed substation are anticipated to be localised and restricted to foundation areas associated with the proposed substation. Substation sites are required to be on level terrain and, therefore, these sites typically have minimal impact on the local topography, apart from the substation foundations.

Potential impacts on topography associated with the construction of the turn-in power lines are anticipated to be localised and restricted to foundation areas associated with the transmission power line towers. The potential impact associated with towers is anticipated to be negligible as technical constraints require Eskom to select transmission power line corridors which avoid areas which are impassable, thus minimising the need to disrupt the local topography.

Potential impacts on topography as a result of the construction of the substation and turn-in lines are, therefore, anticipated to be limited the construction phase and construction areas and of low significance as no major changes on the landscape are required.

5.1.2. Conclusions and Recommendations

Impacts on topography as a result of the construction of the substation and turn-in power lines are expected to be restricted to the foundations and of low significance. Impacts are expected to be similar for all alternative sites identified, and therefore there is **no preferred site** in terms of this aspect. No additional

studies are required to be undertaken within the EIA with regards to potential impacts on topography as primary impacts associated with substation and transmission power line construction are associated with the disruption of the soil surface. However, appropriate mitigation and management measures should be developed within the EIA phase for inclusion in the project EMP.

5.2. Potential Impacts on Transmission Infrastructure associated with Climate and Atmospheric Conditions

The local climate is anticipated to have very little impact on substation and turn-in power line components, but may cause small variations in the transmission of electricity. Extreme phenomena are unlikely to pose a threat to the substation, although secondary effects such as flood conditions associated with high rainfall may present problems to the operation of the substation and transmission power lines. Such events are, however, rare within the study area and, therefore, the risk associated with this potential impact is anticipated to be of low significance.

With the adoption of mitigating measures to alleviate the threat posed by lightning to the transmission of electricity, no negative impacts are anticipated from this phenomenon.

Levels of pollution within the atmosphere may present operational problems to the substation. Pollution levels may be elevated as a result of the extensive mining in the area and dust from gravel roads. Oxidation and subsequent corrosion of metallic components associated with the substation may occur with time. This potential impact is dependent on the levels of pollution in the area, and may vary with time. There do not appear to be any impacts on the existing transmission infrastructure in the area as a result of pollution, and therefore the impacts on the proposed new infrastructure is expected to be of low significance. However, with the implementation of appropriate mitigation measures, this impact is expected to be of low significance.

5.2.1. Conclusions and Recommendations

As the identified alternative substation sites are located in close proximity to each other, it is anticipated that the same climatic conditions would be experienced. Therefore, the impacts associated with climate would not differ between the sites. There is **no preferred site** in terms of this aspect

An assessment of the potential impacts of climate and atmospheric conditions (e.g. potential impacts associated with lightening, precipitation and pollution levels) on the proposed transmission infrastructure should be undertaken by Eskom during the design phase. This is to provide an indication of what

conditions are required to be accounted for by the design team to extend the life and reliability of the new infrastructure.

As the potential impacts associated with climate and atmospheric conditions are anticipated to be of low significance, no additional environmental studies are required to be undertaken in this regard.

5.3. Potential Impacts Associated with Geology and Soils

The construction of the substation and turn-in lines requires 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. Erosion potential is anticipated to increase during the site clearance and construction activities of the proposed substation and turn-in lines. The predicted impact is anticipated to be short-term construction impact on site, and may be of moderate to high significance unless appropriate mitigation measures are implemented.

5.3.1. Conclusions and Recommendations

Impacts on geology and soils are expected to be similar for al identified alternative sites. There is **no preferred site** in terms of this aspect. With the implementation of appropriate mitigation measures, the impacts on geology and soils associated with establishment of the proposed substation and turn-in lines at any of the identified alternatives sites are expected to be of low significance.

A detailed geotechnical survey of the proposed substation site and turn-in power line tower positions should be undertaken by Eskom during the design phase of the project in order to fully understand the soils in terms of founding conditions and erosion potential. This information is required to be used as part of the planning and design phase of the Mokopane Substation.

Detailed mitigation measures should be developed for the proposed site as part of the EIA phase of this project for inclusion in the draft Environmental Management Plan (EMP).

5.4. Potential Impacts on Agricultural Activities

At the time of the study it was believed that the land on which all of the alternatives were located is State-owned. Evidence could be found on Google Earth of a cultivated piece of land in close proximity to Option 1. It would appear

as if all sites are currently used for grazing. As these farms are not privately owned, it is assumed that the area is used for grazing by community members from the surrounding settlements.

To accommodate the substation, land will be permanently lost for agricultural activities. The loss of land will potentially impact on the livelihoods of those parties currently using the site for grazing. It will still be possible to use the land surrounding the site for agricultural activities. However, the presence of power lines entering and exiting the site (i.e. the turn-in lines and Delta-Mokopane lines) will potentially affect agricultural activities, specifically the cultivation of land. Although it is possible to cultivate land in a servitude, the presence of power lines complicates the process.

Temporary loss of cultivated and grazing land will occur due to construction activities around the site and access roads. It may happen that construction teams leave gates open, don't follow access roads, cut through fences and steal cattle. The effect could be that less land is available for cultivation and grazing, the cross breeding of cattle could occur, game/cattle may be lost, and erosion is hastened.

5.4.1. Comparison of the Proposed Substation Site Alternatives

Between impacts on grazing land for cattle and cultivated land, grazing land is generally the preferred option for development. Substation sites that allow for power lines to follow existing infrastructure, such as roads and power lines, should be given preference as the impacts on agricultural activities will be localised in one corridor. However, potential cumulative impacts of a number of power lines running together should be considered.

Considering the potential effect of the site and the proposed two 765kV transmission power lines between the Delta Substation and the new Mokopane Substation on agricultural activities, Construction of the substation on Options 2, 3 and 4 are preferred. The construction of the substation at site option 1 is more likely to affect cultivation activities on land immediately surrounding the site, and is least preferred. The proposed two 765kV transmission power lines will follow a longer length of the existing Matimba-Witkop transmission power lines should Options 3 and 4 be selected, and may localise impacts on agricultural activities. Options 3 and 4 are therefore preferred.

5.4.2. Conclusions and Recommendations

Substation Options 3 and 4 are nominated as being preferred from an agricultural perspective.

To fully assess the potential impacts as a result of geographical change processes, more information is needed on the following aspects:

» The size and number of expected construction and operational vehicles and machinery as well as which route(s) will be used to gain access to the various sites.
» Construction activities on site.
» Planned developments for the area in terms of tourism, mining and agriculture.
» Confirm land use of impacted and affected farm portions.
» Confirm location of dwellings/structures surrounding the sites.
» Agricultural potential of the proposed substation sites.

The following studies are recommended for the Impact Assessment Phase:

» Undertake an agricultural potential specialist study.
» Obtain and analyse information from the project proponent on the size and number of the construction and operational vehicles.
» Further scrutinise the IDP and SDF of the affected District and Local municipality in terms of future developments and tourism. If additional information is required other than that contained in the IDP/SDF, conduct interview(s) with relevant town planners and tourism bodies.
» Interview impacted and affected landowner(s).

5.5. Potential Impacts on Surface Water Resources

The construction of structures close to rivers can potentially impact on water resources through sedimentation and pollution during the construction phase. These potential impacts can be minimised through the implementation of appropriate mitigation and management measures.

Substation Option 1 is not situated within immediate proximity of areas of surface water. There are furthermore not any major rivers that will be crossed by the turn-in lines from the existing Matimba-Witkop 400kV lines. However, small non-perennial streams might be affected by the potential turn-in lines at this site. Substation Options 2, 3 and 4 are situated within relative close distance of drainage lines and the construction and operation of a substation at one of these potential sites might adversely affect the biodiversity status and sensitive biological attributes contained within these rivers and surrounding areas. Many of these impacts can however be mitigated.

5.5.1. Conclusions and Recommendations

Potential impacts associated with the construction and operation of the substation can be significantly minimised through the implementation of appropriate management measures. Although the construction of a substation on Option 1 would potentially have a lower impact on surface water, all of the proposed alternatives are considered to be acceptable as impacts on surface water resources can be relatively easily mitigated. In order to reduce potential impacts on surface and groundwater during the construction and operational phases, detailed mitigation measures should be developed for the proposed site as part of the detailed EIA phase of the process.

5.6. Potential Impacts on Biodiversity

Taking the nature of the development into consideration, no impacts were identified that could potentially be beneficial to the biological environment of the study area. The following impacts were identified as being potentially deleterious to the environment:

» Loss of Biodiversity - Destruction of threatened species and habitat
» Loss of Biodiversity - Destruction of Protected Tree Species
» Loss of Biodiversity - Changes to the local/ regional biodiversity
» Habitat Degradation - Destruction of pristine/ sensitive habitat types
» Habitat Degradation - Impacts on species and habitat in the immediate surrounds

Available data indicate few protected tree species within the study area. This is, however, regarded as a reflection of the poor knowledge of the flora of the region and not necessarily as a result of the absence of these species. Several species are expected to be identified during the EIA investigations, based on previous investigations in similar, nearby areas as well as visual observations made during the scoping and field investigations. However, these trees are generally widespread and occur extensively and the proposed development does not represent a threat to the status of these species, mainly as a result of the localised nature of the disturbance expected to be associated with the construction and operation of a substation of this nature. The likelihood of this impact occurring is regarded as being definite, particularly in the natural regional vegetation. Obtaining relevant permits will therefore be required and transplanting of some individuals may need to be considered in selected areas.

The loss of threatened species or areas that are suitable for these species is considered to be a significant impact on the biodiversity on a local and regional scale. Threatened species, in most cases, do not contribute significantly to the biodiversity of an area in terms of sheer numbers since these generally occur at low abundance values. However, they are extremely important in terms of the biodiversity of an area and high ecological value is placed on the presence of such

species in an area. Threatened species are particularly sensitive to changes in their environment, having adapted to specific habitat requirements. Habitat changes, mostly as a result of human interferences and activities, are one of the greatest reasons for these species having a threatened status. The likelihood of Red Data flora or fauna species occurring within the study area is regarded as being medium. Therefore, this impact is regarded as being moderately significant. The highest probability of occurrence of such species is associated with atypical habitat types such as rocky outcrops and riparian environments as well as pristine habitat types, which are abundantly present in the study area.

In order to avoid impacts on communities of Threatened species it is important to:

» Identify communities/ assemblages of Red Data species;
» Take cognisance of areas where Red Data species are known to occur; and
» Identify habitat that is particularly suitable for the occurrence of Red Data species, taking habitat preferences and requirements of these species into consideration.

The transformation of natural habitat during the construction process will inevitably result in the establishment of habitat types that are not considered representative of the region. As a result of the severity of transformation, surrounding areas are frequently invaded by species not normally associated with the region, while species that occurred abundantly in an area might be affected to a larger or smaller extent. It is expected that the local status of species might therefore be affected, while the regional status of species is not generally impacted on by a development of this nature, unless the area of impact is directly within an extremely limited distribution range and the species has a threatened status.

Furthermore, as a result of decreased habitat, increased competition and lower numbers of endemic biota, the genetic pool of species might eventually be influenced by the introduction of non-endemic species or the disappearance or change in abundance of other species. Different communities and assemblages have developed separate gene structures as a result of habitat selection and geographical separation and the introduction of animals of the same species that might be genetically dissimilar to the endemic species might lead to different genetic selection structures, eventually affecting the genetic structure of current populations.

Figure 5.1: Biodiversity Sensitivities in the study area

Impacts resulting from construction and operational activities associated with the proposed substation could potentially affect surrounding areas and species in the direct vicinity of the development. These impacts could include all of the above impacts, depending on the sensitivity and status of surrounding habitat and species, as well as the extent of impact activities. While impacts from construction and operational activities can in most cases not be prevented entirely, the severity of the impacts can be mitigated against.

5.6.1. Comparison of the Proposed Substation Site Alternatives

» *Substation Site Option 1*
Although situated within areas of relatively low biodiversity sensitivity, the proximity to areas of high biodiversity sensitivity renders this option less suitable for the proposed development, particularly when turn-in lines from the existing Matimba-Witkop lines and potential lines from the Delta Substation are considered[1]. This site is considered the second preferred alternative from a biodiversity perspective.

» *Substation Site Option 2*
This particular site is situated within an area of high biodiversity sensitivity and is regarded the least preferable of the four substation site alternatives.

» *Substation Site Option 3*
This site is regarded the most preferable of the four alternatives and, although situated within an area of medium-high biodiversity sensitivity, the turn-in lines from the existing Matimba-Witkop lines and proposed lines from the Delta Substation are expected to result in the low impact on biodiversity attributes of the region.

» *Substation Site Option 4*
This site is regarded the second most preferable of the four options and, although situated within an area of medium-high biodiversity sensitivity, the turn-in lines from the existing Matimba-Witkop lines and potential lines from Delta Substation are expected to result in a low impact on biodiversity attributes of the region.

5.6.2. Conclusions and Recommendations

Impacts in sensitive areas are not expected to occur as a result of the establishment of the proposed substation. It is largely possible to mitigate significant impacts and limit the extent of ecological degradation by means of site

[1] The proposed 765kV lines are considered within a separate report Mokopane Draft Scoping Report: Transmission Lines

selection, localised realignments and site-specific mitigation measures. The status of habitat types associated with the proposed substation site and turn-in lines will be determined during the EIA on a local as well as regional scale.

Substation Site Option 3 is regarded as the most preferable of the four alternatives from an ecological perspective.

In order to determine the impact of the proposed development on the biological environment, it is necessary to compile baseline information of the area as follows:

» Survey environmentally sensitive areas in order to verify results of the GIS modelling and scoping assessment, preferably in the summer period.
» Survey representative areas in order to obtain a clear understanding of the nature of sensitivity in specific sites.
» Survey the area for general floristic and faunal diversity (common species, Red Data flora and fauna species, alien and invasive plant species).
» Assess the potential presence of Red List flora and fauna species.
» Describe the status and importance of any primary vegetation.
» Provide descriptions of ecological habitat types, plant communities and faunal assemblages.
» Compile an ecological impact evaluation, taking the following aspects into consideration:
  * the relationship of potential impacts to temporal scales;
  * the relationship of potential impacts to spatial scales;
  * the severity of potential impacts;
  * the risk or likelihood of potential impacts occurring; and
  * the degree of confidence placed in the assessment of potential impacts.
» Map all relevant aspects.
» Recommend a preferred substation site and route variants based on results of the ecological impact evaluation.

5.7. Potential Impacts on Avifauna

Table 5.1 shows the historical vegetation composition of the quarter degree squares within the study area (Harrison *et al,* 1997). It is widely accepted within the ornithological community that vegetation structure, rather than the actual plant species, influences bird species distribution and abundance (in Harrison *et al,* 1997). The description of vegetation presented in this study therefore concentrates on factors relevant to the bird species present, and is not an exhaustive list of plant species present.

Table 5.1: Vegetation composition of the study area (Harrison et al, 1997)

Biome	Vegetation type	2328DD	2329CC
Woodland	Arid Woodland	31%	68%
Woodland	Moist Woodland	69%	32%

It is evident from the table above that the dominant vegetation type found within the study area is woodland of one type or another, i.e. Arid or Moist woodland. It must however be noted that the majority of this study area is in a state of transformation, with a number of settlements dotted throughout the immediate surrounds intermingled with mining areas and both commercial and subsistence forms of cultivation. As a result, a great deal of the vegetation within the study area has and is being transformed. The habitat in the area has been subjected to severe pressure from the neighbouring communities and the various land use types.

Two common problems in southern Africa are electrocution of birds (and other animals) and birds colliding with power lines. Other problems are electrical faults caused by bird excreta when roosting or breeding on electricity infrastructure, (Van Rooyen and Taylor 1999) and disturbance and habitat destruction during construction and maintenance activities. A number of Red Data species which are sensitive to interactions with power line infrastructure could potentially occur within the broader study area.

A number of mechanisms exist through which birds are able to cause electrical faults on transmission lines. Frequent faulting affects the quality of electrical supply to the end customers. Power utilities aim to maximise the quality of supply to customers at all times. In the case of a bird streamer induced fault, 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 species capable of producing large or long streamers are more likely to cause streamer faults. Bird pollution is a form of pre-deposit pollution. A flashover occurs when an insulator string gets coated with pollutant, which compromises the insulation properties of the string. When the pollutant is wetted, the coating becomes conductive, insulation breakdown occurs and a flashover results. Larger birds and congregations of many birds are likely to result in heavy pollution of insulator strings. Bird nests may also cause faults through nest material protruding and constituting an air gap intrusion. This impact is only possible on the self support towers along the proposed power line, as the cross rope suspension tower does not provide suitable space in the relevant positions.

Potential ecological impacts associated with the construction of the proposed transmission infrastructure include the following:

» **Electrocutions:** Electrocution of birds on overhead lines refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (van Rooyen 2004). Due to the large size of the clearances on most overhead lines of above 132kV, electrocutions are not a major issue. Therefore, electrocutions are not envisaged as an impact on these proposed lines.

» **Collisions:** Collisions are the biggest single threat posed by transmission lines to birds in southern Africa (van Rooyen 2004). Most heavily impacted upon are 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). 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. Therefore, power lines can be a major cause of avian mortality among power line sensitive species, especially Red Data species.

» **Habitat destruction and disturbance:** During the construction and maintenance substations and turn-in lines, habitat destruction and transformation inevitably takes place. In general, much of the proposed study area for Substation Alternative 1 is disturbed and degraded to some extent already. In this context, habitat destruction associated with construction of the proposed turn-in lines and Substation at this particular site is not anticipated to be significant. The same applies to Substation alternatives 2 and 3 and 4, with the exception being the riparian vegetation within close proximity of these proposed Substation sites.

Whilst much of the bird species distribution in the study area can be explained in terms of the broad vegetation description (refer to Table 5.1), there are many differences in bird species distribution and density that correspond to differences in habitat at the micro-level. These "bird micro-habitats" are evident at a much smaller spatial scale than the broader vegetation types or biomes, and can largely only be identified through a combination of field investigation and experience. The habitat that is relevant to the birds may also be broader than merely the vegetation type and structure and may include abiotic elements such as man-made infrastructure. It was therefore important to visit the study area and examine these characteristics first hand.

The following bird micro-habitats were identified within the immediate surrounds of the substation sites:

» **Dams:** There are several small man-made impoundments within the study area. Whilst dams have altered flow patterns of streams and rivers, and affected many bird species detrimentally, a number of species have benefited from their construction. The construction of these dams has probably resulted in a range expansion for many water bird species that were formerly restricted to areas of higher rainfall.

» **Arable land:** Arable or cultivated land represents a significant feeding area for many bird species in any landscape for the following reasons: through opening up the soil surface, land preparation makes many insects, seeds, bulbs and other food sources suddenly accessible to birds and other predators; the crop or pasture plants cultivated are often eaten themselves by birds, or attract insects which are in turn eaten by birds; during the dry season arable lands often represent the only green or attractive food sources in an otherwise dry landscape. In this study area, there are significant arable lands, both commercial and subsistence varieties.

» **Rivers, pans and wetlands:** Substation Options 2 and 3 are located a short distance (0.3 km) from the Groot-Sandsloot river and Witrivier respectively. Although sections of the river were dry at the time of the field visit, the tall fringing riparian forest and well developed woodland could support diverse and distinct woodland avifauna (Taylor et.al., 1999). These areas are of particular importance for birds, with riparian vegetation being extremely important to threatened riverine bird species and waterbird communities. Relevant to this study, Yellow-billed Stork, Greater and Lesser flamingos will frequent this river system.

Rivers are extremely important sources of water for most bird species and will be regularly utilised not only as a source of drinking water and food, but also for bathing.

Table 5.2: Summarised evaluation of the impacts of the proposed development on the avifauna of the area

Nature of the impact	Extent of the impact	Significance			
		Option 1	Option 2	Option 3	Option 4
Habitat destruction through construction & maintenance of the substation and power line	Local	Low	Medium Note: Riparian vegetation occurs within close proximity to the proposed site	Medium Note: Riparian vegetation does occur within close proximity to the proposed site	Medium Note: Riparian vegetation does occur within close proximity to the proposed site
Disturbance during construction & maintenance of the substation and power line	Local	Low	Low	Medium	Medium

Nature of the impact	Extent of the impact	Significance			
		Option 1	Option 2	Option 3	Option 4
Collision of birds with earth wires of the 400kV loop-in and loop-out power lines Particularly Red Data species such as White-bellied Korhaan, White Stork, Yellow-billed Stork, Abdim's Stork, Secretarybird and Southern Bald Ibis	Local	Medium	Medium	Medium	Medium
Electrocution of birds on power lines	N/A	No Impact	No Impact	No Impact	No Impact
Electrocution of birds within the substation (operational phase)	N/A	Low	Low	Low	Low
Impact of birds on quality of supply	Local	Low - *cross rope suspension towers* Medium - *self support towers*	Low - *cross rope suspension towers* Medium - *self support towers*	Low - *cross rope suspension towers* Medium - *self support towers*	Low - *cross rope suspension towers* Medium - *self support towers*
Nesting of birds on towers	Local	Low	Low	Low	Low

5.7.1. Comparison of the Proposed Substation Site Alternatives

The majority of the Red Data species likely to occur in the area are physically large species, meaning that they are capable of interacting directly with electrical infrastructure through collision, nesting, and electrical faulting. All bird species, including even the smaller ones are vulnerable to indirect impact by the proposed development through factors such as disturbance and habitat destruction.

» *Substation Site Option 1 (Doornfontein):*
The area earmarked for the proposed development is comprised entirely of degraded woodland. A large portion of land adjacent to the site is under cultivation and therefore already transformed. The area is bordered by a secondary road.

» *Substation Site Option 2 (Aaronsfontein):*
The majority of the vegetation is degraded. It is located approximately 0.3km from a tributary of the Groot-Sandsloot River. The area is bordered by a secondary road.

» *Substation Site Option 3 (Zuid Holland):*
The vegetation is comprised largely of fallow fields. It is located approximately 0.3 km from the Witrivier. A large dam is located within 0.25 km to this proposed site. However, it does appear that the proposed substation site is located on the opposite side of the road – the presence of the dam should therefore not have a significant impact on the construction of the substation at this site. The area is bordered by a secondary road.

» *Substation Site Option 4 (Noord Braband):*
The majority of the vegetation is degraded. It is located approximately 1 km from the Witrivier. Four dams occur within 2 km of the proposed site and the area is bordered by a secondary road.

In order to demonstrate the relative preference of the four alternatives from an avifaunal perspective, a score of 1 to 10 was assigned to each alternative. A score of 10 would mean that the substation site is highly preferred, whilst a score of 1 would mean that the corridor is a 'no go' from an avifaunal point of view.

Table 5.3: Preference scores for the four alternative substation sites

Alternative	Preference Score
Option 1	7
Option 2	5
Option 3	5
Option 4	5

From the information provided above coupled with the knowledge and experience of bird interactions with electrical infrastructure it can be concluded that Substation Option 2 (Aaronsfontein), Option 3 (Zuid Holland) and Option 4 (Noord Braband) are not favoured because of their proximity to water sources (dams and river systems). Although Option 1 is bordered by cultivated fields, a draw card for various species, the area is already in a state of transformation through a change in land use and is also comprised almost entirely of degraded woodland, limiting the number and diversity of bird species. All four sites are bordered by secondary roads making them all readily accessible for construction and maintenance purposes, preventing further vegetation and possible habitat loss as a result of the construction of an additional road. Option 1 (Doornfontein) presents itself as the preferred substation site from an avifauna perspective due to the absence of water sources and riparian vegetation within the greater area.

It must be borne in mind that through the establishment of the Mokopane Substation, future electrical infrastructure in the form of distribution power lines will undoubtedly be added to the network in and around this substation site. Although the proposed loop-in lines may not necessarily cross any of the afore-mentioned river systems at present, there is the potential that additional power

lines to be developed in the future may do so, increasing the likelihood of collisions occurring in these sensitive areas. It is therefore recommended that development be restricted to a minimum around these water sources.

5.7.2. Conclusions and Recommendations

Substation Site **Option 1** (Doornfontein) presents itself as the preferred substation site from an avifauna perspective, largely due to the potential future impacts associated with power lines associated with the other substation site options. Should the construction of the substation be undertaken on any of the other substation alternatives identified, extensive mitigation will be required on power lines into and out of the substation site would be required to be implemented in order to minimise these potential impacts.

During the EIA Phase, the above identified impacts will be assessed in more detail for the overall preferred substation site after integration of all specialist input. Particular emphasis will be placed on habitat destruction and disturbance associated with the construction of Mokopane Substation and its associated 400kV loop-in and loop-out power lines, as this has been identified as potentially being of medium significance. Mitigation measures for the alleviation of the identified significant impacts will also be recommended and explained. Once the final corridor for the proposed 400kV loop-in and loop-out power lines has been determined, the collision impacts associated with the power lines will be discussed in detail. In this respect special attention will given to Red Data species, particularly the White-bellied Korhaan, Southern Bald Ibis, Secretarybird and the various stork species. Potential high risk areas will be identified and suitable mitigation measures to reduce the collision risk will be proposed.

5.8. Potential Impacts on Visual/Aesthetic Aspects

Initial viewshed analyses of the four proposed substation sites, based on a 20m contour interval digital terrain model (DTM) of the study area, indicate the potential visual exposure of each substation site and its associated turn-in line infrastructure (refer to Figures 5.2 to 5.5). The object offsets for the viewshed analyses were taken at 20m above average ground level (i.e. the approximate height of the substation structures) and the visibility was calculated for a radius of 5km from each site. The viewshed analyses do not include the potential visual absorption effect of the natural vegetation and represent the 'theoretical visibility' of the proposed substation from the alternative sites.

5.8.1. Comparison of the Proposed Substation Site Alternatives

» *Substation Site Option 1 (Doornfontein)*
Option 1 has a relatively scattered pattern of visual exposure due to the undulating nature of the topography and will potentially be visible from Segoahleng, Ga-Mangou and Glen Roy (refer to Figure 5.2).

» *Substation Site Option 2 (Aaronsfontein)*
Option 2 has, due to its relatively close proximity to Option 1, a very similar pattern of visual exposure. Its location slightly lower down the slope makes it slightly less visible from settlements to the north (Ga-Mangou and Glen Roy) but it would still potentially be visible from Segoahleng (refer to Figure 5.3).

» *Substation Site Option Alternative 3 (Zuid Holland)*
The core area of visual exposure of Site Option 3 is indicated on Figure 5.4. This option is not expected to be visible from any major villages or settlements but it will potentially be visible from the N11 national road at a distance of 3 km at the closest.

» *Substation Site Option 4 (Noord Braband)*
Substation site Option 4 is not expected to be visible, or have a significant visual influence on observers travelling along the N11 (located beyond 5 km from the proposed site) (refer to Figure 5.5). It is also not in close proximity to any major settlements within the core area of visual exposure.

The proposed Mokopane substation should ideally not be visible from major settlements or major roads where it could potentially have a visual impact on observers residing in the area or travelling along these roads. It should also ideally not be located within the sphere of visual influence of areas with potentially conflicting land uses (i.e. nature reserves). Substation site Options 1, 2 and 3 have the potential to visually impact on either settlements and major roads or the Wit Vinger Nature Reserve. From a visual perspective, the preferred option for the construction of the Mokopane substation is Option 4, due to its relatively remote location.

Figure 5.2: Potential visual exposure – substation Option 1

Figure 5.3: Potential visual exposure – substation Option 2

Figure 5.4: Potential visual exposure – substation Option 3

Figure 5.5: Potential visual exposure – substation Option 4

5.8.2. Conclusions and Recommendations

The proposed substation sites have the potential to be visually exposed to fairly large areas. This is based on the theoretical visibility as indicated by the preliminary viewshed analyses undertaken from each of these sites. The fact that these areas are exposed does not imply that it constitutes a significant visual impact, at least not for all of the exposed areas. Further investigation is necessary in order to determine the specific visual impact within these exposed areas (i.e. the potential occurrence of sensitive visual receptors). The preferred option for the construction of the Mokopane substation, due to its relatively remote location, is **Option 4**.

The visual impact assessment within the EIA will address these and other crucial issues related to the visibility of the proposed Mokopane Integration Project. These issues or criteria will aim to quantify the actual visual impact and to identify areas of perceived visual impact.

Other issues/criteria to be addressed by the visual impact assessment include:

» Visual distance/observer proximity to the proposed infrastructure (apply the principle of reduced impact over distance)
» Viewer incidence/viewer perception (identify areas with high viewer incidence and negative viewer perception)
» Landscape character/land use character (identify conflict areas in terms of existing and proposed land use)
» Visually sensitive features (scenic features or attractions)
» General visual quality of the affected area
» Visual absorption capacity of the natural vegetation
» Potential visual impact of lighting (after hours operations and security) of the proposed substation
» Potential mitigation measures

An initial scanning level assessment of the above issues did not reveal any fatal flaws to be associated with the preferred substation alternative as suggested in this report. These issues should however still be investigated in greater detail in order to scientifically motivate and/or identify any other mitigating/aggravating circumstances.

An initial scanning level assessment of the above issues did not reveal any fatal flaws to be associated with the *preferred* alternatives. These issues should however still be investigated in greater detail in order to scientifically motivate and/or identify any other mitigating/aggravating circumstances.

5.9. Potential Impacts on Heritage Sites

At least one archaeological (heritage) zone can be distinguished in the study area considered from an ecological, historical and pre-historical perspective. This cultural landscape comprises the plains to the west of Polokwane which are dotted with scattered mountains, kopjes and knolls across a vast plain.

When considering the pre-historical and historical context for the broader study area it is clear that some of the following types and ranges of heritage resources as outlined in Section 3 of the National Heritage Resources Act (No 25 of 1999) may occur in the project area, namely:

» Stone Age sites or scatters of stone tools near pans, in eroded areas or dongas, near small outcrops and along older beds and floodplains of the Mogol, Lephalale and Mogalakwena Rivers as well as tributaries running into these rivers.
» Early Iron Age farming settlements near main rivers or where tributaries join these major rivers. Small numbers of potsherds and evidence for occupation may be associated with outcrops in the area.
» Late Iron Age remains in the Langa-Ndebele, Seleka-Ndebele and the Shongwane spheres of influence.
» Farm homesteads with associated infrastructure such as sheds and outbuildings, family graveyards or informal graveyards which date from the historical period. (If historical farm homesteads with associated infrastructure and activity areas have remained unaltered such complexes may constitute cultural landscapes).
» Graveyards and informal graves which occur together with dilapidated homesteads on farms, townships and informal villages which scattered across the project area.
» Individual buildings such as farm houses which are older than sixty years which therefore qualify as heritage resources.

Impact analysis of cultural resources under threat of the proposed development, are based on the present understanding of the development. The significance of a heritage site and artefacts is determined by its historical, social, aesthetic, technological and scientific value in relation to the uniqueness, condition of preservation and research potential. It must be kept in mind that the various aspects are not mutually exclusive, and that the evaluation of any site is done with reference to any number of these.

Based on current knowledge and understanding of the area, the heritage sites in the area are evaluated as follows:

Heritage sites are fixed features in the environment, occurring within specific spatial confines. Any impact upon them is permanent and non-reversible. Those resources that cannot be avoided and that are directly impacted by the

development can be excavated/recorded and a management plan can be developed for future action. Those sites that are not impacted can be written into the management plan, whence they can be avoided or cared for in the future.

Heritage sites regarded as having low significance are viewed as being recorded in full after identification and would require no further mitigation. Impact from the development would therefore be judged to be low. Sites with a medium to high significance would require mitigation. Mitigation of heritage sites implies first of all total avoidance, or, secondly, the recovery of sufficient data from the site in order that it can be studied and understood at a later stage. This latter scenario is not necessarily negative as science stands to benefit from such actions, but does require the excavation of a site, which is in essence destructive therefore resulting in an impact which can be viewed as high and as permanent.

Potential risks to heritage sites as a result of the construction and operation of the proposed substation and transmission power line are outlined in Table 5.5 below.

Table 5.5: Potential risks to heritage sites as a result of the construction and operation of the proposed substation

Possible Risks	**Source of the risk**
Construction phase	
Damage to sites	Construction work
Looting of sites	Curio seekers
Operation phase	
Damage to sites	Non-compliance with management plans and/or unplanned construction/developments

5.9.1. Comparison of the Proposed Substation Site Alternatives

No preferred substation site alternatives exist at this stage from a heritage perspective.

5.9.2. Conclusions and Recommendations

Further studies are required during the EIA phase of the project to fully identify heritage resources and mitigation measures. However, there do not seem to be any fatal flaws or red flags associated with heritage resources in the project area. The Phase I Heritage Impact Assessment study will provide a synthesis of the results achieved by the scoping study and the Phase I survey and will describe the status quo of the study area with regard to its pre-historical (archaeological), historical and cultural context. Depending on the types and ranges of heritage resources that may be discovered and the level of significance of these remains certain mitigation and management measures have to be applied to these

resources, particularly if they are to be affected (destroyed, altered, removed) during the construction, operation or maintenance of the Mokopane Integration Project.

Phase II studies include in-depth heritage studies and vary according to the types and ranges of heritage resources that may be affected. These studies include the documentation of sites dating from the Stone Age, Iron Age and the Historical Period by means of mapping, excavating, photographing and describing archaeological sites. Excavations of archaeological sites could be followed by laboratory work when archaeological collections have to be studied and analysed. Phase II work may also include the documenting of rock art, engravings or historical sites and dwellings; the sampling of archaeological sites or shipwrecks; extended excavations of archaeological sites; the exhumation and relocation of graves and graveyards; the collection or excavation of paleontological samples, etc. and may require the input of different types of specialists.

5.10. Potential Impacts on the Social Environment

Potential change processes and impacts on the social environment associated with the establishment of the proposed transmission lines include the following:

» Demographic processes (the number and composition of people)
» Economic processes (the way in which people make a living and the economic activities in society)
» Empowerment, institutional and legal processes (the ability of people to get involved in and influence decision making processes, the role, efficiency and operation of governments and other organisations)
» Socio-cultural processes (the way in which humans behave, interact and relate to each other and their environment and the belief and value systems which guide these interactions)
» Land use processes (land use patterns)

5.10.1. Demographic Change Processes

The Mogalakwena Local Municipality in its IDP (2008/09) states that the many people within the municipal area live in remote farming areas. The population size further changes seasonally as a result of migratory workers either entering or leaving the area. The population size was estimated to be 298 440 in 2007 (IDP 2008/09). The annual population growth rate within the municipal area is estimated at approximately 1.4%, which is more or less on par with the provincial population growth rate.

According to the Polokwane Local Municipality's IDP (2008-2011), the area is home to approximately 561 770 people (2007). This means that this local

municipal area houses more than 10% of the province's total population, even though the area only accounts for approximately 3% of the province's total land surface. The IDP further states that the outskirts of the municipal area is characterised by less formal settlement and that these areas experience enormous influx of people as a result of urbanisation trends. This has resulted in the fact that these areas are in dire need of upgraded services and as such, are struggling to cope with the ever increasing influx of more people expecting an improved quality and standard of living.

The construction and maintenance of the proposed substation and associated infrastructure could lead to a change in the number and composition of the population within the affected local areas, which in turn could negatively impact on health and safety and community cohesion and positively impact on the economy. These potential impacts are discussed in more detail under economic and socio-cultural change processes.

The most significant demographic changes will occur during construction, when an influx of job seekers and workers may be expected. Changes are also expected during operation, as the current maintenance team from the Polokwane based office will operate in areas they have not operated in previously.

Table 5.6: Overview of expected demographic change processes and potential impacts

DEMOGRAPHIC CHANGE PROCESSES			
Change Process Variable	**Potential Impacts**	**Project Phase**	**Status**
Influx of construction workers	Influx of construction workers may lead to a change in the number and composition of the local population, and impact on economy, health, safety and social well-being.	Construction	Negative to neutral
Influx of job seekers	Influx of job seekers may lead to a change in the number and composition of the local population, and impact on economy, health, safety and social well-being.	Pre-construction and construction	Negative
Influx of maintenance workers	Physical presence of maintenance workers in areas they have not previously worked in may impact on economy, health, safety and social well-being.	Operation	Negative to neutral

5.10.2. Economic Change Processes

Economic change processes relate to the way in which people make a living and the economic activities within a society. Job opportunities are created as a result of the construction and maintenance of transmission power lines. However

Eskom appoints specialised contractors and even international companies due to the fact that local contractors do not have the capacity or skills to handle the workload. Therefore, only a limited number of local individuals within the study area could be employed during construction. Local labourers are usually engaged in work that does not require a substantial amount of skill, such as bush clearance, digging of foundations, erection of gates and acting as security guards.

During construction, direct and indirect employment opportunities will be created. Indirect opportunities include provision of building materials and/or equipment. Other economic opportunities as a result of construction workers transpires through construction workers' use of local enterprises (shops and shebeens) and in formal and informal work opportunities created at the construction camp.

When a construction camp is put up money is also paid towards the land owner. This is seen to hugely benefit the community. On tribal or municipal land, negotiations are done with community leaders who consult with the community regarding the issue. Another opportunity for financial gain is the rental of land for the accommodation of the construction workers and storage of equipment. This will have a positive impact on the community that benefits from it.

The accommodation of construction workers in the communities should be considered as it increases the economic benefits of the project to the affected communities. The economic opportunity for the local community is positive, and potential impacts such as pregnancies because of sexual relationships could be prevented to some extent by implementing mitigation measures. The payment to households will vary according to the nature of the accommodation.

Job opportunities associated with the substation and turn-in lines are mainly during construction. Job opportunities during construction would, however, be limited to semi-skilled and unskilled tasks. For operation, the job opportunities could be a permanent job for a skilled worker or a contract for bush clearance. Bush clearance will happen in intervals. Bush clearance opportunities might also be limited because the landowner or Eskom might undertake this activity.

Land for agricultural activities will be permanently lost within the footprint of the substation, which will have an economic impact. Broadly, the economic impact is considered similar for the four sites, as grazing seems to occur on all four sites. Grazing would not be severely affected during operation, as the cattle are still able to move around freely under the turn-in lines as well as around the pylons.

On a regional level, the increase in electricity could boost the economy.

The potential impacts derived from the economic change process could lead to an improvement in the health of people, their education, and their living conditions

due to the fact that money is now available to buy food, pay fees, etc. The impact might be significant in light of the level of poverty experienced in these communities. It is not only the individual that gains from these changes, but also the said individual's family. Although economic change processes can lead to positive impacts, most of these impacts are only temporary in nature as these will only last during the construction period.

As the land on which the substation sites are located are all State-owned, it was assumed that none of these land portions were used for commercial cattle and crop farming and therefore any such activities that take place were assumed to be subsistence farming. The location of substation site Option 1 relevant to the cultivated land makes it unlikely that the turn-in lines would cross this area. No tourism facilities were identified in close vicinity of any of the proposed sites.

Although no tourism facilities were identified in close vicinity of the sites, the visual impact on tourism facilities further away from the site will have to be considered. The presence of a substation site and related power lines may change tourism numbers negatively, which in-turn may have an impact on economy. The potential economic impacts on tourism are assessed within the context of "sense of place". The concept of sense of place is applicable to tourist areas because people go on holiday for various and different reasons, e.g. to escape, to be entertained, to enjoy nature, to socialise, etc. In choosing a destination the image of the place is being considered, e.g. its authenticity, its offering, its status. Limpopo is marketed as "The Preferred Eco-Tourism Destination", which raises expectations of an unspoilt natural environment.

Research on the psychological experience of sense of place suggests that people rapidly discount a landscape as soon as the first scar occurs, rather like a stain ruining a favourite garment (Petrich 1993). Thereafter, any additional impacts on the landscape have a correspondingly smaller effect. Therefore, the aesthetic impact of placing a transmission line or substation in a landscape that already bears the marks of development would be less than that of placing it in a relatively unspoilt environment. People overwhelmingly prefer "nature scenes" to urban and built environments, according to research. Zadik (1985) explains *"people seem to respond to environments as natural if the areas are predominantly vegetation and do not contain human artefacts such as roads or buildings (Relf 1992)."*

The presence of the substation might not only impact on tourism numbers, but also on property values of tourism destinations as well as land used for other purposes.

Table 5.7: Overview of expected economic change processes and potential impacts

ECONOMIC CHANGE PROCESSES			
Change Process Variable	**Potential Impacts**	**Project Phase**	**Status**
Direct formal employment opportunities to local individuals	Direct formal job opportunities for individuals and/or contractors (economic impact).	Pre-construction, construction and operation	Positive (limited to semi-skilled and unskilled workers)
Indirect formal and/or informal employment opportunities to local individuals	Indirect formal and/or informal job opportunities for individuals and/or contractors income (economic impact).	Pre-construction and construction	Positive
Job loss/gain	Economic impact on as a result of the project.	Construction and operation	Negative
Loss of income and output	Economic impact as a result of the project.	Construction and operation	Negative
Reduction in property values	Economic impact as a result of the presence of the site.	Construction and operation	Negative
Benefits (regional and/or national)	Economic impact as a result of the construction and operation of the substation – benefits economic growth.	Construction and operation	Positive

5.10.3. Empowerment and Institutional Change Processes

Institutional processes relate to the role, efficiency and operation of government sectors and other organisations within the area in terms of service delivery during construction. As was previously mentioned, the presence of construction workers may put additional strain on municipalities, which might impact on health. Empowerment processes investigates the ability of people to engage in decision-making processes to such an extent that they have an impact on the way in which decisions are made that would concern them.

In terms of institutional change processes, the disadvantages of locating the site far from existing settlements would appear that it would increase the distance that would have to be traversed by services infrastructure such as electricity supply and sanitation to the site and construction village, notably during construction. Therefore, it would increase the burden on local authorities that are required to provide that infrastructure.

Negotiation for land is a change process on legal and empowerment level. The same applies to the stakeholders that will be involved in the public participation process. The EIA process is an opportunity for these stakeholders to give input into the process and project. However, stakeholders would have to offer up their time to become actively involved in the process and they should clearly understand their rights in terms of the process to enable them to use these

rights. Attitude formation may start during the EIA process. Attitude formation is a change process, and not an impact. Attitude formation might result in delays in project implementation, which might result in secondary impacts such as economic impacts.

A number of issues and concerns were raised with regards to the negotiation process, and these should be addressed to prevent a breakdown in the negotiation process. A breakdown in the negotiation process in terms of land acquisition could severely delay the project and result in an economic impact on both the landowner as well as on Eskom.

Considering institutional processes and the potential burden on the municipality for the construction village, Option 3 is preferred because of its shorter distance from settlements and the N11, followed by Option 2.

Table 5.8: Overview of expected empowerment and institutional change processes and potential impacts

EMPOWERMENT AND INSTITUTIONAL CHANGE PROCESSES			
Change Process Variable	**Potential Impacts**	**Project Phase**	**Status**
Attitude formation against the proposed project	Attitude formation against the project could have economic impacts and could impact on social well-being.	Pre-construction and construction	Negative
Negotiation process	A breakdown in the negotiation process in terms of land acquisition could severely delay the project and result in an economic impact on both the landowner as well as on Eskom.	Pre-construction	Negative to neutral
Additional demand on municipal services	Additional demand on municipal services could impact on the availability of these services. A lack of services could impact on health and have an economic impact.	Pre-construction and construction	Negative

5.10.4. Socio-Cultural Change Processes

Socio-cultural processes relate to the way in which humans behave, interact and relate to each other and their environment, as well as the belief and value systems which guide these interactions.

» *Change processes and potential impacts during construction:*
Construction workers form part of a significant section of the South African population known as migratory workers. Due to their unique situation, construction workers engage in behaviour that makes them vulnerable, such as risky sexual behaviour (e.g. unprotected sex) and destructive behaviour (e.g. alcohol abuse, damaging the environment), which could be explained by their migratory status. When they are separated from their homes, they are also distanced from traditional norms, prevailing cultural traditions and support systems that normally regulate behaviour within a stable community. In addition, it might also be that construction workers who are faced with dangerous working conditions and the risk of physical injury might be more preoccupied by immediate (direct) risks and therefore tend to disregard salient (more indirect) risks, such as HIV infection.

Not only do health issues impact on communities, but the physical safety of communities can also be endangered as a result of the influx of job seekers and construction workers (e.g. potential increase in crime). This has a mental health impact, such as fear. The construction activities, construction vehicles and movement patterns of these vehicles and equipment could also impact on the health and safety of communities. However, this only becomes a real concern if such activities occur in close proximity to roads and settlements.

» *Change Process and Potential Impacts during operation:*
Physical and mental health in the context of substations and power lines are related to Electro Magnetic Fields (EMFs), electrocution, fire and collapse of structures. The reason why mental health is mentioned in relation to physical health is because the physical effect or the knowledge of the potential physical effect that transmission power lines have on people could, in turn, have an effect on the mental state of members of the community.

» *Change process and potential impacts related to sense of place:*
Much of what is valuable in a culture is embedded in place, which cannot be measured in monetary terms. It is because of a sense of place and belonging that some people loath to be moved from their dwelling place, despite the fact that they will be compensated for the inconvenience and impact on their lives.

The potential impact on socio-cultural behaviour and the related perception of environmental changes could either have a positive or a negative impact on sense of place (i.e. peace of mind or frustration/anger). It could be viewed as a positive impact if people perceive the project as a means of job creation, free/less expensive electricity, and infrastructural and/or economic development, which is not intrusive on their lives and do not cause them immediate danger. Potential negative impacts include the visual impact and the resultant intrusion on sense of place.

Table 5.9: Overview of expected socio-cultural change processes and potential impacts

EMPOWERMENT AND INSTITUTIONAL CHANGE PROCESSES			
Change Process Variable	**Potential Impacts**	**Project Phase**	**Status**
Mental health	Presence of construction workers and job seekers on surrounding landowners' sense of safety and security and being in control.	Construction	Negative
Behavioural changes – sexual relations and alcohol abuse	Presence of construction workers and job seekers my impact on local people's health and safety	Construction	Negative
Integration of construction workers into local areas	Socially acceptable integration, including the risk of spreading STIs and HIV/AIDS with an impact on health.	Pre-construction and construction	Negative
Cultural landscape	Psycho-social impact of construction activities and the presence of the line (nuisance, socio-cultural)).	Construction and operation	Negative

5.10.5. Geographical Change Processes

Geographical change processes refer to land use change as a result of the actual or perceived changes in land use, whether it be on a temporary or permanent basis.

» *Substation site Option 1 (Doornfontein):* The closest human settlement to this site is Segoahleng, which is located some 3 km east of the proposed site. Other human settlement in fairly close proximity to the proposed site includes Ga-Matlapa (approximately 4.7 km southeast), Glen Roy (approximately 4.3 km north), and Ga-Mangou (approximately 4.1 km north-northeast).

» *Substation site Option 2 (Aaronsfontein):* The closest human settlements are Segoahleng (approximately 3.8 km east), Ga-Mangou (approximately 4.8 km north), Glen Roy (approximately 5.2 km north-northeast), and Ga-Matlapa (approximately 4.9 km southeast).

» *Substation site Option 3 (Zuid Holland):* The closest human settlements to this option is Dorsland, which is located approximately 2.8 km southeast and Suid-Holland, which is located approximately 3.3 km southwest of the proposed site. Other human settlement in the vicinity of the proposed site includes Sakuruwa (approximately 6km south), Ga-Maloka (approximately 7 km west-southwest), Ga-Malebana (approximately 7.5 km southwest), and Ga-Mabusela (approximately 9.1 km west).

» *Substation site Option 4 (Noord Braband):* The closest human settlement is Sukuruwe, which is located approximately 4.9 km southwest of the proposed site. Other formal settlements in fairly close proximity to this option include Jupiter (approximately 5.4 km northeast), Suid-Holland (approximately 6.2 km west), Ga-Mangou (approximately 8.8km east) and Phetole (approximately 8.9 km north).

The existing Matimba-Witkop 400kV Transmission power lines located in the vicinity of the substation site alternatives already prohibit development towards the servitude. Development is likely to occur to the north and south of the existing power lines. In terms of scattered dwellings on farm portions, no dwellings will be directly impacted by the proposed substation or turn-in lines at any of the proposed sites.

The main social concerns which arise when considering the presence of a substation and related power lines close to human settlement are health and safety aspects. The intention is that the footprint of the substation and the servitudes of the power lines mitigate these potential health and safety related impacts. Development will therefore have to avoid the servitudes of power lines that enter and exit the proposed substation.

Risks are related to Electro-Magnetic Fields (EMF), electrocution, fire and collapse of the substation and related power lines. A malfunctioning substation could cause fatal/traumatic accidents because of mechanical failure or fire. Fire can be caused by electrical malfunction or human error.

Utilities in South Africa involved in the generation and distribution of electrical energy, are bound by the Occupational Health and Safety (OHS) Act [63] to provide such services in a safe manner. There are currently no regulations (under the Hazardous Substances Act) in terms of exposure to power frequency EMF in South Africa and the International Commission for Non-Ionising Radiation Protection (ICNIRP) guidelines are used for assessing human exposure to these fields. The guidelines for electric and magnetic field exposure set by the ICNIRP, an organisation linked to the World Health Organisation (WHO), receive world-wide support (Pretorius, 2006).

The results of a study commissioned by Eskom Holdings Limited on the possible health effects of EMF noted the following (Pretorius, 2006):

» The main focus of research has been on a possible association between long-term exposure to magnetic fields and childhood leukaemia.
» Based on the epidemiological findings, the risk of EMF being a health hazard is small.

» Based on current understanding of the topic, EMF is regarded a possible but not proven cause of cancer.
» The suggestion for this health outcome stems mainly from a fairly consistent pattern of the increased but small risk observed from some epidemiological studies. This finding has not been confirmed by (notably all) controlled laboratory studies.
» No evidence of a causal relationship between magnetic field exposure and childhood leukaemia has been found and no dose-response relationship has been shown to exist between EMF exposure and biological effects.
» A possible explanation for the epidemiological findings may be confounding (a factor other than EMF) or bias (subjects studied are not representative of the target population for which conclusions are drawn) which render the data inconclusive and prevent resolution of the inconsistencies in the epidemiologic data.

It would seem preferable to select a site that is as remote as possible from existing settlements. However, in order to obtain a complete view, it is also necessary to consider activities and structures that are associated with any substation site. It is necessary to take into consideration the need for access roads for construction and maintenance activities. If a substation is remote from existing settlements, it is also likely to be far removed from existing infrastructure. Longer access roads could increase the probability that:

» Relocation of populations will be necessary;
» Access roads might interfere with people's daily movement patterns and impact on their safety;
  * Access roads might cut across private property, thereby increasing the number of landowners to be affected by construction and maintenance activities; and
  * Access roads could interfere with tourism and recreational activities.

All four substation sites are placed along/in close vicinity of the existing Matimba-Witkop transmission power line, as well as relatively close to existing local gravel roads. The assumption is therefore that existing roads (be these local gravel roads or power line maintenance roads) will be used to access the preferred site.

Table 5.10: Overview of expected geographical change processes and potential impacts

GEOGRAPHICAL CHANGE PROCESSES			
Change Process Variable	**Potential Impact**	**Project Phase**	**Status**
Cultivated and grazing land	Temporary loss of cultivated and grazing land due to construction activities, leads to a decreased area for cultivation and grazing,	Construction and Operation	Negative

GEOGRAPHICAL CHANGE PROCESSES			
Change Process Variable	**Potential Impact**	**Project Phase**	**Status**
	resulting in an economic impact. Also permanent loss of cultivated and grazing land through the land acquisition process during operation.		
Spatial development (future land use)	Developments may encroach upon the substation which may impact on health and safety. People who move into the servitudes of the power lines or the substation will have to be moved.	Operation	Negative

5.10.6. Comparison of the Proposed Substation Site Alternatives

This section intends to provide a preliminary comparison between the different substation alternatives in order to determine which of them is likely to have the least significant negative impacts on the change processes of the social environment.

» *Demographic Change Processes*
It is not expected that the changes and potential impacts will differ significantly between the alternative sites, and a preferred site is therefore not selected considering demographic change processes.

» *Economic Change Processes*
Considering the potential economic impact of the substation sites, more detail about the livelihood activities on the sites is needed. In terms of proximity to settlements to provide a boost to the informal economic sector, substation site Option 4 is not preferred. However, the economic boost will occur during construction, which is a short term activity. Considering potential long-term economic impacts as a result of visual impacts, substation site Option 4 is preferred. According to the visual scoping assessment, only site 3 could impact tourists, as this site is located in the vicinity of the N11. According to the visual scoping assessment, the preferred site is site Option 4.

» *Empowerment, Institutional and Legal Change Processes*
Considering institutional processes and the potential burden on the municipality for the construction village, Option 3 is preferred because of its shorter distance from settlements and the N11, followed by Option 2.

» *Socio-Cultural Change Processes*
Considering the potential socio-cultural impacts, Option 3 is closest to settlements, followed by Options 1 and 2. Option 4 is the preferred site, not taking into account potential impacts on cultural landscape during operation.

» *Geographical Change Processes*
Considering the potential affect on settlement patterns & development (current and future) as well as agriculture, the following emerges:

* *Settlement Patterns:*
  - In terms of access roads, there is no preferred site.
  - Option 3 is closest to settlements, followed by Options 1 and 2. In terms of potential health and safety impacts, Option 4 is preferred.
  - Transmission power line corridors not following the existing Matimba-Witkop transmission power lines and entering and exiting Options 1 and 2 will potentially affect more settlements.
  - Considering proposed transmission power lines going to Options 3 and 4, it is possible to avoid settlements and not affect their development.

  To avoid potential negative impacts on health and safety and settlements developments, the preferred site is Option 4.

* *Agricultural Activities*
  Considering the potential effect of the site and the proposed two 765kV transmission power lines on agricultural activities in the vicinity of the substation, Options 2, 3 and 4 are preferred. Option 1 is more likely to affect cultivation activities on land immediately surrounding the site, and is least preferred. The proposed two 765kV transmission power lines will follow a longer length of the existing Matimba-Witkop transmission power lines should Options 3 and 4 be selected, and may localise impacts on agricultural activities in the vicinity of the substation. Options 3 and 4 are therefore preferred.

5.10.7. Summary of Social Scoping

» To avoid potential negative impacts on health and safety and of displacement of people as a result of changes in current and future settlement patterns that may be affected by the proposed sites, the preferred site was identified as Option 4.
» To avoid potential negative impacts on agricultural activities as a result of the proposed transmission power line, the preferred sites were Options 3 and 4.
» It was not expected that the changes and potential impacts due to the influx of job seekers and workers would differ significantly between the alternative

proposed sites, and a preferred site was therefore not be selected considering demographic change processes.

» Considering the potential economic impact of the site, Option 4 was preferred. This recommendation was based on the potential visual impact.
» Considering institutional processes and the potential burden on the municipality, Option 3 was preferred because of its shorter distance from settlements and the N11, followed by Option 2.
» Considering the potential socio-cultural impacts, Option 3 is closest to settlements, followed by Options 1 and 2. Option 4 was the preferred site.

Overall Option 4 (Noord Braband) closely followed by Option 3 (Zuid Holland) are nominated as preferred alternatives.

5.10.8. Conclusions and Recommendations

To fully assess the ***potential demographic impacts*** as a result of socio-cultural change processes, more information is needed on the following aspects:

» Statistical demographic data on the various settlements, towns, landowners and workers adjacent to the site(s);
» Current crime rate and nature of crimes committed in the area;
» An understanding of local residents' viewpoint on the proposed project and the potential risk for conflict and other forms of active and passive social mobilisation;
» The construction processes and associated timeframes;
» The composition of the construction workforces in terms of size, skills levels, and origin;
» The composition of the maintenance workforce and their activities;
» The number of local employment opportunities;
» The skills level of local people;
» The expectations of the local communities in terms of employment opportunities;
» Other projects in the area, their timeframes and work force size as well as location of construction camps; and
» The nature and extent of social problems experienced in the municipalities as a result of an influx of job seekers and employees.

In order to address these information gaps, the following studies are recommended for the Impact Assessment Phase:

» Conduct a comparative desktop study between Census 2001 and Community Survey 2007 data;
» Access a skills audit of the local people, if available;

» Request construction and maintenance information from the project proponent;
» Review the Comments and Responses Report compiled by the public participation consultants and interview the public participation consultants if necessary;
» Interview the project proponent, other companies and the municipality; and
» Access crime statistics and interview members of the SAPS if necessary.
» Access crime statistics and interview members of the SAPS if necessary.

To fully assess the ***potential impacts as a result of economic change processes***, more information is needed on the following aspects:

» Study area's contribution to the GDP;
» The potential effect of the substation site on property values;
» The local employment opportunities that will be created, both directly and indirectly;
» The skills levels of people in the study area;
» Number of jobs available and skills levels of these;
» If available, an outline of a typical salary package for skilled and unskilled labour during the construction period, which is estimated to be over a period of around 2 years;
» The input and output cost of the project;
» Potential job losses as a result of the project;
» The size of farm portions and the economic activities on farms.

In order to address these information gaps, the following studies are recommended for the Impact Assessment Phase:

» Request the necessary information from the project proponent and interview them if necessary;
» Access Quantec data;
» Conduct a choice modelling study among hunters and/or tourists and/or potential buyers of property in the area;
» Use an input-output model to quantify economic impacts; and
» Execute an economic dependency model.

To fully assess the ***potential impacts as a result of institutional and empowerment change processes***, more information is needed on the following aspects:

» The risk for attitude formation against the project (social mobilisation);
» The settlements' ability to sustain an additional demand on municipal services and/or natural resources;

» The capacity of the affected local municipality to able to supply municipal services to both the construction site as well as the construction village; and
» Existing disaster management plans (if any) for substations.

In order to address these information gaps, the following studies are recommended for the Impact Assessment Phase:

» Obtain the issues register or issues report from the public participation consultants to determine the recurrent issues raised from the public's side and how these issues were addressed throughout the process. An analysis of these issues would indicate the risk for social mobilisation;
» Obtain information from the local municipality on the existing capacity to deliver municipal services and to determine the capacity for an additional demand on municipal services;
» Discuss issues and concerns regarding the negotiation process and how these issues should be addressed with the project proponent; and
» Obtain and analyse information on any existing disaster management plans at similar installations. Also obtain information from the local municipality on any existing emergency and health care services (both governmental as well as private) and determine their capacity to handle potential disasters.

To fully assess the ***potential impacts as a result of socio-cultural change processes***, more information is needed on the following aspects:

» Request information from the project proponent on the construction process and the likely profile of a typical construction worker;
» Assess the visual assessment report;
» Participant Rural Appraisal including interviews and/or focus group discussions with land owners and communities in the study area to gain an understanding of the cultural landscape;
» Conduct a desk top study to determine the health profile of the area, including typical indicators such as HIV prevalence, etc.; and
» Interviews with municipal officials and other authority figures (such as the South African Police Service) to determine the current extent of social problems in the area and initiatives to combat them.

In order to address these information gaps, the following studies are recommended for the EIA Phase:

» Request information from the project proponent;
» Assess the visual assessment report;
» Participant Rural Appraisal including interviews and/or focus group discussions with land owners and communities in the study area;
» Conduct a desk top study to determine the health profile of the area; and

» Interviews with municipal officials and other authority figures (such as the South African Police Service).

To fully assess the ***potential impacts as a result of geographical change processes***, more information is needed on the following aspects:

» The size and number of expected construction and operational vehicles and machinery as well as which route(s) will be used to gain access to the various sites;
» Construction activities on site;
» Planned developments for the area in terms of tourism, mining and agriculture;
» Confirm land use of impacted and affected farm portions;
» Confirm location of dwellings/structures surrounding the sites.

In order to address these information gaps, the following studies are recommended for the Impact Assessment Phase:

» Obtain and analyse information from the relevant specialist on the agricultural potential of the site(s);
» Obtain and analyse information from the project proponent on the size and number of the construction and operational vehicles;
» Further scrutinise the IDP and SDF of the affected District and Local municipality in terms of future developments and tourism. If additional information is required other than that contained in the IDP/SDF, conduct interview(s) with relevant town planners and tourism bodies; and
» Interview impacted and affected landowner(s).
» Identify and assess other relevant studies.

5.9. Evaluation of Cumulative Impacts

Apart from the proposed Mokopane Substation and turn-in lines which is the subject of this scoping study, there are currently other development projects underway in or planned for the study area, including platinum and coal mining operations. In addition, the surrounding area is impacted by agricultural activities and residential developments. Infrastructure which is present in the area includes the existing Matimba-Witkop 400kV transmission power lines, as well as various major and minor roads. These developments will all impact in some way on the surrounding environment. There is, therefore, the potential for the proposed project to add to the cumulative impact on the environment in the area. Potential cumulative impacts include:

» Potential impacts on flora, fauna and ecological processes
» Potential impacts on heritage sites

» Potential impacts on aesthetics and the visual character of the area
» Potential impacts on the social environment, including impacts on tourism potential and land use

In order to determine the significance of cumulative impacts associated with the proposed Mokopane Substation and turn-in lines, these potential cumulative impacts will require further investigation within the EIA.