PROPOSED ISUNDU 765/400 KV SUB-STATION AND TURN-IN TRANSMISSION LINES

DEA EIA REF: 14/12/16/3/3/2/745

FINAL ENVIRONMENTAL IMPACT ASSESSMENT REPORT

PROPOSED ISUNDU 765/400 KV SUB-STATION AND TURN-IN TRANSMISSION LINES

DEA EIA REF: 14/12/16/3/3/2/745

FINAL ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Report prepared for:

Eskom Holdings SOC Limited
PO Box 1091
Johannesburg
2000

Report prepared by:

ACER (Africa) Environmental Consultants
P O Box 503
Mtunzini
3867

September 2017

FINAL EIA REPORT DISTRIBUTION

Following the public review of the Draft Environmental Impact Assessment Report (DEIAR), revisions and additions have been made in the compilation of this Final Environmental Impact Assessment Report (FEIAR).

The FEIAR is available for a further round of public review for a period of 21 days from **7 September 2017 to 29 September 2017**. Hard copies of the report have been placed at the following public venues:

Area	Venue	Street	Contact Person and Number
Camperdown	Camperdown Public Library	18 Old Main Road Camperdown 3720	Mrs. Samke Duma 031 785 9337
Cato Ridge	Cato Ridge Public Library	Cnr. Doornrug & Old George Road Cato Ridge 3680	Mr. Isaac Nxela 031 782 1632
Pietermaritzburg	Msunduzi Municipal Library	260 Church Street Pietermaritzburg 3201	Ms. Kammy Naidoo 033 392 2634

I&APs who wish to submit further comments should submit these directly to the Department of Environmental Affairs:

Ms Olivia Letlalo
Department of Environmental Affairs (DEA)
Private Bag X447, Pretoria, 0001 | 012 399 8815
Email: oletlalo@environment.gov.za
Cc: EIAAdmin@environment.gov.za

Copies of submissions to the Department should be sent to the Environmental Assessment Practitioner:

ACER (Africa) Environmental Consultants
PO Box 503, Mtunzini, 3867
Fax: 035 340 2232
Email: isundu@acerafrica.co.za

PREFACE

Between 2009 and 2011, Eskom investigated various options to bring a 765 kV transmission line from the Venus Sub-station, near Estcourt, to a new sub-station (Sigma) in the KZN Midlands, with two 400 kV transmission lines from the new Sigma Sub-station linking into the existing Hector and Ariadne Sub-stations, near Camperdown and Pietermaritzburg, respectively.

The Venus-Sigma-Hector-Ariadne (VSHA) environmental authorisation process resulted in environmental authorisation of the following infrastructure:

- 1 x 765 kV transmission line between the Venus and Sigma Sub- stations.
- 2 x 400 kV transmission lines between the Sigma and Hector Sub-stations[1].
- 3 x 400 kV feeder bays at the existing Hector Sub-station.
- The new Sigma Sub-station to the west of Wartburg.

The 400 kV transmission line link between the Hector and Ariadne Sub-stations would have been achieved on a spare circuit of the existing double circuit 400 kV transmission line between these two sub-stations.

The authorised Sigma Sub-station site is no longer considered financially feasible. Therefore, the current authorisation process is investigating the proposed Isundu Sub-station site, near Ashburton, as an alternative, more cost effective sub-station site.

Please note that this environmental authorisation process is being conducted under the EIA Regulations of 2010.

[1] Currently under appeal.

EXECUTIVE SUMMARY

Introduction

Eskom Holdings SOC Limited (Eskom) is the largest generator of electricity in South Africa. Since 2009, Eskom has been investigating options to bring a 765 kV transmission line from the Venus Sub-station, near Estcourt, to a new sub-station in the KwaZulu-Natal (KZN) Midlands, with two 400 kV transmission lines from the new sub-station linking into the existing Hector and Ariadne Sub-stations. This forms part of Eskom's KZN Strengthening Programme which aims to increase and strengthen the electricity transmission network to the KZN Midlands and southern KZN.

The Venus-Sigma-Hector-(Ariadne) (VSHA) 765/400 kV Transmission Line environmental authorisation process undertook extensive environmental investigations between 2009 and 2011. The outcome of this process was that the Sigma 1 Sub-station site, north-west of Wartburg, was identified as the preferred new sub-station site. However, since authorisation, more detailed geotechnical investigations have shown that the earthworks and foundations at this Sigma Sub-station site would be exorbitantly expensive.

Therefore, Eskom initiated further investigations to identify if alternative, more cost-effective sub-station sites were available without needing to significantly alter the authorised VSHA transmission line corridor. Sixteen alternative sites were investigated, all of which proved unsuitable except for the proposed Isundu site, located to the east of Ashburton. In addition, five alternative sites suggested by RCL Foods during this EIA process have been considered.

The proposed Isundu 765/400 kV Sub-station is a replacement to the Sigma Sub-station previously authorised. If the Isundu Sub-station is authorised, the 765 kV transmission line from the Venus Sub-station will need to continue along the authorised transmission line corridor until the Isundu Sub-station. By implication, a single 765 kV transmission line rather than 2 x 400 kV transmission lines will be constructed in the corridor between the Sigma and Isundu sites, as currently authorised by the VSHA Environmental Authorisation.

In terms of the Environmental Impact Assessment Regulations, 2010, the proposed Isundu Sub-station and associated turn-in transmission lines trigger activities that may significantly affect the environment and, thus, require authorisation from the national Department of Environmental Affairs (DEA).

Two other applications are being undertaken concurrently with this Isundu Sub-station environmental authorisation process:

- Eskom is required to obtain a Water Use Licence for the proposed Isundu Sub-station (in terms of section 40(4) of the National Water Act (Act No. 36 of 1998)).
- An amendment to the existing VSHA authorisation for 2x400 kV transmission lines from the proposed Sigma Sub-station site to the existing Hector Sub-station. If the Isundu Sub-station is authorised then this line would need to change to a single 765 kV transmission line running from the original Sigma Sub-station site to the new Isundu Sub-station.

ACER (Africa) Environmental Consultants (ACER) is the Independent Environmental Assessment Practitioner (EAP) undertaking the application for environmental authorisation on behalf of Eskom.

Eskom has a number of legal obligations in terms of legislation, the pertinent obligations being: to supply electricity to the citizens of South Africa; to undertake the necessary environmental impact assessments for all listed activities; to obtain permits in terms of other relevant environmental legislation (for example, heritage, water and biodiversity); and to adhere to the principles of sustainability.

Need and Desirability

The expansion and upgrade of the transmission network is required in order to attain a higher security of supply. The proposed 765 kV and 400 kV transmission lines will link to other new transmission lines entering northern KZN (from the main power generation facilities in Mpumalanga).

Sub-stations are an important component of the transmission network allowing voltages to be stepped-down to allow for distribution, and to allow transmission line sections to be de-energised for maintenance whilst still keeping the whole network supply system running.

The position of sub-stations in the network, as well as the distance between sub-stations, is determined by the peculiarities of electricity transmission at extra high voltage. In order to comply with the known and laid down safety limits, sub-stations must be about 400 km apart with an absolute maximum distance of 450 km, to prevent voltage increases along the line because of capacitance, known as the Ferranti Effect. Electricity needs to be delivered at high voltages as close as possible to the demand centres and, thus, it is not simply a matter of moving to a different area if suitable sub-station sites are difficult to find.

Project Alternatives

Since 2008, Eskom has considered both the expansion of existing sub-stations and over 25 potential new sites in between Estcourt and Camperdown in order achieve the overall project objective of having a suitable 765/400 kV sub-station in this region of KZN.

Transmission line corridors and the sub-station sites have been investigated taking into cognizance their potential impacts on surrounding forestry, sugar cane, tourism and other important land-uses within this area of KZN.

The VSHA environmental authorisation process investigated three of these sites in more detail, namely Sigma 1, 6 and 7. Sigma 1 was the preferred site. Unfortunately, since authorisation significant technical constraints were identified during further geotechnical investigations. It is estimated that the earthworks alone will cost in the region of R 500 to R 800 million more than typically incurred for a sub-station of this size. Eskom, as a public utility, is bound by the Public Finances Management Act and needs to declare and justify all costs. Furthermore, costs need to be recovered by way of tariff increases. In this context, large additional costs for earthworks alone cannot be justified, making the Sigma 1 site no longer feasible.

Further potential sites were then investigated that would still allow the new sub-station to feasibly fit in with the authorised VSHA corridor. Only the proposed Isundu site was found to merit further consideration.

Two layout alternatives for the Isundu Sub-station on the proposed 100 ha area have been considered during this assessment. Layout options are limited by needing to optimise the position of the infrastructure on the site to minimise earthworks, whilst also needing to ensure that the layout will be able to accommodate the required transmission lines and from which direction these lines enter and exit the sub-station.

The no-development option was also assessed. However, it is not an attractive option given that the national grid is operating nearly at full capacity. Apart from this, due to the Ferranti Effect and the location of the load centres, it becomes increasingly difficult to identify suitable sites that still meet the overall objectives of the KZN Strengthening Programme.

Project Description

The proposed Isundu Sub-station is being planned to accommodate the following transmission lines:

- 1 x 765 kV transmission line (the authorised VSHA transmission line).
- 2 x 400 kV double-circuit transmission lines from the sub-station to tie into the existing Hector-Ariadne 400 kV double-circuit transmission lines approximately 4 km away.
- 2 x 400 kV lines from the proposed Mbewu Sub-station near Empangeni.

In addition, the site and layout design allow sufficient space to accommodate additional transmission lines if required at some point into the future. The space allowed will potentially accommodate the following additional transmission lines:

- 1 x 765 kV or High Voltage Direct Current (HVDC) transmission line.
- 2 x 400 kV transmission lines.

The proposed sub-station will include the standard electrical components required, such as transformers, reactors, busbars, isolators etc.

Environmental authorisation has been applied for a 100 ha site. If fully developed into the future, the sub-station infrastructure footprint will be approximately 50-60 ha, whilst for the initial phase of development, the sub-station is likely to have a footprint in the region of 25 ha.

Other infrastructure will include a tarred access road, a microwave radio communication mast between 30 and 50 m high. Oil and fuel storage facilities will be bunded and there will be an oil bund to contain any transformer oil spills (capacity of ≥ 30 m^3 but ≤ 80 m^3).

This environmental application also includes the construction of two double-circuit 400 kV transmission lines from the proposed Isundu Sub-station to the existing Hector-Ariadne 400 kV double-circuit transmission line approximately 4 km away. The reason for proposing a double-circuit transmission line is that it will allow Eskom in the future to increase capacity at the sub-station without needing to secure an additional servitude to the immediate south of the sub-station. This will benefit surrounding stakeholders in this rapidly developing area.

The required servitude for these 400 kV double circuit lines is 55 m for a single line and 110 m where the lines run in parallel.

The bulk earthworks and civil construction phase for the sub-station will take approximately 21 months. The installation phase of the equipment along with stringing, cabling, earthing and commissioning will take approximately 20 months. In total, the construction of the sub-station is estimated to take three years with these phases overlapping.

During construction when the civil works are being carried out (foundations, storm water drainage, buildings, etc), there should not be more than approximately 80 people present on the site at any one time. Construction staff will not be housed on site but transported to site each day.

No people will be housed on site on a permanent basis during the operational life of the sub-station. However, there will be ongoing monitoring and control of operations as well as planned and other maintenance work done on an *ad hoc* basis.

Water will be obtained from the existing municipal supply. During construction, sewage will be managed through the use of portable toilets. During operation, sewage flows will be minimal and sewage will be directed into a sealed conservancy tank of less 10,000 m^3. When full, a sewage truck will pump it empty and dispose of the waste at a licensed sewage treatment plant.

The exact number of local people that will be employed during construction is unknown at this stage and will vary according to the construction activities taking place at any given time. Much of the construction will involve specialised tasks.

The construction of the transmission lines has a number of steps which include: surveys of technically feasible alignments within the authorised corridor, a walk down by environmental specialists to assess specific tower locations; and negotiations on the final servitude with the landowner; followed by construction activities, stringing and commissioning.

The registration of servitudes can be a lengthy process requiring contractual negotiations with each affected landowner and the lodging of an application for registration of the servitude with the Provincial Deeds Office against the property title deed.

Maintenance is carried out at regular intervals, and may be done by helicopter if areas are inaccessible.

Public Participation
The public participation process has been designed to comply with the requirements of the EIA Regulations. Public participation activities have included background information letters, public meetings, key stakeholder meetings between the EAP, specialists and Eskom with specific stakeholders and the opportunity for stakeholders to comment and review draft and final reports.

All comments submitted are recorded and responded to in Appendix 3.

Strategic Electrical Infrastructure
A common and almost universal response, to any proposed electrical infrastructure project, is for the majority of surrounding stakeholders to object to having any project affect part of their own environment, own neighbourhood, own property or plans, etc. Many concerns raised are valid and assist the EAP to correctly assess the impacts. However, many objections can simply be because they personally do not want a particular project near them or are concerned about apparent or perceived facts concerning electrical infrastructure.

The environmental impact assessment process is scientific; thus, it falls to the assessing EAP and the specialists to evaluate the legitimacy of the issues and concerns raised by stakeholders.

Importantly, an objection, no matter how carefully worded or supported by petitions, etc. still needs to be evaluated and examined as objections do not necessarily constitute a fatal flaw to a proposed project. Indeed, if the latter was the case, then there would be no electricity coverage in South Africa as no stakeholders wish to reside next to either sub-stations or transmission lines. Yet, due to lack of generation capacity over the past decade, all South African's now recognise clearly the need and economic importance of reliable electricity supplies.

The KZN Midlands is a relatively unique area of KZN in that there is a range of land-uses, economic sectors and stakeholders all situated in close proximity. This has made the identification of suitable transmission line routes and sub-station sites since 2008 challenging.

With the current Isundu Sub-station proposal, the nature of the comments is again one of various stakeholders presenting facts and figures as to why this site and area should not be considered for the sub-station. Part of this assessment process has been to investigate these claims and figures. One of the key overarching issues, which both the EAP and stakeholders, need to keep in mind is that this infrastructure is aimed at benefiting the whole of KZN over the long-term.

A unique challenge of this particular Ashburton site is that some of the local objections are based on the possible future impacts on planned or proposed projects. This assessment needs to consider possible future impacts but also the reality that some of the proposed projects may never materialise as envisaged, either because of overstated expectations or other economic, investment or socio-political issues.

Description of the Receiving Environment

The topography of the proposed Isundu Sub-station site is undulating with local high points along the south-east and north-west borders. The site is underlain at a relatively shallow depth by Diamictite sedimentary rock layers and boulder shales belonging to the Dwyka Formation within the Karoo Sequence.

The annual rainfall in this area is approximately 860 mm and there are small seasonal streams on the north and north-east side of the Isundu site with associated riparian vegetation. There is a range of small farm dams on and surrounding the proposed site. Four depression wetlands and three hillslope seepage wetlands occur on site.

The vegetation type is KwaZulu-Natal Hinterland Thornveld, which supports a low to moderate diversity of fauna primarily as a result of the vegetation type being predominately disturbed grassland. The grass is cut and sold for hay.

The proposed site is on land zoned in the Mkhambathini SDF as Agricultural Tourism and falls within a rural/urban fringe area that has a mixture of agricultural enterprises and rural farmland. There are a number of existing and planned tourism activities surrounding the site, including existing enterprises such as the African Bird of Prey Sanctuary and Raptor Rescue, and the Natal Zoological Gardens and Natal Lion Park. The planned and developing land-uses include the Mayibuye Game Reserve, whilst another development, the Aloe Wildlife Estate, is also proposed (environmental authorisation for this latter estate has been denied but is still under appeal by the applicant). Agricultural activities are predominated by RCL Foods (formerly Rainbow Chickens) which has seven of its KZN chicken laying farms to the north and north-west of the site. However, RCL Foods is currently downscaling and relocating out of KZN, and the farms nearby the proposed sub-station are all up for sale.

Assessment and Specialist Studies

A total of 15 specialist studies have been conducted as part of this assessment. It is important to recognise that each specialist study is primarily a short-term study providing input only on what can be a relatively specific component of the project. Thereafter, it is the role of the EAP, with assistance from the specialists, to collate, evaluate and integrate the various potential impacts and the relationships between them.

The assessment process has included a joint site visit with a group of specialists. This site visit was to the Isundu site as well as surrounding sub-stations for comparison in both the day-time and night-time to discuss potential impacts and take measurements. In addition, a number of specialists have liaised and met directly with stakeholders to discuss specific concerns.

A summary of the specialist findings is provided in Chapter 10 and the reports are contained in Appendix 5.

Summary of Environmental Issues and Potential Impacts

An issue is a point of concern around which debate can be held, whilst an impact is how the natural, social or economic environment will be affected by a specific intervention. The key issues identified during Scoping and carried through to the Impact Assessment are outlined below along with a summary of the impacts (and significance) associated with the issue.

What are the potential economic and socio-economic impacts associated with the construction and operation of the proposed sub-station?

The positive economic benefits of the proposed project include a significant injection of investment into the local, regional and national economy during construction and increased reliability of electricity supply, along with associated economic benefits, during operation.

However, potential negative impacts are also possible on some of the surrounding enterprises such as RCL Farms, as well as the existing and planned tourism centres which may conceivably have their planned economic potential curtailed by negative impressions or views of electrical infrastructure.

Potential negative economic impacts on surrounding local enterprises are discussed under the various sections dealing with the key issues and concerns related to each enterprise. Negative economic impacts upon RCL are now unlikely given their intention to sell these surrounding farms and relocate their operations out of KZN. Furthermore, RCL Foods continually raised the point that any impact upon them would result in significant negative national food security impacts. Section 11.1.3 specifically examines this claim against the four dimensions of food security and finds it to be untrue.

The no-development option is not considered attractive when it comes to service infrastructure such as electricity; indeed, the no-development option is really the option of simply relocating the impacts elsewhere.

The positive economic benefits were found to be highly significant whilst the potential localised negative impacts can vary from not being significant to being significant, and are addressed under the various sections dealing with the key issues and concerns related to each enterprise.

What impacts will the construction and operation of Isundu Sub-station have on the natural environment (flora and fauna) of the site?

The sub-station will not transform the entire property (100 ha); rather it will transform an area of approximately 40-45 ha.

The predominant vegetation type is natural grasslands which are mowed regularly for hay production. Although a large portion of the area is disturbed grasslands, four wetland pans and three hillslope seepage wetlands were identified on site and rated largely natural and unmodified.

Regardless of the degraded nature of the surrounding grassland, the wetlands were considered valuable because of their unmodified hydrological and geomorphological condition, and because they are well covered with hydrophilic vegetation.

Due to the grassland disturbance, the site supports a low to moderate diversity of fauna with few species of conservation importance; however, it is the aquatic habitats (including the several small farm dams) that provide suitable habitat for diversity. However, the species survey undertaken did not find the two Near Threatened and Vulnerable frog species, viz. the Natal Leaf-folding Frog (*Afrixalus spinifrons)* and Spotted Shovel-nosed Frog (*Hemisus guttatus),* respectively*,* predicted to potentially occur on site by the terrestrial fauna specialist.

Overall, whilst the proposed site is relatively low value agricultural land consisting of generally disturbed grassland, the wetlands were considered sufficiently valuable to require mitigation through re-creation of the ecosystem services that will be lost. This can be achieved on the same property just outside the sub-station footprint resulting in no net-loss of ecosystem services from the site that would require off-set mitigation.

To minimise impacts associated with the 2 x 400 kV double-circuit lines from the sub-station to the existing Hector-Ariadne 400 kV double-circuit transmission line, it is recommended that the lines follow the alignment previously agreed to with affected stakeholders along the existing 275 kV Georgedale-Mersey transmission lines.

How will the development of the Isundu Sub-station impact on existing and developing tourism land-use plans and other town planning initiatives?
The proposed sub-station site falls within an area zoned by the local municipality for agriculture and eco-tourism. The existing surrounding enterprises are either agricultural or tourism related activities and future development plans in the area are also based around eco-tourism initiatives. Thus, the construction of a large sub-station within this area, along with at least the five currently planned transmission lines is likely to have direct and indirect impacts upon existing and future plans.

From both a visual and noise perspective the site falls within two landscape characters, one being the urban fringe corridor that runs beside the N3 and the other the more rural settlement that starts to occur as one travels away from the N3.

The agricultural value of the area is moderate with the main agricultural activities being those associated with poultry, which create an agri-industrial feel to the area. The dominant views along parts of the P477 are already visually degraded due to the existing RCL chicken houses whilst across the valley, the quarry and industry of Camperdown are clearly visible during the day and also at night.

The future development of this area is currently in a balance between developing around tourism and low density residential activities or developing along a higher density residential and/or light industrial trajectory.

The impact upon planning and land-use was found to be of medium significance, because even if the development pathway is more towards tourism developments into the future, these developments will themselves visually change the views along the P477. The existing poultry farms also create a distinct built up urbanised feel when travelling along this road.

The curtailment of future tourism potential of the Mayibuye Game Reserve was also found to be of medium significance because the predominant views from the Reserve will be across the valley. In addition, from within the valley the sub-station will be largely out of sight.

How will the construction and operation of the Isundu Sub-station impact upon surrounding enterprises dealing with sensitive animals and birds?
Three existing enterprises surrounding the proposed sub-station have raised concerns regarding the impact of the proposed project upon their animals and birds.

The EMF levels calculated at all three enterprises were found to be not significant and will not present any harm to birds or humans.

The Natal Zoological Gardens is the enterprise located furthest away from the proposed sub-station site and the wild animals and birds, as well as the breeding parrots, will not be significantly impacted by the proposed sub-station. Nevertheless, even though it is unlikely that any animals will be affected by blast noise or disturbance, monitoring by the Environmental Control Officer and Zoological staff of any possible behaviour changes or stresses should be undertaken initially as a precaution.

The Africa Bird of Prey Sanctuary and Raptor Rescue[2] (ABOPS) have a range of different activities and species. There will be few direct impacts upon the Sanctuary. However, noise from trucks passing on the nearby road was found to be a potential noise disturbance.

Based on Eskom's estimates and data from similar construction sites, construction activities could generate 36-80 vehicle trips (two way trips) daily, which, at times, could peak at 300 vehicle trips per day. The noise specialist stated that this construction traffic would have a significant effect on the noise climate alongside the P477 and calculated the sound of a loaded truck at these distances at 67 dBA.

Whilst this may not be significant for injured display birds, the ABOPS has been nominated as the centre in which to establish a captive breeding programme for the Bearded Vulture. This species is critically endangered and the breeding programme is the subject of a Government Gazetted Biodiversity Plan. The traffic noise from construction was found to add a significant variable into the success of what is a long-term breeding programme. Bearded Vultures take seven years to reach sexual maturity and are highly sensitive and, thus, all variables need to be controlled as far as possible in order to ensure success. The proposed timing of the sub-station construction is also likely to coincide with the critical breeding period of the first birds of the programme. Thus, if negative impacts occur and breeding is affected, it may be too late for the species to start a new breeding programme elsewhere.

One of the key income generating activities of the Sanctuary is the flying demonstration. Transmission lines present a threat to flying raptors. Although the ABOPS established itself approximately 750 m from the existing 2 x 275 kV Georgedale-Mersey transmission line, the sub-station and the five currently planned transmission lines will all be larger and closer, and will be on different sides of the ABOPS. These will present an increased risk to flying birds. Importantly, all raptors are flown with tracking devices so that if lost they can be tracked and retrieved. Electrical transmission lines interfere with these receivers and, therefore, with more transmission and electrical infrastructure surrounding the Sanctuary, the risk of losing protected permitted raptors increases.

These two impacts were found to be highly significant for the ongoing success of the ABOPS and the conservation of raptors. The only feasible mitigation measure is the complete relocation of the ABOPS to an alternative site.

RCL Foods raised a large number of issues, concerns and objections to the proposed project. Through stakeholder meetings, discussions and input from a poultry specialist, the key risks were focussed to the following three areas of potential impact: light, dust and noise.

[2] The African Bird of Prey Sanctuary and Raptor Rescue are two separate organisations, one commercial, one an NGO, operating from the same property. There is, however, synergy between them. All references in this report or the specialist studies to either ABOPS or the Sanctuary, includes both organisations, unless specifically mentioned otherwise.

Due to the nature and strategic importance of the sub-station, it will have lighting. This will include fencing with security lights mounted on 4 m poles at approximately 20 m intervals and floodlights in the HV Yard mounted on 36 m high masts. These lights will turn on when staff enter the HV yard at night. The perimeter fencing lighting will turn on during security patrols of the fence.

There is a risk that if lighting is poorly designed, glare from the tall mast lighting or light spill from the security fencing could enter the nearest RCL laying houses and disrupt their controlled lighting programme. However, RCL itself has lights on the outside of its laying houses and during the night-time visit it was the RCL chicken houses which were the main source of light in the area.

No lighting impacts or disturbance of significance were identified provided Eskom follows the lighting designs recommended by the visual impact specialist. Eskom also has new lighting designs that minimise light dispersion. Nevertheless, mitigation has also recommended that monitoring be undertaken in conjunction with RCL to ensure no light from the infrastructure is entering the laying houses. If light is found to be entering the houses, then suitable mitigation screening measures should be devised on the houses or at the source.

Dust and noise are similar in some respects, because unlike light which affects the active and resting times of the birds, dust and noise can affect stress levels of the birds and increase their susceptibility to infections. However, because these birds are biological entities, there is a wide range of tolerance. Birds of different breeds, flocks and age groups may respond differently, with some being more tolerant than others to either dust or noise stress factors. Tolerance to one aspect, for example, dust, can change for individual birds if they have been stressed by ammonia, heat, noise or other disease agents.

Thus, this assessment found it a challenge to predict with precision how significant dust and noise impacts may be on a particular farm and flock at RCL within a particular year or part of the laying cycle.

Increased dust levels can result in physical damage to the bird's respiratory tract and/or the entry of infectious agents. These aspects again increase susceptibility to disease and stress within the birds. The creation of dust is a common occurrence on construction sites and, in this instance, the prevailing wind direction is towards the RCL farms.

Dust models using various limits and assumptions were used to make predictions. However, these predictions are challenging as there are no data on current average dust levels or recommended dust levels. In addition, the risk could be more due to the nature of inorganic dust damaging the bird's respiratory tracts or potentially being abrasive to fans and their operation, thereby, increasing ammonia levels in the chicken houses.

This assessment has found that dust levels are certainly likely to be increased around the RCL houses during at least the initial 8-12 month construction period. Whilst the significance of these risks could be very low depending on all the uncertain variables, there is also the possibility that it could significantly increase disease and mortality in either one or all three of the nearest laying houses. If the latter occurred, these impacts would be highly significant for RCL's production throughout KZN.

Based on the recommendations of the poultry specialist that effects will most likely be on the closest house in the direct path of a 'dust storm', and the modelling which shows L14 to be most significantly affected, this assessment concludes that L14 is the farm at most risk. This is also the only farm with open houses which would allow more dust to enter.

Chickens are extremely sensitive to unusual activities and disturbances. Incidences such as sudden loud noises can startle the birds, which can result in panic and piling with some deaths resulting. This assessment found that operational noise and general construction noise will not affect the chickens due to the existing noise within the laying houses.

However, geotechnical investigations have shown that blasting will be required as part of the earthworks. The duration of blasting activities could range anywhere from between two and a half to four months with approximately two blasts per week. The blasting specialist has shown that the vibration and air blast pressures expected from the blasting are significantly low and are not anticipated to affect the birds. However, the modelled noise calculations indicate that at L14, the audible noise could range from anywhere between 51.5 dBA to 92.1 dBA.

This range is significant and difficult to model or predict. Thus, if noise is on the low side of the scale, it is quite possible to conduct this blasting, based on the design provided, so that the birds will not be disturbed or distressed at all. However, if as some calculations indicate, the audible noise from blasting could possibly range up to around 90 dBA (similar to being 7.5 m from a passing motorbike or truck) and will occur twice a week for 4 months, then it is likely to increase the stress levels of the birds and affect their production levels.

Audible noise is also affected by vegetation, buildings and other structures and, thus, there is the possibility that even if blasting noises are modelled or heard outside the buildings at the high end of the decibel scale, within particular houses, depending on their exact topography or orientation, the experience could be far less. This is particularly the case for farms L1 and L2 which are closed farms further away. Alternatively, a poorly drilled or overcharged blast hole on a cloudy day could result in louder noise levels than predicted in the model.

Due to its proximity to the site, L14 is again the farm that is most likely to be affected by audible noises that may potentially result in production losses.

The challenge of mitigation is that it is difficult to predict with certainty exactly how either blasting noise or dust may affect RCL's chickens. The significance of any impact can also range as there are too many variables and assumptions involved in the calculations making it difficult to predict how accurate the models are compared to how actual impacts will be experienced on the ground, especially by biological entities that have a range of tolerances. It is possible these initial earthworks will have no significant impact at all. However, they could have significant financial and production impacts for RCL.

However, considering that no impacts of significance have been identified during the operational phase and the only major impacts, occur during the initial phase of the construction period, on-site solutions need to be found, particularly as these impacts are not certain and may not have any impact on RCL.

For this reason, this assessment has not recommended the no-development option, but has proposed a mitigation approach that will better define and address any possible negative impacts. This mitigation measure includes conducting a test blast, as per the design, along with various monitoring requirements. Thereafter, the EAP believes it will be quite feasible to design the blasting and earthworks programme, with layer house modifications, to address the uncertainties around noise and dust. An important part of the proposed mitigation is to undertake this test blast sufficiently before construction commences, but once Eskom has bought the property. This will allow Eskom and RCL to negotiate and/or programme contract activities to best reduce any impacts. If after mitigation financial losses are still incurred as a result of construction activities, Eskom may need to compensate RCL for such losses.

Importantly, since the publication of the Draft EIAR, RCL Foods has put these farms up for sale, along with a large number of their other KZN farms. Thus, it is quite likely that RCL Foods will not even own the adjacent properties when Eskom wishes to start construction. Mitigation now proposed needs to start with the confirmation of whether or not RCL Foods still own the adjacent properties and, if they do, whether or not any management and production strategies could suitably mitigate any potential losses during construction.

Can the construction and operation of the Isundu Sub-station be detrimental to the health and safety of local communities?

No significant health impacts from electromagnetic fields were identified. Large construction projects will typically result in an increase in vehicle and pedestrian traffic, and the temporary migration of people either to work or to seek work. The health and safety issues associated with this increased traffic and movement in the area are common to many large construction projects and can be acceptably managed to be of low significance.

What effects will the construction of Isundu Sub-station have on cultural heritage resources?

No cultural heritage resources of significance will be impacted by the proposed project. However, the farm buildings are over 60 years old and permission from Amafa will be required to destroy these buildings.

How will earthworks during construction, and stormwater during and after construction, affect the surrounding water courses and environment?

The proposed Isundu Sub-station, when fully developed, will have an infrastructure footprint of approximately 45 - 60 ha, whilst for the initial phase of development the sub-station is likely to have a footprint in the region of 30 ha.

This assessment found that there will be no significant risk of pollution to the surrounding water courses or groundwater. Also, run-off from the site will be controlled as per the Storm Water Management Plan to address any potential erosion hazards.

What cumulative effects will the proposed Isundu Sub-station contribute, considered in association with impacts arising from other activities in the region?

Two key cumulative impacts were identified, viz.

- The impact and alignment of future transmission lines on surrounding enterprises.
- The location of the sub-station will alter the development trajectory of this local area more towards industrialisation rather than eco-tourism.

It is not possible to predict or determine with any certainty what lines would in the future be required and from which direction they may come. This is dependent on the location and size of future power demands, and the location of power generation. However, for this sub-station it is possible to give a relatively good prediction of what future lines may be required and their possible alignment. These are illustrated in Figure 32. However, when or if these transmission lines may be required is not certain.

The Mkhambathini Local Municipality has stated throughout the process that the proposed sub-station is incompatible with their Municipal Strategic Development Framework and adopted Rural Planning Policy. In particular, the Municipality is concerned that the location of the sub-station will stop the further development of the area for eco-tourism as planned. Although this development falls within two landscape character areas, the urban fringe corridor and traditional rural settlement, the presence of the sub-station is certainly likely to have some influence on development planning and designs on the farms surrounding the sub-station which run along the P477.

The proposed sub-station is not in line with current planning objectives, but this does not constitute a fatal flaw. Although Eskom will need to apply for land-use re-zoning and other permissions from the Mkhambathini Local Municipality, the Local Municipality is also required to recognise that national infrastructure of strategic importance can take precedence over local planning objectives. The proposed sub-station and transmission line configuration would not necessarily prevent or change all eco-tourism possibilities within this area of the municipality. However, it is also important to consider the balance of cumulative impacts. Whilst there may be some potentially negative set-backs to this localised area in terms of tourism planning, there may be far more significant cumulative economic set-backs to KZN if strategically important infrastructure such as the KZN electricity grid is not improved and enhanced in line with demand predictions.

In regard to this balance, the Mkhambathini Local Municipality is the second smallest municipality within the Umgungundlovu District Municipality and some of the key proposed tourism developments are still to be developed. Considering that some of these development plans appear to be based on exaggerated returns, it is quite possible their full development and the anticipated economic/employment benefits to be generated may be significantly delayed or less than anticipated.

Furthermore, there are other trends, such as the relocation of RCL Foods and the significant expansion of unplanned middle to high-income houses adjacent to the boundary of the Mayibuye Game Reserve, just 2.5 km along the road from the sub-station site on the same ridgeline, which may similarly reduce the potential of tourism or agricultural land-uses being successful into the future.

Importantly, the manufacturing sector together with the agriculture sector, are the dominant employment creators in the Mkhambathini Local Municipality, and the sub-station would not impact the further development of these sectors.

The EAP found that the possible cumulative impact of the sub-station on tourism ventures still to be developed in an urban-fringe environment, is not sufficiently significant to warrant consideration of the no-development option.

Environmental Impact Statement

By its nature, the construction and operation of a large sub-station and associated transmission lines will have a negative impact upon the local environment, both biophysical and socio-economic. However, due to the strategic national and provincial need to maintain and improve the electrical infrastructure network, the no-development option is not considered feasible.

However, in considering the authorisation of the proposed sub-station and associated transmission lines, there are a number of the pre-construction mitigation measures, where timing is important, if negative impacts are to be avoided. These relate specifically to the following:

- Eskom needs to relocate the Africa Bird of Prey Sanctuary entirely. A partial relocation will result in staff, funding and other resources being divided which will have a negative impact upon other conservation activities. This relocation needs to be timed and planned taking cognizance of the fact that impacts from noise and traffic during the initial earthworks stage of construction can potentially put at risk the success of the Bearded Vulture Breeding programme. Representatives from EKZN Wildlife and DEA Biodiversity should be included in all key discussions and negotiations on the relocation, as these authorities also have an interest in ensuring that relocation does not jeopardise this breeding programme's success, or the long-term success of ABOPS.
- If RCL Foods, or another producer, still owns the property, Eskom should negotiate with them if any farm management and production strategies could suitably mitigate any potential poultry losses during construction.

- If still necessary, Eskom should programme a test blast on the site at a suitable time prior to construction to ensure the mitigation measures, programme and timing are optimised to reduce impacts upon RCL.
- If still necessary, Eskom should negotiate with RCL the closing up of RCL's L14 laying farm to make it light tight and establish suitable dust mitigation screens around the ventilation fans and openings of farms L14, L1 and L2. Necessary monitoring equipment as agreed between RCL and Eskom should also be installed prior to the commencement of site clearing, earthworks and blasting. If suitable mitigation and programming will not sufficiently mitigate the risks to RCL's production, Eskom should negotiate a compensation scale with RCL to cover any financial losses which occur as a result of this initial construction phase and/or negotiate the relocation of RCL's L14 farm.

- During any blasting, visual monitoring of animals at the Natal Zoological Gardens and Natal Lion Park should be undertaken to confirm that the animals are not being unduly stressed or frightened by blasting activities. If behaviour changes and stresses are identified, appropriate mitigation measures should be designed.
- There is also the need to develop the required wetland mitigation areas to conserve the existing ecosystem services prior to the commencement of site clearing, earthworks and blasting.
- Eskom should also commence procuring servitudes, where necessary, to plant the line of visual screening trees at the same time as construction commences.

Opinion on Activity Authorisation and Conditions

It is the opinion of the EAP that the proposed Isundu sub-station and turn-in transmission line can be authorised based on the findings of this assessment and the conditions outlined in Chapter 13.

This final EIAR has been prepared after a long process involving stakeholder consultation and participation, and obtaining a range of specialist input. The unique challenges associated with this project arise due to:

- The strategic importance of the infrastructure and the limitations outlined in terms of feasible alternative sites.
- The wide range of different land-use concerns surrounding the proposed site.

The EAP believes that this final report and the proposed mitigation measures have suitably balanced these different objectives to ensure that the positive benefits of the project are realised whilst the negative impacts are suitably mitigated.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF PLATES

ACRONYMS AND ABBREVIATIONS

ABOPS	Africa Bird of Prey Sanctuary and Raptor Rescue
AC	Alternating Current
ACER	ACER (Africa) Environmental Consultants
ADT	Average Daily Traffic Flows
AES	Agricultural Economics Study
Amafa	Amafa aKwaZulu-Natali
CC	Closed Corporation
CRR	Comments and Responses Report
DEA	Department of Environmental Affairs (National)
DEIAR	Draft Environmental Impact Assessment Report
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EKZNW	Ezemvelo KZN Wildlife
ELF	Extremely Low Frequency Fields
EMPR	Environmental Management Programme Report
Eskom	Eskom Holdings SOC Limited
FSR	Final Scoping Report
HV	High Voltage
HVDC	High Voltage Direct Current
I&APs	Interested and Affected Parties
IARC	International Agency for Research on Cancer
ICNIRP	International Commission for Non-Ionising Radiation Protection
IDP	Integrated Development Plan
KSW	Key Stakeholder Workshop
KZN	KwaZulu-Natal
kV	Kilo-Volt
LM	Local Municipality
MOU	Memorandum of Understanding
N3	National Route 3 highway
NAAQS	National Ambient Air Quality Standards
NEMA	National Environmental Management Act (Act No. 107 of 1998)
NEMBA	National Environmental Management: Biodiversity Act (Act No. 10 of 2004)
NHRA	National Heritage Resources Act (Act No. 25 of 1999)
NMPP	Multi-Product Pipeline
NSR	Noise Sensitive Receptors
NWA	National Water Act (Act No. 36 of 1998)
NZG	Natal Zoological Gardens
PDA	Planning and Development Act (KwaZulu-Natal) (Act No. 6 of 2008)
PES	Present Ecological State
PM	Particulate Matter
RCL	Rainbow Chicken Limited
RI	Electromagnetic Interference
SABS	South African Bureau of Standards
SABAP1	Southern African Bird Atlas Project 1
SABAP2	Southern African Bird Atlas Project 2

SAM	National Social Accounting Matrix
SAHRA	South African Heritage Resources Agency
SD	Scaled Depth of Burial value
SDF	Spatial Development Framework
SME	Small Medium Enterprises
SPLUMA	Spatial Planning and Land Use Management Act (Act No. 6 of 2013)
VSHA	Venus-Sigma-Hector-(Ariadne) 765/400 kV Transmission Line Project

REPORT CONTRIBUTORS

The author of this report is Mr Paul Scherzer. The report was internally reviewed by Ms Ashleigh McKenzie and Dr Dieter Heinsohn (ACER), and externally reviewed by Ms T Calmeyer.

ENVIRONMENTAL APPLICATION: 14/12/16/3/3/2/745 ADHERENCE TO REGULATORY REQUIREMENTS

Table 1 Adherence to Regulatory Requirements, Regulation No R. 543 published in terms of the National Environmental Management Act, 1998 (Act 107 of 1998)

No.	Regulation 31(2): Contents of Environmental Impact Assessment Report	Covered in the EIAR
A	details of - (i) the EAP who compiled the report. (ii) the expertise of the EAP to carry out an environmental impact assessment.	Section 1.3
B	a detailed description of the proposed activity.	Chapter 5
C	a description of the property on which the activity is to be undertaken and the location of the activity on the property, or if it is - (i) a linear activity, a description of the route of the activity. (ii) an ocean-based activity, the coordinates where the activity is to be undertaken.	Chapters 4 and 5
D	a description of the environment that may be affected by the activity and the manner in which the physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity.	Chapter 5
E	details of the public participation process conducted in terms of subregulation (1), including - (i) steps undertaken in accordance with the plan of study. (ii) a list of persons, organisations and organs of state that were registered as interested and affected parties. (iii) a summary of comments received from, and a summary of issues raised by registered interested and affected parties, the date of receipt of these comments and the response of the EAP to those comments. (iv) copies of any representations, objections and comments received from registered interested and affected parties.	Tables 3 and 4, Chapter 6 and Appendices 2, 3 and 4
F	a description of the need and desirability of the proposed activity.	Chapter 3
G	a description of identified potential alternatives to the proposed activity, including advantages and disadvantages that the proposed activity or alternatives may have on the environment and the community that may be affected by the activity.	Chapter 4
H	an indication of the methodology used in determining the significance of potential environmental impacts.	Chapter 9
I	a description and comparative assessment of all alternatives identified during the environmental impact assessment process.	Chapters 4, 10 and 11
J	a summary of the findings and recommendations of any specialist report or report on a specialised process.	Chapter 10
K	a description of all environmental issues that were identified during the environmental impact assessment process, an assessment of the significance of each issue and an indication of the extent to which the issue could be addressed by the adoption of mitigation measures.	Chapters 11 and 12

No.	Regulation 31(2): Contents of Environmental Impact Assessment Report	Covered in the EIAR
L	an assessment of each identified potentially significant impact including - (i) cumulative impacts. (ii) the nature of the impact. (iii) the extent and duration of the impact. (iv) the probability of the impact occurring. (v) the degree to which the impact can be reversed. (vi) the degree to which the impact may cause irreplaceable loss of resources. (vii) the degree to which the impact can be mitigated.	Chapter 12
M	a description of any assumptions, uncertainties and gaps in knowledge.	Chapter 9.2
N	a reasoned opinion as to whether the activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation.	Chapter 13
O	an environmental impact statement which contains - (i) a summary of the key findings of the environmental impact assessment. (ii) a comparative assessment of the positive and negative implications of the proposed activity and identified alternatives.	Chapter 12
P	a draft environmental management programme containing the aspects contemplated in regulation 33.	Appendix 6
Q	copies of any specialist reports and reports on specialised processes complying with regulation 32.	Appendix 5
R	any specific information that may be required by the competent authority	Appendix 5 (in terms of specialist reports required)
S	any other matters required in terms of sections 24(4)(a) and (b) of the Act	N/a

1. INTRODUCTION

1.1 Background

Eskom Holdings SOC Limited (Eskom) is the largest generator of electricity in South Africa. It also transmits electricity countrywide via a network of high-voltage sub-stations and inter-connecting transmission lines (765, 400 and 275 kV). From the transmission sub-stations, the electricity is distributed to end users through a network of smaller sub-stations and power lines (132, 88, 66 33, 22 and 11 kV) (Eskom, 2013).

Eskom's KwaZulu-Natal (KZN) Strengthening Programme aims to increase and strengthen the electricity transmission network to the KZN Midlands and southern KZN. This programme involves strengthening the transmission network by constructing a number of new transmission lines, linking the main generating facilities in Mpumalanga with demand centres in KZN. This requires the construction of transmission lines from the Alpha Sub-station near the Tutuka Power Station in Mpumalanga, to the Eros Sub-station near Harding in southern KZN.

Since 2009, Eskom has been investigating options to bring a 765 kV transmission line from the Venus Sub-station, near Estcourt, to a new sub-station (Sigma) in the KZN Midlands, with two 400 kV transmission lines from the new Sigma Sub-station linking into the existing Hector and Ariadne Sub-stations. This infrastructure forms a key component of the overall KZN Strengthening Programme.

Following extensive environmental investigations between 2009 and 2011, the Sigma 1 Sub-station site, north-west of Wartburg, was identified as the preferred sub-station site. Also, a preferred transmission line corridor for both the 765 kV and 2 x 400 kV transmission lines was identified. The National Department of Environmental Affairs (DEA) issued Environmental Authorisation on 11 June 2012 for the Venus-Sigma-Hector-(Ariadne) 765/400 kV Transmission Lines (EIA: 12/12/20/1397/1, EIA: 12/12/20/1397/3) and the new Sigma Sub-station (765 kV) (EIA: 12/12/20/1397/2).

Both Environmental Authorisations were appealed, subject to the concluding of a Memorandum of Understanding (MOU) between Eskom and the South African Sugar Association concerning the cultivation of sugarcane in 765 kV and 400 kV transmission line servitudes, inclusive of the burning of sugar cane immediately prior to its harvest. This MOU has since been signed and the appeals were withdrawn[3].

In the interim, more detailed geotechnical investigations undertaken at the Sigma Sub-station site have shown that earthworks and foundations will be exorbitantly expensive. Thus, Eskom initiated further investigations to identify if alternative, more cost-effective sub-station sites were available without needing to significantly alter the authorised VSHA transmission line corridor. Sixteen alternative sites were investigated, all of which proved unsuitable except for the proposed Isundu site, located at S29º 39' 50.77''; E30º 30' 48.37'' to the east of Ashburton (Figure 1).

The proposed Isundu 765/400 kV Sub-station is a replacement to the Sigma Sub-station previously authorised. If the Isundu Sub-station is authorised, the 765 kV transmission line from the Venus Sub-station will need to continue along the authorised transmission line corridor until the Isundu Sub-station. By implication, a single 765 kV transmission line rather than 2 x 400 kV transmission lines will be constructed in the corridor between the Sigma and Isundu sites.

[3] RCL Foods currently have appealed the 2 x 400 kV transmission lines authorisation.

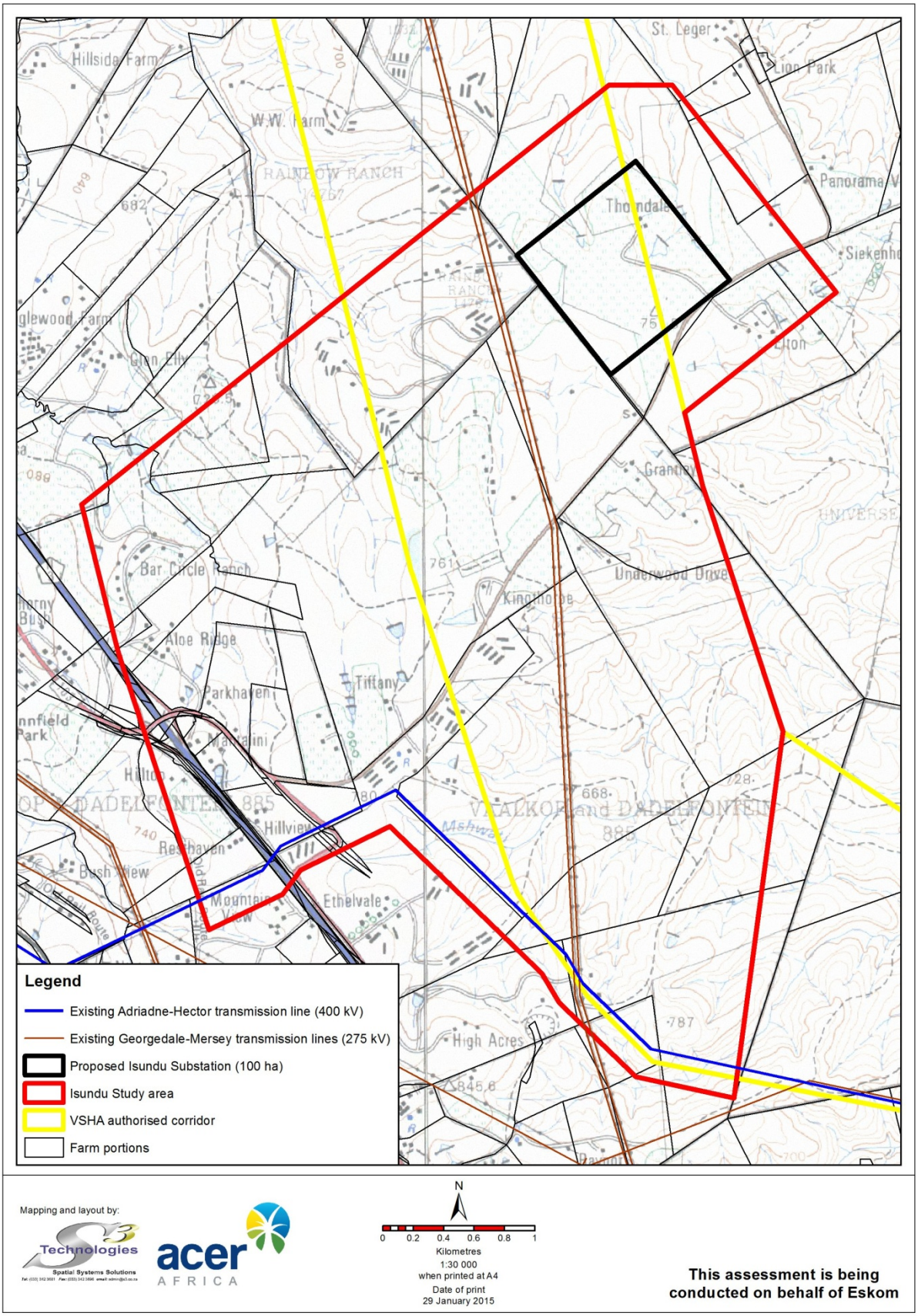

Figure 1 Location of the proposed Isundu Sub-station, near Ashburton, KwaZulu-Natal

1.2 Purpose of this report

In terms of the Environmental Impact Assessment Regulations, 2010, published in Government Notices R 543, R 544, R 545 and R 546 of 18 June 2010 under Section 24 of the National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998), the proposed Isundu Sub-station and associated turn-in transmission lines trigger activities that may significantly affect the environment. Thus, this project requires authorisation from the national Department of Environmental Affairs (DEA) and is subject to a full Environmental Impact Assessment (EIA) requiring Scoping and an Impact Assessment.

ACER (Africa) Environmental Consultants (ACER) is the Independent Environmental Assessment Practitioner undertaking the application for environmental authorisation on behalf of Eskom.

1.3 Qualifications and experience of the independent Environmental Assessment Practitioner

ACER (Africa) Environmental Consultants (ACER) is a well-established company with wide ranging expertise in environmental management and assessment processes. ACER has twice won the IAIAsa National Premium Award for excellence in environmental management and assessment. The qualifications and experience of the primary assessors and report compilers are outlined below.

Dr Dieter Heinsohn (Project Director)
Dr Heinsohn has more than 25 years' experience in South Africa and SADC countries (Lesotho, Botswana, Swaziland, Zimbabwe and Mozambique). He has undertaken numerous environmental assessments across a range of sectors: agriculture (including irrigation), bulk water, industry, transport, ports, energy, residential, tourism, and protected areas management.

Dieter Heinsohn contributed to the review of the International Finance Corporation's Handbook for Preparing a Resettlement Plan and, more recently, he was contributing author to the UNEP: Dams and Development Project: Compendium of Relevant Practice, covering Social Impact Assessment and also contributed to drafting the Compendium itself. Dieter Heinsohn has been Project Manager of five award-wining projects: Thukela Water Project (x 2), Hillside Aluminium Expansion Project, and the Sasol Natural Gas Project (Resettlement Aspects in Mozambique) (x 2).

He is registered with the South African Council for Natural Scientific Professions in the field of environmental science (Registration No. 400442/04) and is a certified Environmental Assessment Practitioner with the Interim Certification Board.

Paul Scherzer (Environmental Assessment Practitioner)
Mr Scherzer is a registered Professional Natural Scientist (Registration No. 400030/05) and a certified Environmental Assessment Practitioner with the Interim Certification Board (Registration No. 0072/05). He has 19 years' experience across a range of Central and Southern African countries (South Africa, Malawi, Mozambique, Botswana, Uganda, Tanzania, Swaziland and the Republic of Sao Tomé and Principe). Mr Scherzer has a BSc (Agriculture) and a MA in Food, Society and International Food Governance.

He has been involved in numerous development projects and has led large, complex environmental impact assessment projects requiring the input and integration of a range of scientific disciplines. His work has been recognised by the Southern African Institute for Environmental Assessment which included a project he managed as one of its twenty case studies from Southern Africa illustrating examples of best practice for the purposes of training and capacity building in environmental management.

1.4 Environmental assessment process and requirements

1.4.1 Scoping and Impact Assessment

The main phases of the environmental impact assessment process are shown in Figure 2.

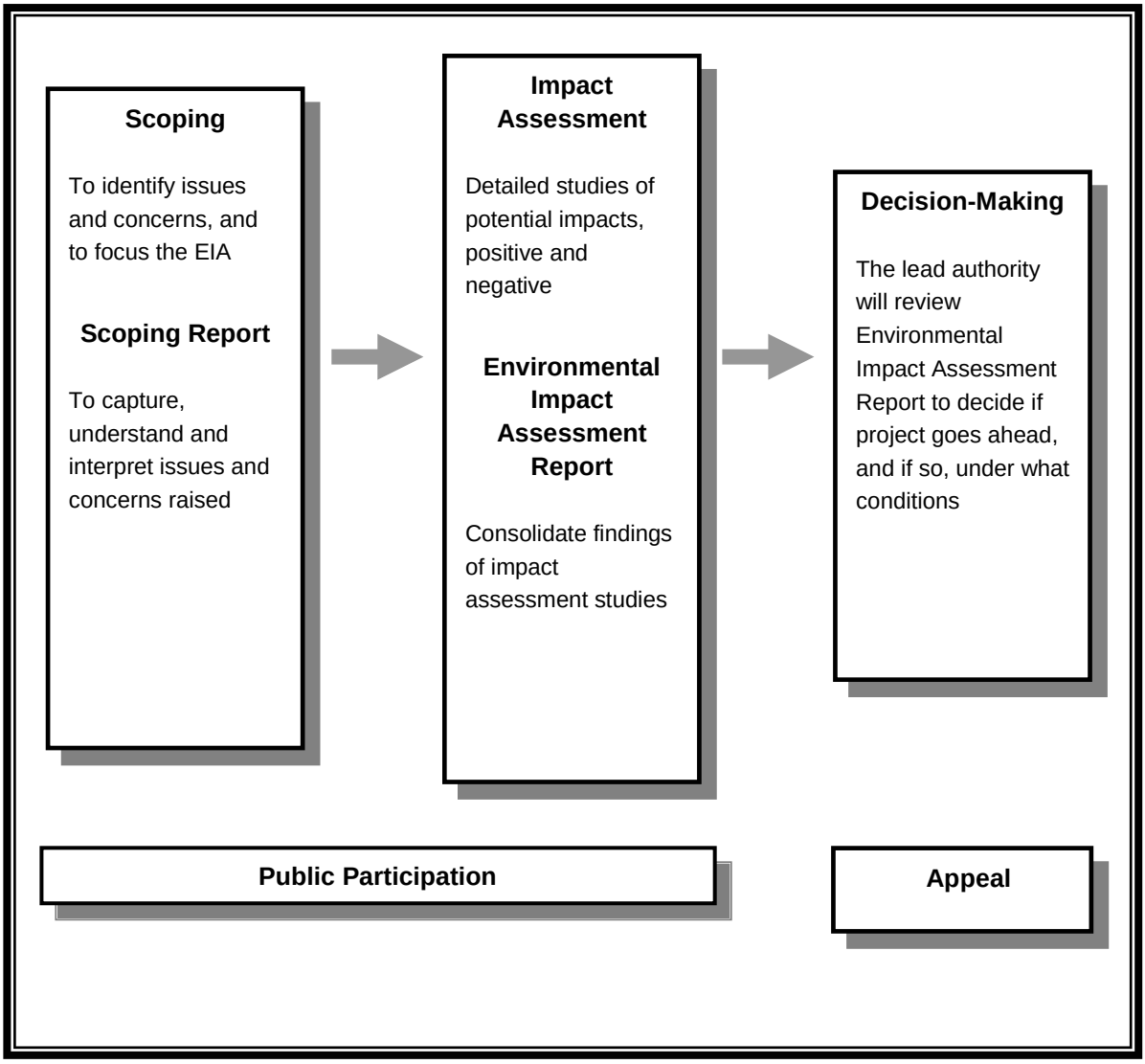

Figure 2 The main phases of an environmental impact assessment

1.4.2 Listed activities for which Eskom seeks authorisation

Eskom requires environmental authorisation from the lead authority, viz. the National Department of Environmental Affairs (DEA). In this regard, Eskom has submitted an application for authorisation for the activities listed in Table 2.

The EIA Regulations 2010 were repealed by the EIA Regulations 2014 contained in GN R 982, which came into effect on 8 December 2014. Section 53(1) of the EIA Regulations 2014 dealing with transitional arrangements states that pending applications must, despite the repeal of the 2010 regulations, be dispensed with in terms the 2010 regulations as if they were not repealed.

Importantly, Section 53(3) of the EIA Regulations 2014 states that: 'Where an application submitted in terms of the previous NEMA regulations, is pending in relation to an activity of which a component of the same activity was not identified under the previous NEMA notices, but is now identified in terms of section 24(2) of the Act, the competent authority must dispense of such applications in terms of the previous NEMA regulations and may authorise the activity identified in terms of section 24(2) as if it was applied for, on condition that all impacts of the newly identified activity and requirements of these regulations have also been considered and adequately assessed.'

The majority of the listed activities for which Eskom has applied are contained in both the 2010 and 2014 regulations. Two 2010 listed activities are no longer listed and, thus, now do not need to be authorised. However, there is one listed activity under the 2014 regulations which will be triggered which was not included the 2010 regulations. This activity is, however, assessed and, thus, should be authorised even though not contained in Eskom's initial application based on the 2010 regulations. Neither the 2010 activities which now fall away nor the new 2014 listed activity to be considered make any material difference to this assessment as they all relate to the size and use of the land and vegetation to be cleared.

The 2014 listed activity references have been added into Table 2 as well as the additional 2014 listed activity assessed[4]. In addition, two other applications are being undertaken concurrently with this environmental authorisation process:

- An amendment to an existing authorisation for 2 x 400 kV transmission lines from the proposed Sigma Sub-station site to the existing Hector Sub-station (12/12/20/1397/3/AM2). If the Isundu Sub-station is authorised then this line would need to change to a single 765 kV transmission line running from the proposed Sigma Sub-station site to the new Isundu Sub-station.

  The Department of Environmental Affairs considers this amendment to be substantial and, thus, requires further public participation and the preparation of a report on the potential impacts. Given that the two applications are closely linked, the amendment application was initially incorporated into the Isundu public participation and reporting process. However, the findings cannot be distributed for public comment with this Draft EIAR because the original environmental authorisation is under appeal (thereby automatically suspending the amendment application). Once the appeal has been concluded, an amendment report will be circulated for public comment as a separate process.

[4] The 2007 listed activities were also reviewed. No changes were necessary.

Table 2 Listed activities for which Eskom is seeking environmental authorisation

Relevant 2010 notice and listed activity	Relevant 2014 notice and listed activity	Activity Description
GN R. 544, 18 June 2010, 11(xi)	GN R.983, 4 December 2014 LN1 (12xii)	The project entails the construction of a sub-station and power line infrastructure including towers and access roads in excess of 50 m^2 in size potentially within watercourses or within 32 m from watercourses
GN R. 544, 18 June 2010, 13	GN R.983, 4 December 2014 LN1 (4)	The project entails the construction of a new sub-station, including storage facilities for oil. Based on initial concept designs, storage facilities will have a capacity of ≥ 80 m^3 but not exceeding 500 m^3
GN R. 544, 18 June 2010, 18(i)	GN R.983, 4 December 2014 LN1 (19i)	During construction, the work will involve the disturbance of watercourses by the dredging and removal of soil and rock material of more 5 m^3 from a watercourse. The work will also involve infilling and stabilisation
GN R. 544, 18 June 2010, 22	GN R.983, 4 December 2014 LN1 (24)	A tarred access road with a total width, shoulder to shoulder, of approximately 9 m. The length is estimated to be approximately 750 m. Tracks across the veld will be required to access the transmission line towers
GN R. 545, 18 June 2010, 8	GN R.984, 4 December 2014 LN2 (9)	The project entails the construction of a new sub-station, outside an urban area, with a capacity of 765 kV. The project also entails the construction of 2 x 400 kV double circuit transmission lines
GN R. 545, 18 June 2010, 15	GN R.984, 4 December 2014 LN2 (15)	The project entails the construction of a new sub-station with a site footprint of approximately 100 ha and a sub-station footprint of approximately 50-60 ha
GN R. 546, 18 June 2010, 3 (a)(ii)(gg)	GN R.985, 4 December 2014 LN3 (3)(d)(xii)(aa)	The project entails the construction of a new sub-station, including a telecommunications tower, where (i) the mast will be placed on a site not previously used for telecommunications purposes and (ii) the height of the mast is expected to exceed 15 m, and will be within 5 kilometres of a protected area
GN R. 546, 18 June 2010, 4 (a)(ii)(gg)	GN R.985, 4 December 2014 LN3 (4)(d)(xii)(aa)	The project entails the construction of a 765/400 kV sub-station and 2 x 400 kV double circuit transmission lines. Eskom will require an access road for construction and operation. It is anticipated that the access road will be wider than 4 m and will be within 5 kilometres of a protected area
GN R. 546, 18 June 2010, 10	GN R.985, 4 December 2014 LN3 (10)(d)(xii)(cc)	The project entails the construction of a new sub-station, including storage facilities for oil. Based on initial concept designs, storage facilities may have a capacity of ≥ 30 m^3 but ≤ 80 m^3
GN R. 546, 18 June 2010, 12(a)	GN R.985, 4 December 2014 LN3 (12)(b)(v)	The project entails the removal of indigenous vegetation for the sub-station site and transmission line servitudes. Based on initial concept designs, 300 m^2 or more of indigenous vegetation will be removed.

Relevant 2010 notice and listed activity	Relevant 2014 notice and listed activity	Activity Description
GN R. 546, 18 June 2010, 13 (c) (ii) (ff)	No longer a listed activity	The project entails the removal of indigenous vegetation for the sub-station site and transmission line servitudes. Based on initial concept designs, 1 ha or more of indigenous vegetation will be removed
GN R. 546, 18 June 2010, 16(iv) (ii) (hh)	GN R.985, 4 December 2014 LN3 (14)(d)(vii)	The project entails the construction of a sub-station and power line infrastructure including towers and access roads in excess of 10 m^2 in size, potentially within watercourses or within 32 m from watercourses and will be within 5 kilometres of a protected area
GN R. 546, 18 June 2010, 14(a)	No longer a listed activity	The project entails the removal of indigenous vegetation for the sub-station site and transmission line servitudes. Based on initial concept designs, 5 ha or more of indigenous vegetation will be removed
Additional 2014 listed activity to be assessed		
	GN R.983, 4 December 2014 LN1 (28)	This project will develop an area larger than 1 hectare for institutional use on land that has previously been used for agriculture.

- In addition, Eskom is required to obtain a Water Use Licence for the proposed Isundu Sub-station (in terms of section 40(4) of the National Water Act (Act No. 36 of 1998)). This application has been completed and the Department of Water Affairs and Sanitation has issued the General Authorisation required (Appendix 1).

1.4.3 Environmental Impact Assessment Plan of Study

In terms of Regulation 31 (1) of GN R. 543, the EAP must undertake the tasks contemplated in the Plan of Study for EIA, including the public participation process, as outlined in Chapter 9 of the Final Scoping Report, and prepare an Environmental Impact Assessment Report in respect of the proposed activity.

Table 3 indicates the activities undertaken in terms of the Plan of Study for EIA approved by DEA.

Table 3 Checklist of activities undertaken in accordance with the Plan of Study for EIA

No.	Activities undertaken in accordance with Plan of Study for EIA	Reference/Comment
1	Take into consideration any comments from DEA with respect to the Final Scoping Report and Plan of Study for EIA.	A detailed response to each comment from DEA has been included in Appendix 3
2	Commission and undertake focused specialist studies on the potentially significant issues identified during the Scoping Phase.	Chapter 10 and Appendix 5
3	Maintain communication and interaction with stakeholders for the duration of the Impact Assessment Phase.	Section 6.2 and Appendix 2,3 and 4
4	Integrate the findings of the detailed studies into a comprehensive and objective EIAR, inclusive of mitigation measures to ameliorate the effects of negative impacts and optimise positive ones.	Chapters 11 and 12
5	Prepare an Environmental Management Programme (EMPR).	Appendix 6
6	Distribute the Draft EIAR and EMPR to registered stakeholders for review.	The review period was from 31 October 2016 to 15 December 2016, The reports were made available at public libraries, on ACER's website and hard copies and CDs were emailed and/or posted to key registered stakeholders who requested copies.
7	Process and consider stakeholder review comments.	Undertaken.
8	Amend and finalise the Draft EIAR and EMPR as required, incorporating review comments into a Final Comments and Responses Report.	Undertaken. Final Comments and Responses Report in Appendix 3.
9	Submit the Final EIAR and EMPR to DEA for their consideration and decision-making.	Undertaken.
10	Notify registered stakeholders of the decision on the application (Environmental Authorisation) and of their right to appeal.	This will be undertaken following the issuing of the Environmental Authorisation by DEA

1.4.4 Public participation process during the environmental impact assessment

The public participation process is described in detail in Chapter 6. Table 4 lists the steps undertaken for public participation in accordance with the Plan of Study for EIA. Public Participation Documentation and correspondence is provided in Appendix 2. Appendix 3 contains the Comments and Responses Report. The Stakeholder Database is provided in Appendix 4.

Table 4 Checklist of public participation activities undertaken in accordance with the Plan of Study for EIA

No.	Public participation tasks undertaken during Impact Assessment Phase in accordance with Plan of Study	Reference/Comment
1	Continued interaction with I&APs.	Appendix 2 contains records of correspondence with I&APs.
2	Database updated.	Refer to database in Appendix 4.
3	Queries and comments responded to and recorded.	Appendix 2 contains records of correspondence with I&APs. Comments and responses have been recorded in the Comments and Responses Report (Appendix 3).
4	Comments and Responses Report.	Appendix 3.
5	ACER has been in regular contact with I&APs.	Interactions are recorded in Appendices 2 and 3.
6	Meetings held by ACER with key authorities and stakeholders as necessary.	Meetings were held during the public review period for the draft EIAR. Proceedings, attendance registers and presentations are contained in Appendix 2.
7	I&APs timeously notified of the availability of the Draft EIAR for public review.	I&APs were notified timeously by media adverts, email and post (Appendix 2).
8	Draft EIAR distributed for public review (40 day review period).	Distributed for public review during period **31 October 2016 to 15 December 2016**
9	Draft EIAR to be amended in accordance with public review comments prior to submission of final EIAR to DEA.	Undertaken.
10	Registered I&APs notified when Environmental Authorisation is issued and informed of appeal procedure.	To be undertaken when EA is issued.

1.4.5 Environmental Impact Assessment Report

In terms of Regulation 31 (2) of GN R. 543, an EIAR must contain all information that is necessary for the competent authority to consider the application and to reach a decision, and must include certain components, as listed in Table 1. The latter also indicates where in this EIAR these various components are covered.

2. LEGISLATIVE FRAMEWORK

2.1 Applicable legislation

There is a host of legal requirements (national, provincial and local government spheres) to which the project proponent must adhere for the construction of the proposed Isundu Sub-station. Fundamentally, the proponent is required to include and integrate environmental principles and values into all planning and implementation procedures taken for development purposes.

Underlying the above reasoning is the constitutional right that people have to environmental protection as set out in the Bill of Rights in the Constitution (Section 24). These rights have been interpreted and included in NEMA, which, together with other national and provincial legislation, governs the way environmental principles are incorporated into any form of development.

Some of the key legislation that is applicable to this project is provided hereunder.

2.2 Constitution of the Republic of South Africa Act, 1996 (Act 108 of 1996) (as amended)

The Constitution is the supreme law of South Africa, against which all other laws are measured. It sets out a number of fundamental environmental rights.

2.2.1 The Environmental Clause

Section 24 of the Constitution outlines the basic framework for all environmental policy and legislation: It states:

"Everyone has the right –

- *a) to an environment that is not harmful to their health or well-being; and*
- *b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that –*
  - *i) prevent pollution and ecological degradation;*
  - *ii) promote conservation; and*
  - *iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development".*

2.2.2 Access to Information

Section 32 of the Constitution provides that everyone has the right of access to any information held by the State or another juristic person, which is required for the exercise or protection of any rights.

2.2.3 Fair Administrative Action

Section 33 of the Constitution provides the right to lawful, reasonable and procedurally fair administrative action.

2.2.4 Enforcement of Rights and Administrative Review

Section 38 of the Constitution guarantees the right to approach a court of law and to seek legal relief in the case where any of the rights that are entrenched in the Bill of Rights are infringed or threatened.

2.3 National Environmental Management Act, 1998 (Act 107 of 1998) and Regulations (as amended)

NEMA is South Africa's overarching environmental legislation. It provides the legislative framework for Integrated Environmental Management in South Africa. The Act gives meaning to the right to an environment that is not harmful to health or well-being, entrenched in Section 24 of the Constitution. In addition, NEMA provides for: equitable access to natural resources, environmental protection and the formulation of environmental management frameworks. The Act is underpinned by the global concept of sustainable development. Section 2 of NEMA provides a set of principles that apply to the actions of all organs of state where activities may significantly affect the environment.

The interpretation, administration and application of NEMA are guided by fundamental principles of sustainable development, provided in Chapter 1 of the Act. "Development must be socially, environmentally and economically sustainable" (s 2(3)) and requires the consideration of all relevant factors, which are elaborated by eight sub-principles, including:

- The sustainability principle.
- The life-cycle, cradle-to-grave principle.
- The 'polluter pays' principle.
- The precautionary principle.
- The duty of care principle.
- Fair and transparent public consultation.

The concept of sustainability underpinning this assessment considers three inter-related dimensions of the environment, viz. the social, economic and biophysical dimensions. For an option or project to be sustainable, it needs to demonstrate economic growth, social acceptability and soundness, and ecological integrity within a framework of good governance.

2.4 The Environmental Impact Assessment Regulations, 2010 (as amended)

The EIA Regulations contained in Government Notices R 543, R 544, R 545 and R 546 of 18 June 2010, published in terms of Section 24 of the NEMA, regulate environmental management in South Africa.

Activities that require authorisation from the competent authority prior to their commencement are listed in Government Notices R 544, R 545 and R 546. The procedures dealing with the EIA Regulations are contained in GN R 543.

The EIA Regulations 2010 were repealed by the EIA Regulations 2014 contained in GN R 982, which came in to effect on 8 December 2014. However, as Eskom's applications were submitted under the 2010 EIA Regulations, these regulations are still applicable in terms of the transitional arrangements contained in Section 53 of the EIA Regulations 2014.

2.5 National Water Act, 1998 (Act 36 of 1998)

The National Water Act, 1998 (Act 36 of 1998) (NWA) has various sections of relevance to the proposed project. The Department of Water and Sanitation (DWS) is the responsible authority with regard to matters affecting water resource management, including water quality. Added to this, certain provincial and local authority powers influence the regulation of water resources, including agriculture, the environment, health services, nature conservation, pollution control, regional planning and development, soil conservation, and water and sanitation services.

The development or modification of water courses or wetlands in any form are governed by conditions provided in Chapter 4, Part 1 of the Act, which sets out general principles for regulating water use.

In general, water use must be licensed unless:

- It is listed in Schedule 1 of the Act.
- Is an existing lawful water use.
- It is permissible under a general authorisation.
- A responsible authority waives the need for a licence.

As development or modifications of watercourses or wetlands are not included in Schedule 1, a licence is required to carry out any activity involving modifications to watercourses or wetlands. This is relevant due to the fact that the sub-station construction will fill in and level some small farm dams and modify the existing watercourse channels. Therefore, a Water Use License Application was prepared and has been approved by DWS (Appendix 1).

2.6 National Heritage Resources Act, 1999 (Act 25 of 1999) and KwaZulu-Natal Heritage Act, 2008 (Act 4 of 2008)

The National Heritage Resources Act, 1999 (Act 25 of 1999) (NHRA) aims to promote an integrated system for the identification, assessment and management of the heritage resources of South Africa. Furthermore, it established the South African Heritage Resources Agency (SAHRA) to implement the Act.

KwaZulu-Natal has promulgated its own legislation, the KwaZulu-Natal Heritage Act, 2008 (Act 4 of 2008) which contains similar provisions to those of the NHRA, although it establishes a provincial body, Amafa aKwaZulu-Natali (Amafa) as the relevant heritage authority for the protection and management of heritage resources in KwaZulu-Natal. By means of a Memorandum of Understanding, Amafa acts as the agent for the national agency (SAHRA) in the province.

The primary objective of the KZN Heritage Act is the care, maintenance, repair and management, as well as the protection, of all forms of historically and culturally important sites, including, for example, public monuments and archaeological sites, important cultural objects and traditional burial sites.

The proposed sub-station requires authorisation from Amafa because it will alter an area larger than 5,000 m² and the transmission lines will exceed 300 m in length.

2.7 National Forest Act, 1998 (Act 84 of 1998)

2.7.1 Protected trees (national protection)

In terms of the National Forests Act, 1998 (Act 84 of 1998), trees in natural forests or protected tree species (as listed in Government Gazette Notice 716 of 7 September 2012) may not be cut, disturbed, damaged, destroyed and their products may not be possessed, collected, removed, transported, exported, donated, purchased or sold, except under licence granted by the Department of Agriculture, Forestry and Fisheries. Each application is evaluated on merit before a decision is taken whether or not to issue a licence (with or without conditions). Such decisions must be in line with national policy and guidelines.

The proposed project may affect some tree species which are protected. This will only be confirmed on the sub-station site once the layout is finalised and during the walk-down of the transmission line route by the specialists.

2.7.2 Protected trees (provincial protection)

Certain indigenous plant and animal species in KwaZulu-Natal are provided with special protection under the KwaZulu-Natal Nature Conservation Ordinance and permits are required from Ezemvelo KZN Wildlife (EKZNW) for their removal, destruction or translocation.

The proposed project may affect some indigenous species which are protected. This will only be confirmed on the sub-station site once the layout is finalised and during the walk-down of the transmission line route by the specialists.

2.8 KwaZulu-Natal Planning and Development Act, 2008 (Act 6 of 2008)

The Spatial Planning and Land Use Management Act, Act 16 of 2013 (SPLUMA) came into force on 1 July 2015 and replaces the KwaZulu-Natal Planning and Development Act, 2008. However, the two will run in parallel until each Local Municipality has set up the structures required by SPLUMA.

In terms of the current KwaZulu-Natal Planning and Development Act, 2008, Eskom will need to submit a Planning and Development Application (PDA) to the Local Municipality. This application will need to meet all the requirements of legislation. Important aspects will include planning considerations, and compliance with the municipality's Integrated Development Plan and Spatial Development Framework.

The Mkhambathini Municipality's Spatial Planning and Land Use By-law came into effect on 15 January 2016. Thus, Eskom will not be required to submit a PDA application to the local municipality. However, it is believed that Eskom will still need to obtain planning approval, in terms of the KwaZulu-Natal Planning and Development Act 2008, for the zoning and development of the land as the area is not currently zoned for service infrastructure.

The exact requirements will depend on the timing of Eskom's application to the Municipality and the status of the legislation and by-laws currently applicable at the time in the local municipality.

2.9 Applicable National and Provincial Legislation

Other legislation which may be applicable to this project and which will need to be considered if found to be relevant are the following:

- National Environmental Management: Waste Act, 2008 (Act 59 of 2008).
- Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983).
- National Environmental Management: Biodiversity Act, 2005 (Act 10 of 2004).
- Promotion of Administrative Justice Act, 2000 (Act 3 of 2000).
- KwaZulu-Natal Nature Conservation Management Act, 1997 (Act No. 9 of 1997).

2.10 Guidelines

The following guidelines apply:

- Department of Water Affairs and Forestry, 2008. Updated manual for the identification and delineation of wetlands and riparian areas. Department of Water Affairs and Forestry. Pretoria. South Africa.
- Department of Environmental Affairs and Tourism (DEAT), 2004. Integrated Environmental Management Information Series, Department of Environmental Affairs and Tourism, Pretoria.
- DEAT, 2010. NEMA Draft Implementation Guideline. Public Participation.
- DEAT, 2010. NEMA Draft Implementation Guideline. Companion Document on the Environmental Impact Assessments Regulations.

2.11 Summary

In summary, Eskom has a number of legal obligations in terms of legislation, the pertinent obligations being:

- An obligation to supply electricity to the citizens of South Africa.
- An obligation to undertake an EIA for activities that fall within the scope of Government Notices R 543, R 544, R 545 and R 546 of 2010.
- An obligation to obtain permits in terms of other relevant environmental legislation (for example, heritage, water and biodiversity).
- Adherence to the principles of sustainability.

3. PROJECT PURPOSE, NEED AND DESIRABILITY

All Eskom's recent audits indicate the need for expansion of the transmission network to attain a higher security of supply. This needs to be achieved through the implementation of a 765 kV backbone through the centre of the country.

The existing KZN transmission network is constrained and reaching capacity. In order to meet growing demand and to improve service quality and reliability, the network needs to be strengthened. For these reasons Eskom needs to establish new 765 kV and 400 kV transmission lines, linking the main power generation facilities in Mpumalanga to the load centres in KZN.

Sub-stations are needed in order to step-down voltages to allow for distribution. By having sub-stations in the transmission network, it also makes it possible for Eskom to de-energise a transmission line or other electrical switchgear for maintenance or construction whilst still keeping the whole network supply system running. This is important as faults can develop in transmission lines or in the associated switchgear. At other times faults could result if a line is hit by lightning or, in extreme cases, a tower may be blown down by high winds.

The purpose of a new sub-station in the network between Estcourt and Camperdown is to:

- Strengthen electricity supply to the greater Pietermaritzburg load area.
- Strengthen electricity supply to the KZN South Coast area via the Ariadne-Eros section of the overall KZN Strengthening Programme.
- Be able to establish transmission line linkages with load areas on the KZN North Coast, in particular, the Empangeni/Richards Bay area.

These linkages are illustrated in Figure 3. These linkages are important as under the Grid Code for Transmission networks, Eskom is required to ensure that if one transmission line is lost (due to maintenance, faults, etc) there will be another line that can bring power to the areas affected.

The position of sub-stations in the network, as well as the distance between sub-stations, is determined by the peculiarities of electricity transmission at extra high voltage. In order to comply with the known and laid down safety limits, sub-stations must be about 400 km apart with an absolute maximum distance of 450 km. This is because on long transmission lines the voltage increases along the line because of capacitance in the line (known as the Ferranti Effect). Compensation is done at the sub-station where reactors are installed to neutralize inductive reactance in the long transmission lines. If the voltage is allowed to become too high it will burn out equipment. Thus, it is not possible to have endless transmission lines without sub-stations.

Added to this, load centres and demands change, for example, Newcastle and surrounds (with mines and steel factories) used to be a load centre, whilst now places like Richards Bay require additional electricity. Therefore, to get electricity to the demand centres requires new infrastructure in different locations.

Aspects such as these constrain planners as to where sub-stations need to be located within the grid (it is not simply a matter of moving to a different area if suitable sub-station sites are difficult to find).

The Sigma 1 Sub-station site, which was previously identified and authorised as the preferred sub-station site to meet these requirements, is not considered a financially feasible option to develop. Hence, the need for Eskom to identify a new site for the proposed sub-station between Estcourt and Camperdown which still fulfils the overall system requirements.

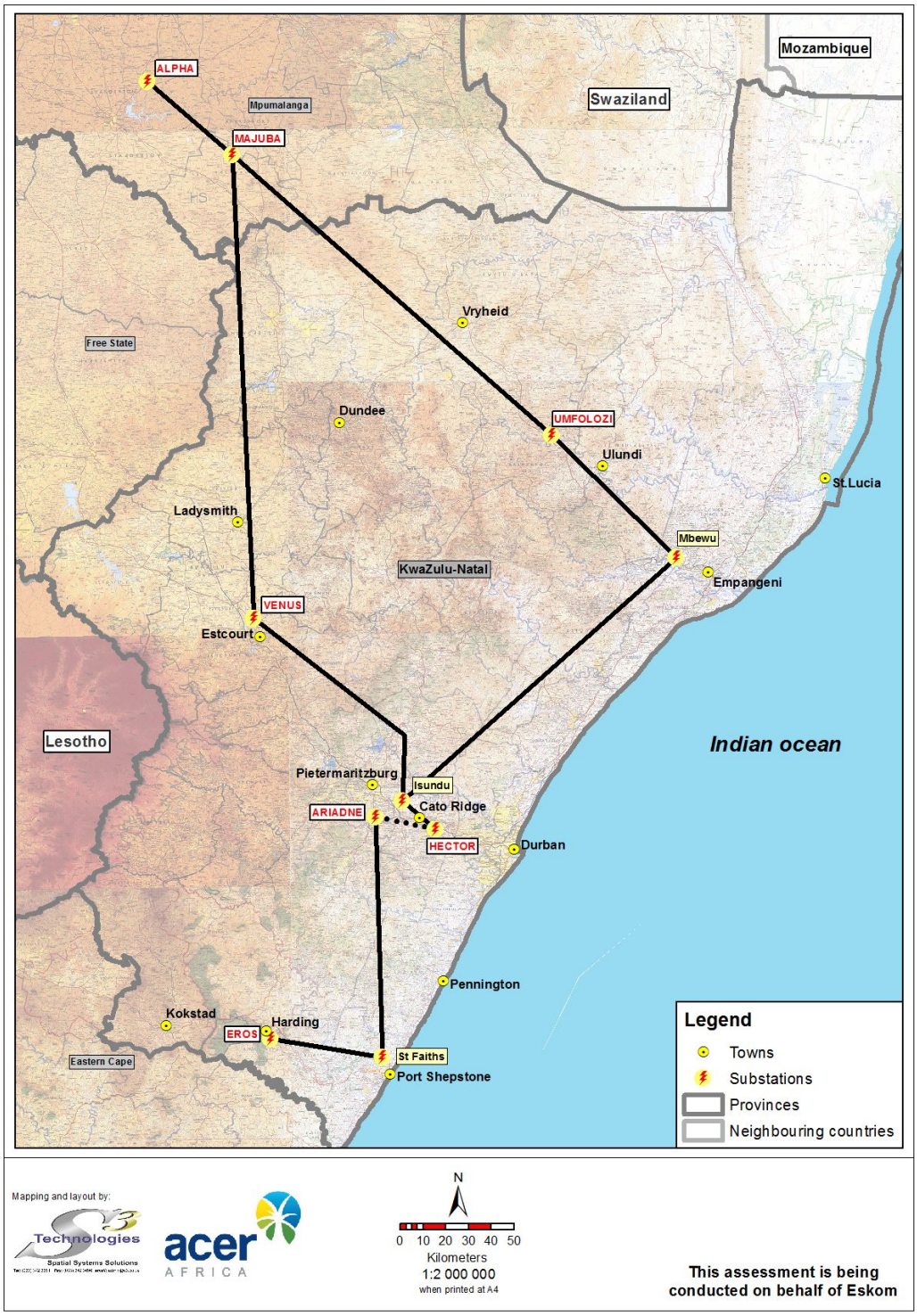

Figure 3 KZN Strengthening Programme

4. PROJECT ALTERNATIVES

Since the start of project planning in late 2008, Eskom has considered the expansion of existing sub-stations and over 25 potential new sites in order to achieve the overall project objective of having a suitable 765/400 kV sub-station between Estcourt and Camperdown.

4.1 Expansion of existing substations

The expansion of existing sub-stations in the area was initially considered.

The Mersey Sub-station has only 400 kV capacity and would require upgrading. Eskom's Grid Planning team did investigate the option of upgrading Mersey at the beginning of the project, but it was found that the topography around the existing sub-station did not lend itself to such an upgrade. There is insufficient level ground because the area falls away steeply towards the east and significant earthworks would be required to establish a sufficiently large area to accommodate a 765 kV sub-station. The high cost of earthworks during site preparation foreclosed the further consideration of this option.

The Ariadne Sub-station, with a capacity of 400 kV would also require upgrading. However, it is congested by existing transmission lines, developments and settlements surrounding the sub-station. This makes expansion and entering the sub-station with a 765 kV transmission line almost impossible. Future linkages towards the North Coast would also be virtually impossible due to the existing congestion.

Similarly, the area around the existing Hector Sub-station is developing and congested, and there is insufficient space to expand the sub-station to incorporate a new 765 kV transmission line as well as the required 400 kV linkages with the south coast and to the proposed Mbewu Sub-station on the north coast.

4.2 New sub-station site alternatives

During project planning in late 2008, Eskom Grid Planning identified five potential sub-station site alternatives. In early 2009, for technical reasons, Eskom reduced the initial five sub-station sites to three.

The three site alternatives were all located within the uMshwati Local Municipality area, north-east and east of the existing Mersey Sub-station near Albert Falls Dam. These three sites were numbered Sigma 1, Sigma 2 and Sigma 3. The reason for the positioning of the three site alternatives in this general area of KwaZulu-Natal is due to the future requirement to link the Sigma Sub-station with the proposed Mbewu Sub-station close to Empangeni on the North Coast of the province.

Three 2 km wide corridors were identified (viz. the Western, Central and Eastern Corridors) which would connect the Venus Sub-station to the Sigma Sub-station, and, in turn, the Sigma Sub-station to the Hector Sub-station.

In March 2009, as part of Environmental Scoping, a Key Stakeholder Workshop (KSW) was held with potentially affected landowners and associated stakeholders from the agricultural sector in the uMshwati Municipality. These landowners and industries would potentially have been the most significantly affected by the three Sigma Sub-station site alternatives initially identified.

Issues and concerns raised during this meeting, particularly related to the potential impact of a sub-station and associated transmission lines on the agriculture and local economy of the area. This led to the decision to appoint an agricultural economist to conduct an Agricultural Economics Study (AES) during Scoping (the three sub-station sites were located within an agricultural area comprising fairly dense timber plantations and sugarcane cultivation).

The AES found that the three sub-station sites, together with the associated transmission lines, in the context of other constraints within the agricultural sector, could potentially significantly affect the agricultural economy of the study area. This led to two key recommendations being made by the specialist:

- To investigate additional Sigma Sub-station site alternatives further to the south, i.e. effectively moving out of the area with high-density timber and sugarcane farming.
- To reconsider the Eskom policy of sugarcane free servitudes, subject to formal agreement with individual landowners.

Based on the findings of the AES, Sigma 1, together with the Western Corridor for the transmission line, was the preferred site and alignment at the time (from an agricultural economics perspective).

Based on the findings and recommendations of the AES, Eskom Grid Planning investigated a number of additional sub-station sites (Sigma 4 – 7), further to the south and closer to the Hector Sub-station. After both desk-top and in-field investigations, it was determined that two of the additional sites, Sigma 6 and Sigma 7, were technically feasible while still fulfilling the future requirement of a linkage with the Mbewu Sub-station. A decision was taken to eliminate two of the three initial sub-station sites, Sigma 2 and Sigma 3, which were both located within dense timber growing areas (Figure 4).

Therefore, for the Venus-Sigma-Hector-Ariadne (VSHA) environmental authorisation process, three sub-station sites were investigated, viz. Sigma 1, Sigma 6 and Sigma 7. This led to the consideration of another transmission line corridor, viz. the Southern Corridor, or the ‘Blue Route’ as it became known, around the western side of Albert Falls dam (Figure 5).

In the VSHA EIA, the two sub-station sites further south, Sigma 6 and 7, were not recommended, and Sigma 1 was recommended as the preferred site on condition that Eskom allows the burning of sugar cane under the transmission lines. A MOU between Eskom and the South African Sugar Association to this effect was signed by both parties in October 2013.

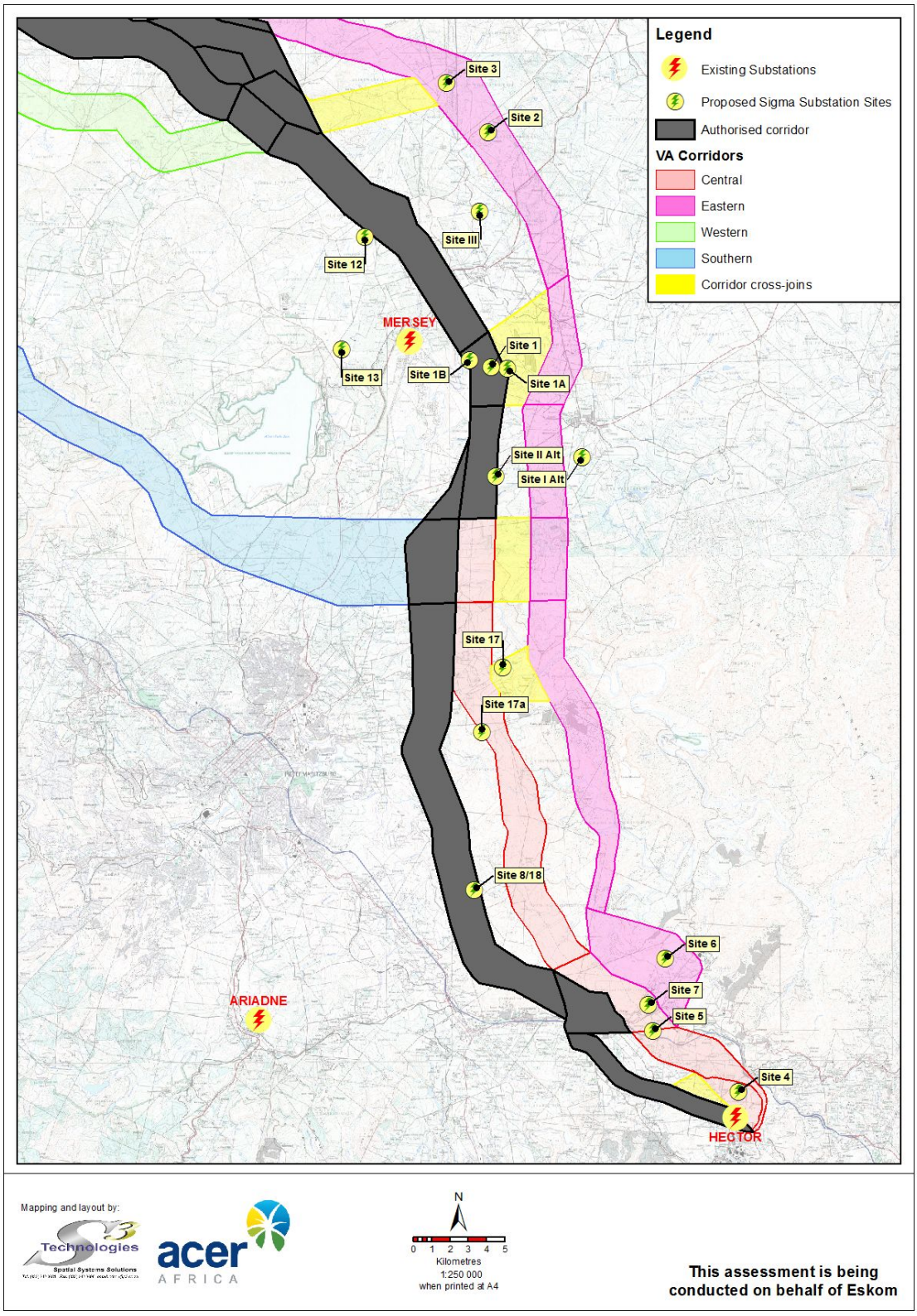

Figure 4 Sigma sites considered to date

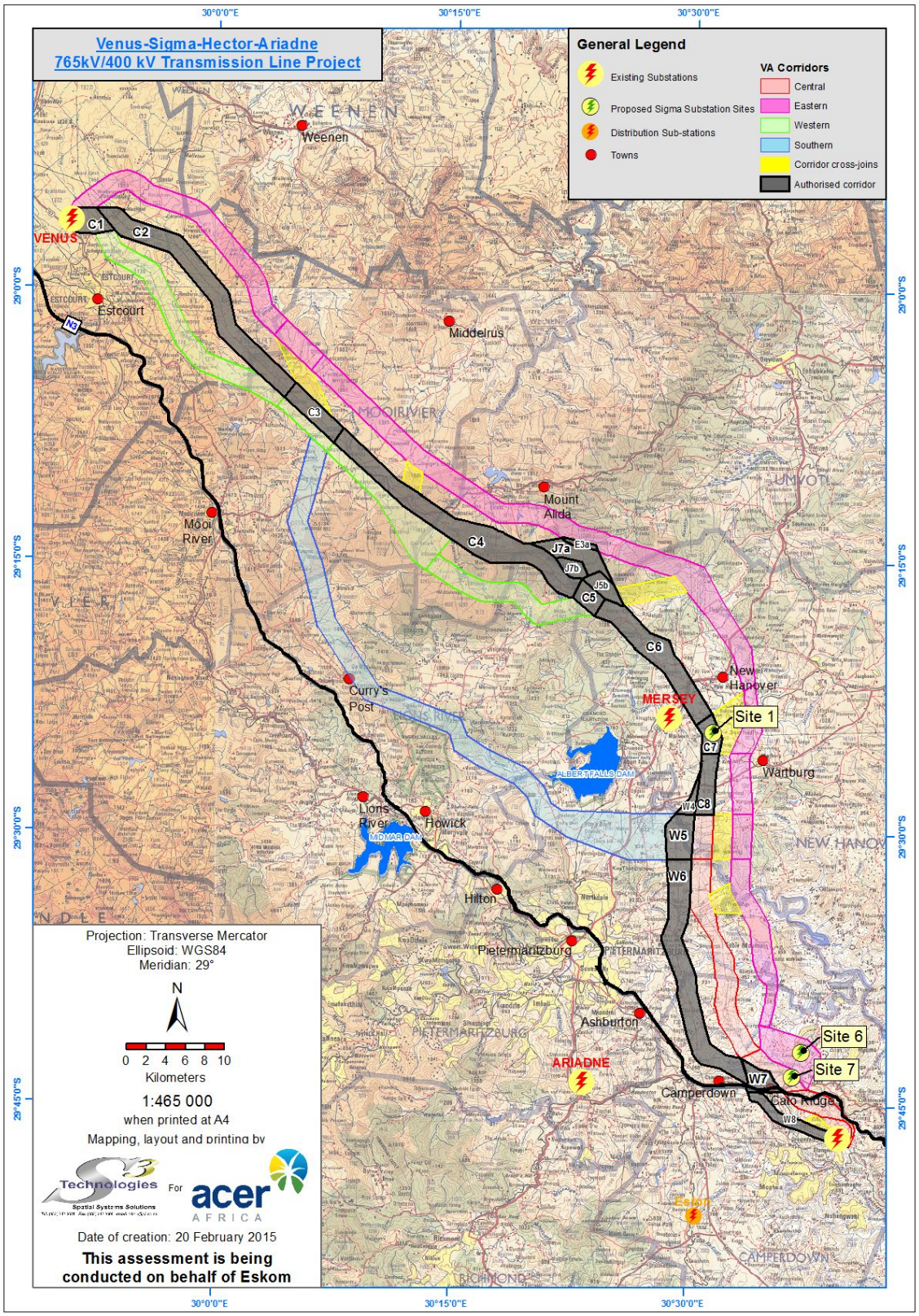

Figure 5 VSHA EIS Sub-station sites and authorised corridor

4.3 Sigma 1 technical constraints

Since the environmental authorisation of the Sigma 1 Sub-station site, further, more detailed geotechnical investigations were undertaken which showed that earthworks and foundations alone will be in the order of R 500 to R 800 million more than typically incurred during sub-station construction. Due to the current financial status of Eskom and Government's need to optimise the expenditure of taxpayers' money, the Sigma 1 Sub-station site is no longer considered financially feasible.

In addition, Eskom, as a public utility is bound by the Public Finances Management Act in which costs need to be declared and justified. All additional costs have to be recovered by a general increase in tariffs.

The terrace and equipment costs for various design options and configurations are provided in Table 5.

Table 5 Sigma versus Isundu costs

Design Option	Terrace Costs (R)	Equipment Costs (R)	Total (R)
Sigma 1 Site			
Live Tank with HVDC	1,363,189,800	193,166,358	1,556,356,158
Live Tank*	785,981,100	193,166,358	979,147,458
Dead Tank with HVDC**	1,315,034,400	225,071,466	1,540,105,866
Dead Tank*	724,579,050	225,071,466	949,650,516
Isundu Site			
Live Tank with HVDC	514,873,800	193,166,358	708,040,158
Live Tank	264,427,200	193,166,358	457,593,558
Dead Tank with HVDC	505,305,000	225,071,466	730,376,466
Dead Tank	240,827,400	225,071,466	465,898,866

* A circuit breaker is an automatically operated electrical switch designed to protect an electrical circuit from damage caused by overload or short circuit. Its basic function is to detect a fault condition and interrupt current flow. In addition, circuit breakers are utilised for power system configurations by opening and closing circuits. Live Tank and Dead Tank circuit breakers are the two different design types.

** HVDC refers to a High Voltage Direct Current transmission line. This system requires converter and inverter stations at the remote ends of the transmission line to convert between Alternating Current and Direct Current.

It is the nature of project planning that some alternatives will immediately present significant constraints, from either an environmental, technical or financial perspective, at a pre-feasibility stage of investigation. However, other constraints may only be identified at the feasibility stage or, in rarer cases, only during construction or the operational phase, with hindsight, making the project site less desirable.

There are various reasons as to why the technical limitations of the Sigma 1 site were not identified earlier in the planning process or at least prior to the VSHA EIA process. One of the main reasons is that geotechnical investigations cost in the region of R 500,000 per site and, thus, such investigations cannot be undertaken for all potential sites identified.

During the planning process, initial desktop geotechnical investigations confirmed that the Sigma 1, 6 and 7 sites were all feasible. These sites were then taken through the environmental authorisation process. During this period, no further technical investigations were undertaken, to avoid further expenditure, until the environmental feasibility of one of the sites had been confirmed by obtaining authorisation from DEA.

It was only after further technical investigations were undertaken on this authorised site that the full geotechnical constraints became apparent.

4.4 Further site investigations

Given that the authorised Sigma site is no longer considered financially feasible, Eskom made the decision to identify and assess further alternatives to Sigma 1.

Eskom reconsidered Sites 6 and 7 but space constraints within this industrial area were found to be limiting and, due to some of the findings from the VSHA EIR, it was decided not to re-consider these sites.

Eskom commissioned Geopractica Consulting Engineers to do a comparative geotechnical investigation on a further two sites identified (Sites 12 and 8/18). From a geotechnical perspective, Site 8/18 (the Isundu site) was preferred.

Thereafter, during 2013, ACER conducted a Feasibility Study which reconsidered the findings of previous studies, considered the environmental aspects of Sites 12 and 8/18, and identified further sub-station sites that could potentially work as an alternative to Sigma 1 (Figure 5).

Acknowledging the considerable investigative work, including comprehensive stakeholder participation that had been undertaken to identify the optimum VSHA corridor alignment, the study area for new sites was confined to that which would allow the proposed Isundu Sub-station to feasibly fit in with the authorised VSHA corridor. The site also needed to meet Eskom's future electrical transmission requirements for central, southern and northern KwaZulu-Natal.

Using GIS, ACER undertook a search for all areas within a defined zone with suitable (flattish) gradient that were potentially large enough to accommodate a sub-station. After ruling out areas of incompatible land use, 12 potential sites (60 ha in size) were identified. These 12 sites (named Sites B, C, D, E, F, G, H, I, J, K, M and N) as well as Sites 12 and 8/18, were comparatively assessed (Figure 6). Of these, only site 8/18, the proposed Isundu site, was found to merit further consideration.

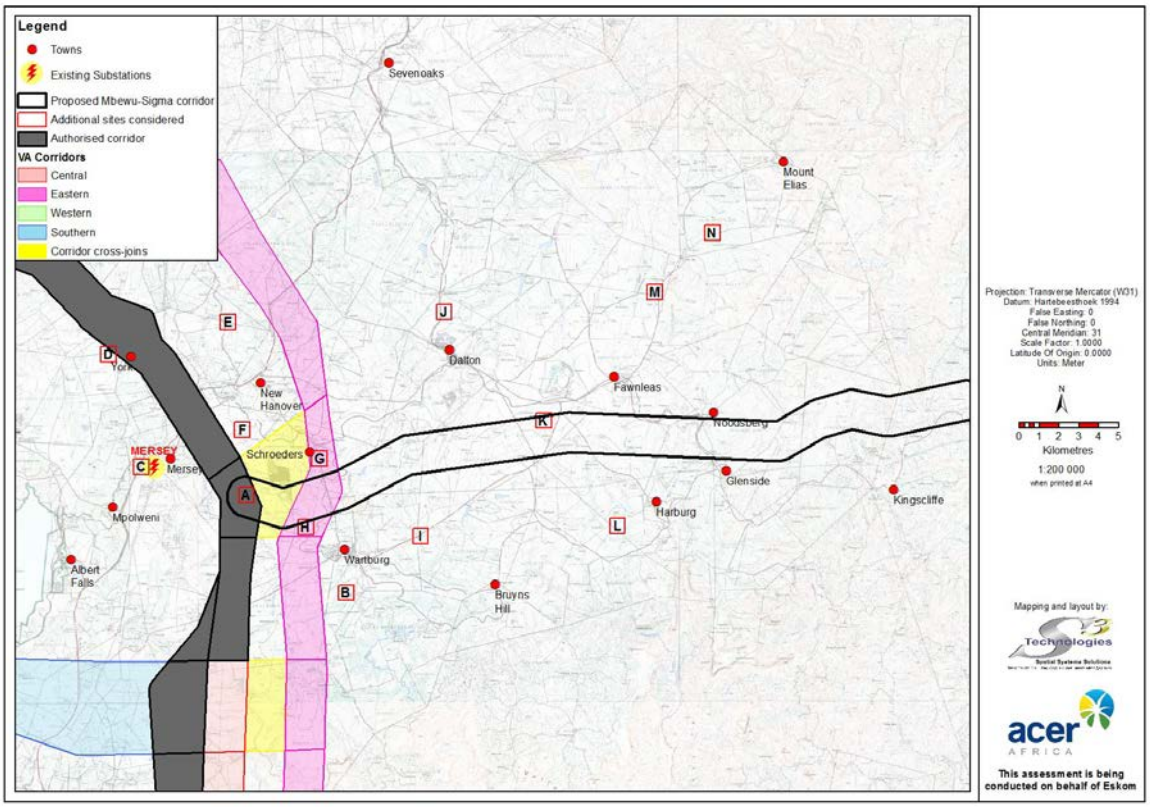

Figure 6 Additional new Sigma site alternatives identified for consideration

4.4.1 RCL Food's suggested alternatives

During this EIA process, RCL Food's submitted a letter directly to Eskom, stating that 'RCL may be prepared to sacrifice less sensitive sites in order to accommodate Eskom'. RCL provisionally identified five alternative sites for consideration. Two of these alternative sites were partly over other RCL properties, whilst the other three were on properties not owned by RCL Foods.

Eskom and the EAP evaluated these five suggested alternatives; the findings are presented in Table 6. Figure 7 provides an overview of where these sites are located in relation to the proposed site and RCL's laying farms.

Table 6 Evaluation of RCL Food's suggested alternatives

RCL Suggested Alternative	Negative Aspects	Fatal Flaw	Comments
1	This site would require the relocation of two existing tarred roads, one being a major diversion of the R103 which is unlikely to be feasible. In addition, there is a Transnet fuel pipeline servitude on this site as well as an existing poultry farm, and two residences that would need to be relocated. There is also an existing double circuit 400 kV line running through the middle of this proposed site. This site would also have significant cut and fill requirements, particularly on the south-eastern side.	The proximity of the site to the N3 makes this site unfeasible. Transmission line towers cannot be placed within 60 m (for 765 kV) of a national road and, thus, Eskom would not be permitted (by Eskom's standards and the Department of Transport/SANRAL's standards) to establish strategic electrical infrastructure adjacent to strategic transport infrastructure.	
2	This site would require the relocation of an existing tarred road, two poultry farms, and some farm residences. This site is also across an existing airstrip. The major relocations required, in addition to the fact that it covers more than two or three separate landowners, makes this alternative less feasible than the current proposal. It would be difficult to bring future transmission lines into this site without also crossing RCL's laying farm property as there is little room to enter the site from the NNW side.	The major relocations required and the cut and fill volumes which will be high, make this site unfeasible.	This site is approximately 913 m from RCL's existing layer farm L13. Compared to the current proposed Isundu site, this alternative would only increase the distance between the sub-station and their nearest laying farm by approximately 480 m. Recommending this as an alternative raises doubt over the validity of many of RCL Food's objections to the current proposed site.
3	This site would require in the region of 4 km of tarred access roads to be constructed over difficult terrain to gain access.	The topography of this site would require significant earthworks. The cut and fill	

RCL Suggested Alternative	Negative Aspects	Fatal Flaw	Comments
	This would add significantly to the overall cost of the site.	volumes for this site were estimated at 8 million m³, compared to the estimated 730,000 m³ for Isundu. This site is not feasible.	
4	This site would require a longer access road than site 3 and would also be over difficult terrain.	The topography of this site would require significant earthworks. The cut and fill volumes for this site were estimated at 20 million m³, compared to the estimated 730,000 m³ for Isundu. This site is not feasible.	
5	This site would require the relocation of existing tarred roads and possibly two residences. It also falls over approximately 3-4 different landowners.	The relocation of the existing road. The size of the site is too small to accommodate the footprint of the sub-station. In addition, the surrounding topography does not allow for feasible expansion and relocation of the road, making this site unfeasible.	This site moves the sub-station approximately 690 m further away from RCL's nearest laying farm. Recommending this as an alternative raises doubt over the validity of many of RCL Food's objections to the current proposed site.

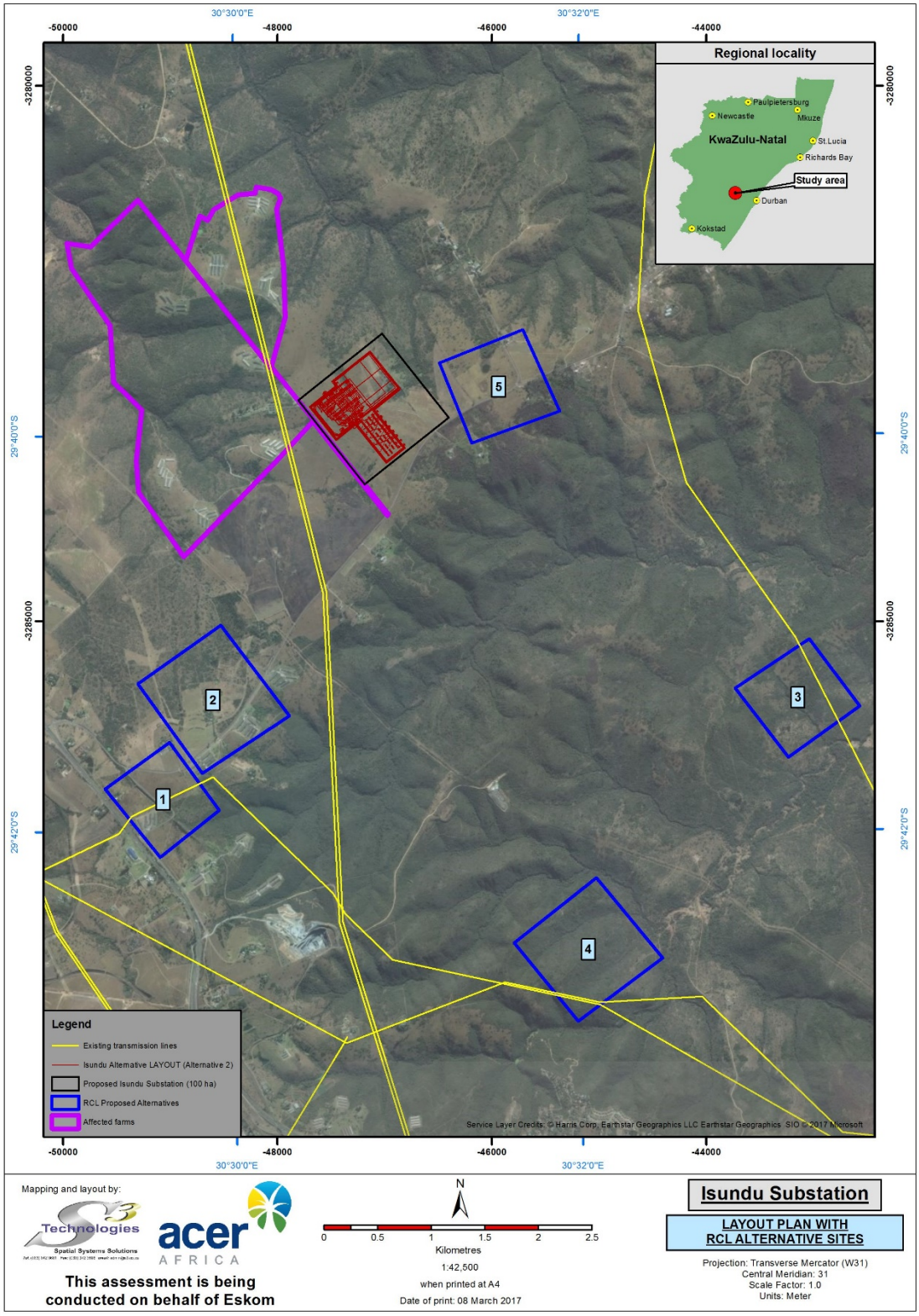

Figure 7 RCL Food's suggested alternatives

4.5 Layout alternatives

Two layout alternatives for the Isundu sub-station on the proposed 100 ha area have been considered during this assessment. Layout options are limited by needing to optimise the position of the infrastructure on the site to minimise the earthworks required, whilst also needing to ensure that the layout will be able to accommodate the required transmission lines (taking note of the direction of the transmission lines entering and exiting the sub-station).

The two sub-station layout alternatives considered are shown in Figures 8 and 9.

At a key stakeholder meeting between RCL and Eskom on 12 November 2015, RCL requested that a change to the layout of the sub-station be considered so that the part to be constructed first would be furthest from them, i.e. the bulk of the layout from Layout 1 be combined with the 400 kV yard of Layout 2.

However, this alternative layout is not considered feasible for two main reasons. Firstly, it will not optimise the layout of the sub-station site in terms of cut and fill requirements, and would possibly result in the 400 kV yard needing to be orientated differently, thus, increasing the transmission line impacts on surrounding developments. If the 400 kV yard is not reorientated, it would make access using the existing road difficult, thus, increasing the earthworks required to construct an alternative access road. Secondly, any future anticipated DC transmission lines could ultimately have a higher impact on RCL than the currently proposed 765 kV transmission line.

Figure 8 Layout 1: 400 kV yard facing the road and space for future lines on the west

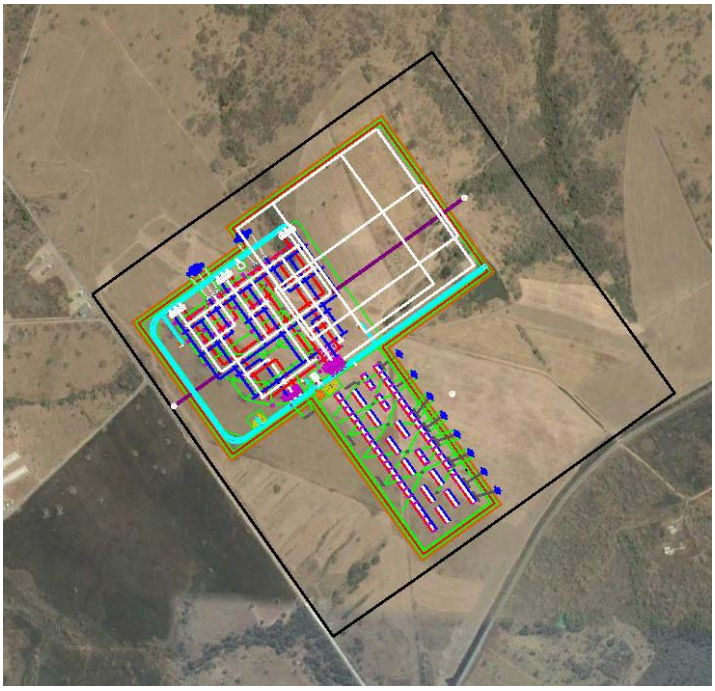

Figure 9 Layout 2: 400 kV yard parallel to the road and space for future lines on the north-east

4.6 No development alternative

Eskom has investigated numerous alternatives since 2008 in order to meet future demands and improve the reliability of electricity supply to the KZN Midlands and southern regions. None of these other alternative sites have proved suitable and the previously authorised Sigma 1 site is now no longer considered a feasible alternative.

Thus, currently, the only two site alternatives under consideration are either to construct the Isundu sub-station on the site proposed or the no-development option. The no-development option will mean that Eskom will need to further delay grid improvements and continue further investigations to try and identify other potential sub-station sites. Any sites would need to be further away as all options near the VSHA corridors have been exhausted. This would then also result in a significant rerouting of the authorised transmission line corridor. Apart from this, due to the Ferranti Effect and the location of the load centres as discussed in Chapter 3, it will become increasingly difficult to identify a suitable site that still meets the overall objectives of the KZN Strengthening Programme.

The no-development option has been assessed. However, it will mean that Eskom's distribution system will come under increasing pressure to reliably supply electricity to the KZN Midlands and southern regions, whilst further investigations are undertaken.

This is not an attractive option. Over recent years, electricity supply nationwide has been under pressure, with rolling blackouts and load shedding, as a direct result of the lack of generation capacity in the country. The new Medupi and Kusile coal fired power stations, the first to be built for 20 years, will address this lack of generation capacity.

However, if significant delays occur in increasing and strengthening the electricity transmission network and infrastructure, the additional available power generated will not be able to benefit customers.

Thus, without the required sub-station in the KZN Midlands, a key component of the KZN Strengthening Programme, as demand grows relative to the available transmission capacity, the risk of load-shedding and blackouts will arise and possibly increase over that previously experienced.

5. PROJECT DESCRIPTION

5.1 General sub-station infrastructure

A sub-station is an important element of an electricity generation, transmission and distribution system. Its function is mainly to transform voltages from high to low or the reverse, using transformers and other heavy-duty electrical switchgear. Sub-stations are generally designed to accomplish the following functions:

- Stepping up or stepping down voltage.
- Regulating voltages to compensate for system voltage changes.
- Switching transmission and distribution circuits into and out of the grid system.
- Measuring the electric power qualities flowing in the circuits.
- Connecting communication signals to the circuits.
- Control of electrical surges, including from lightning.
- Connecting electric generation plants to the system.
- Facilitating interconnections between the electric systems of more than one utility.
- Controlling reactive kilovolt-amperes supplied to, and the flow of reactive kilovolt-amperes in the circuits.

Table 7 lists the typical components of a sub-station and their functions. Plates 1 – 5 illustrate selected components.

Table 7 Sub-station components and their functions

Equipment	Function
Transformers	To step-down or step-up voltage and transfer power from one current to another. The windings of such large transformers are immersed in transformer oil, which is a highly refined mineral oil that is stable at high temperatures and has excellent electrical insulating properties. Its functions are to insulate, suppress corona and arcing, and to serve as a coolant for transformers
Circuit breakers	Automatic switching during normal or abnormal conditions
Feeder bay	Steelwork housing for circuits
Reactors	Equipment for the efficient operation of long transmission power lines as they compensate the voltage on power lines to avoid uncontrolled voltage rise, especially on lightly loaded lines
Isolators	Equipment for de-energising a circuit for maintenance and repair
Busbars	Incoming and outgoing circuits of the same voltage tie into a common node called a busbar, which consists of a number of tubular conductors made of aluminium
Oil holding bund	For containment of accidental oil spills from transformers
Wave trapper	Equipment for trapping communication signals sent via the transmission lines rather than the telephone network
Loop-in lines	Incoming power lines (connected to busbars)
Loop-out lines	Outgoing power lines (connected to busbars)
Telecommunication mast	Equipment used for remote communication with the sub-station
Buildings	Administrative office, control room, ablution blocks, equipment and storage areas
Lighting	For safety and security as well as for night-time emergency operations and maintenance

Plate 1 Sub-station busbars

Plate 2 Transformers

Plate 3 Transformer showing oil storage and fans for cooling

Plate 4 Sub-station and communication tower

Plate 5 Oil holding bund

5.2 Proposed Isundu Sub-station infrastructure

5.2.1 Electrical infrastructure

The proposed Isundu Sub-station is being planned to accommodate the following transmission lines:

- 1 x 765 kV transmission line (the authorised VSHA transmission line corridor).
- 2 x 400 kV double-circuit transmission lines from the sub-station to tie into the existing Hector-Ariadne 400 kV double-circuit transmission lines approximately 4 km away.
- 2 x 400 kV lines from the proposed Mbewu Sub-station near Empangeni.

In addition, the site and layout design allow sufficient space to accommodate additional transmission lines if required at some point into the future. The space allowed will potentially accommodate the following additional transmission lines[5]:

- 1 x 765 kV or High Voltage Direct Current (HVDC) transmission line.
- 2 x 400 kV transmission lines.

The proposed sub-station will include the standard electrical components required such as transformers, reactors, busbars, isolators etc. as listed in Table 7.

Environmental authorisation has been applied for a 100 ha site. If fully developed into the future, the sub-station infrastructure footprint will be approximately 50-60 ha, whilst for the initial phase of development, the sub-station is likely to have a footprint in the region of 30 ha.

5.2.2 Other infrastructural components

Other infrastructure included in this application is as follows:

- A tarred access road to the sub-station with a total width, shoulder to shoulder, of approximately 9 m. The length is estimated to be approximately 750 m.
- Access to the towers will be via tracks across the veld from within the corridor, wherever possible.
- A microwave radio communication mast with a height of approximately 75 m.
- Floodlight masts approximately 36 m high.
- Oil and fuel storage facilities, and an oil bund to contain any transformer oil spills with a capacity of ≥ 30 m³ but ≤ 80 m^3.

5.3 Proposed transmission lines

This environmental authorisation application also includes the construction of two double-circuit 400 kV transmission lines from the proposed Isundu Sub-station to the existing Hector-Ariadne 400 kV double-circuit transmission line.

The reason for proposing a double-circuit transmission line is that it will allow Eskom in the future to increase capacity at the sub-station without needing to secure an additional servitude to the immediate south of the sub-station, an area which is rapidly developing.

---

5 Whilst the design and space on the site may allow for these potential lines, there is no certainty at this stage what lines may be required, from which direction they may come and whether or not developments surrounding the sub-station in the future would make bringing in additional lines impossible or easier. Any future transmission lines will be required to undergo an EIA or any other regulatory process at the time.

Thus, the long-term planning advantage of constructing these towers now outweighs the financial disadvantage of constructing these more expensive towers over this short distance of approximately 4 km.

The required servitude for these 400 kV double circuit lines is 55 m for a single line and 110 m where the lines run in parallel (except if they go through forestry, which they do not in this area, where the servitude then increases to 131 m for a double-circuit transmission line).

The standard process for the construction of transmission lines is described in Section 5.5.

Plate 6 shows the existing Hector-Ariadne 400 kV double circuit transmission line towers which are 35.98 m high.

Plate 6 Double-circuit 400 kV transmission line

5.4 Sub-station construction

Construction of the sub-station is estimated to take three years. This entire time will not necessarily consist of the civil works which is usually when the main noise, dust and transport impacts occur.

Table 8 provides an approximate breakdown of the timeframes anticipated for each stage based on the construction programme of Lambda Sub-station, a similar sized sub-station also including 765 kV and 400 kV yards.

Table 8 Approximate sub-station construction timeframes

Construction Stage	Approximate Duration*
Civil Works	**21 months**
Bulk earthworks (site establishment, bulk earthworks and terracing, road works etc.)	8 months
Civil construction (foundation construction, buildings, fencing, steelwork, yard stone/paving)	13 months
Installation and Commissioning	**20 months**
Installation of transformers, reactors, busbars	4 months
Stringing, cabling and earthling	7 months
Final commissioning	9 months

* The total estimated construction timeframe is estimated at three years (36 months). This table gives an approximate breakdown of different stages. Please note that some of these stages overlap and are not necessarily finalised prior to the next stage commencing.

Construction will commence with the clearing of vegetation, and the levelling and terracing of the ground surface in those areas where heavy electrical transformers and other switchgear will stand. Once levelled and terraced, the concrete works and construction of foundations for the supporting steelwork, transformers and other switchgear will commence. This will also include the construction of storm water drainage pipes, slabs, bund walls, a control room, small buildings and storage areas that are needed.

All open areas between the transformer plinths and other switchgear foundations will be covered with about a 100 mm layer of 25 – 38 mm crushed stone. Before laying the crushed stone, the ground surface is intensively treated to strict specification with insecticide and herbicide to prevent insect activity and the growth of weeds and other plants in the high voltage yard.

The steelwork will then be erected. The transformers, circuit breakers, reactors and other high voltage equipment will be delivered to site, erected and then commissioned. The sub-station will be built in phases. As the demand for power increases, so the number of incoming and outgoing transmission lines with their electrical switchgear will be increased.

The sub-station will be served by a tarred access road which will probably run on a similar route to the existing farm access road. Around the site there will be internal gravelled traffic areas for access to the electrical equipment.

All equipment, commissioning, and operational procedures and protocols are subject to strict specifications which Eskom has had in place for many years.

During construction when the civil works are being carried out (foundations, storm water drainage, buildings, etc), there should not be more than approximately 80 people present on the site at any one time. Construction staff will not be housed on site but transported to site each day.

No people will be housed on site on a permanent basis during the operational life of the sub-station. However, there will be ongoing monitoring and control of operations as well as planned and other maintenance work done on an *ad hoc* basis.

5.5 Construction and operation of a transmission line

Typical steps followed by Eskom in the construction and operation of transmission lines are outlined below.

With respect to construction:

- Aerial survey of the route.
- Determine technically feasible alignments within the authorised corridor.
- Walk down by environmental specialists to assess specific tower locations.
- Negotiation of a final servitude alignment within the authorised corridor with landowners.
- Selection of best-suited structures and foundations.
- Final design of line and placement of towers.
- Establishment of construction camps and construction of access roads, where necessary.
- Vegetation clearance and gate erection.
- Centre line track establishment.
- Construction of foundations.
- Assembly and erection of towers.
- Stringing of conductors.
- Rehabilitation of working areas and protection of areas susceptible to erosion.
- Testing and commissioning.

During operation, Eskom requires access to the servitude to enable maintenance of the transmission and distribution power lines. This could require traversing private property. Maintenance is carried out at regular intervals, and is often done by helicopter in inaccessible areas. Maintenance activities are highly specialised and are, therefore, carried out by Eskom employees/contractors.

The transmission line servitudes will need to be cleared occasionally to ensure that vegetation and trees, including the management of alien species, do not interfere with the operation of the transmission lines. Relevant specifications regarding maintenance are provided in the EMPR.

Different tower designs, such as Guyed-V Suspension or Cross-roped Suspension are used whilst Self-supporting Strain Towers will be required for bends greater than 3º and/or when crossing difficult terrain. Figure 10 and Plate 7 illustrate these different designs.

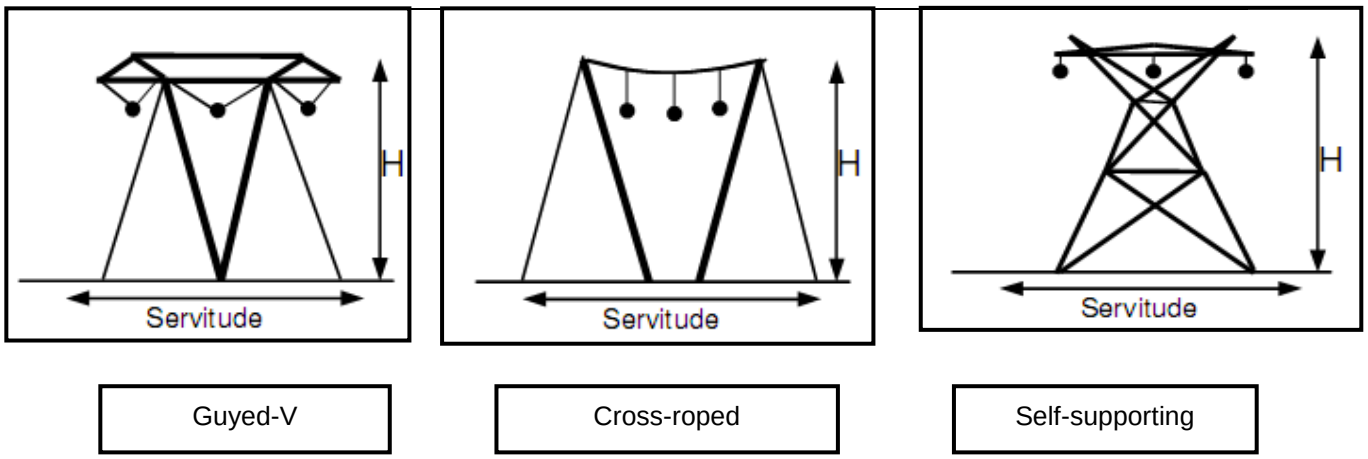

Figure 10 Typical tower types

Plate 7 Two tower types on existing parallel transmission lines

5.6 Servitude negotiations and registration

Before construction commences, Eskom needs to purchase the land for the sub-station and also secure servitude rights for the transmission lines by negotiating with affected landowners. A servitude provides Eskom certain defined rights over the use of the specific area of land but not ownership thereof. These rights include:

- Access to erect a power line along a specific agreed route.
- Reasonable access to operate and maintain the power line inside the servitude area.
- The removal of trees and vegetation that will interfere with the operation of the power line. If other structures not permitted exist within the servitude they may need to be removed. However, this forms part of the negotiation process with landowners and the planning of the agreed route.

The registration of servitudes can be a lengthy process requiring contractual negotiations with each affected landowner. Once this is complete, an application for registration of the servitude is lodged with the Provincial Deeds Office against the property title deed.

The actual location of the towers on which the conductors will be strung is determined by a number of different factors, including:

- The outcome of Eskom negotiations with landowners.
- Environmental features and technical requirements.

As a result of these factors, it is not possible to predict the exact position of the towers during the environmental authorisation process as these positions are only determined after authorisation, with site-specific input from specialists.

5.7 Use of services and resources during construction

5.7.1 Water

Water will be required for potable use and for construction of the sub-station. This will be obtained from the existing municipal supply.

5.7.2 Sewage

Sewage during construction will be managed on site through the use of portable toilets. During operation, sewage flows will be minimal and sewage will be directed into a sealed conservancy tank of less than 10,000 m^3. When full, a sewage truck will pump it empty and dispose of the waste at a licensed sewage treatment plant.

5.7.3 Roads

The existing road to the site will be used during construction and operation. For the construction of a sub-station like Isundu, the construction period would be around three years but not all of this time would entail heavy civil works. Heavy civil works would most likely take between 13 - 20 months.

For this period of the construction programme, it is envisaged that trucks will probably be running from 07:00 to 19:00 spoiling or delivering material for the platform, or ready mix concrete for foundations. Thereafter, steel work deliveries will take place. It is estimated that there will be potentially an average of two trucks per hour for a period of about two years.

The use of roads on private property for construction of the transmission line towers is subject to the provisions of an Environmental Management Programme (EMPR) that will be prepared for the project (with individual landowner specifications being determined during discussions with landowners during the negotiation process).

5.7.4 Storm water

Storm water infrastructure will be carefully designed and managed during the construction of the sub-station terrace and internal roads. Storm water will be diverted into the surrounding fields at low energy levels to make sure that erosion is avoided in and around the site. This will be in accordance with Eskom's Guidelines for Erosion Control and Vegetation Management. A Storm Water Management Plan is provided in the EMPR and also included in the Water Use Licence Application.

5.7.5 Solid waste disposal

All solid waste will be collected at a central location on the construction site and will be stored temporarily until removal to waste disposal facilities licensed to accept particular waste streams. Recycling of recyclable substances will be done where possible.

5.7.6 Electricity

Electricity will be required during construction. If the current supply to the property is insufficient a 22 or 33 kV power line will be constructed from the outset of the construction process. Prior to this, diesel generators will be utilised for the provision of electricity.

5.7.7 Local labour

The exact number of people that will be employed during construction is unknown at this stage. It is anticipated that the workforce for the construction of the sub-station and transmission lines will vary in number depending on the level and nature of construction activity taking place, and, as construction activities will not be continuous, people will be employed at specific times throughout the construction process over a wide area.

It is important to note that the construction of electrical infrastructure is a specialised undertaking, requiring skilled people. It is probable that the appointed contractors will bring in skilled labour from other areas. By implication, job opportunities for local people will be limited to unskilled jobs. Apart from direct employment, local people and businesses will benefit through the supply of goods and services to the appointed contractors.

5.8 Decommissioning

The process of decommissioning any major electrical infrastructure, such as sub-stations and major power lines[6], has yet to take place in South Africa. Thus, the decommissioning of the sub-station is not envisaged at this point. However, should decommissioning be required, the following are assumed:

- The physical removal of the sub-station infrastructure and rehabilitation of the site would be required, unless alternative land-uses are authorised.
- Removal of the transmission towers and rehabilitation of the sites would need to be agreed upon with the landowners before being implemented.
- The disposal of materials from the decommissioned sub-station would be at waste disposal facilities licensed to accept particular waste streams. Alternatively, recycling opportunities could be investigated and implemented.
- Specific considerations regarding the servitude and landowner rights would need to be negotiated with the landowner at the time of decommissioning.
- The final decommissioning plan would identify site specific impacts relevant to the time of decommissioning, including residual impacts (for example, alien plant invasion and soil erosion) and provide appropriate mitigation and monitoring measures.

All of the afore-mentioned would be subject to legislative requirements at the time.

6 Smaller electrical infrastructure has been decommissioned in South Africa in the past.

6. PUBLIC PARTICIPATION PROCESS

The public participation process has been designed to comply with the requirements of the EIA Regulations (Sections 54 to 57 of Regulation 543) and NEMA as well as aligning the process with the relevant DEA public participation guidelines. The important elements relating to the public participation process that are required by the Regulations are the following:

- The manner in which potential I&APs were notified of the application for environmental authorisation, and that a public participation process was mandatory. This includes on-site notice boards, giving written notice to landowners, letters, background information documents and advertisements in the media (Section 54).
- Opening and maintaining a register, which contains the names and addresses of I&APs. These include all persons who have submitted comments, attended meetings, are organs of State who have jurisdiction in the assessment process, and all those who have requested that they be placed on the register as registered I&APs (Section 55).
- Registered I&APs are entitled to comment, in writing, on all written submissions made to the competent authority by the applicant or the Environmental Assessment Practitioner managing the application, and to bring to the attention of the competent authority any issues, which that party believes may be of significance when the application is considered for authorisation (Section 56).
- The comments of registered I&APs must be recorded and included in the reports submitted to the competent authority (Section 57).

Public participation in an EIA aims to provide sufficient and accessible information to I&APs in an objective manner to assist them to:

- During the Scoping Phase.
  - Identify issues of concern, and provide suggestions for enhanced benefits and alternatives.
  - Contribute local knowledge and experience.
  - Verify that their issues have been considered.

The key objective of public participation during Scoping is to assist to define the scope of the technical specialist studies to be undertaken during the Impact Assessment.

- During the Impact Assessment.
  - Verify that I&AP's issues have been considered either by the EIA Specialist Studies, or elsewhere.
  - Comment on the findings of the Environmental Impact Assessment Report (EIAR), including the measures that have been proposed to enhance positive impacts and reduce or avoid negative ones.

Sections 6.1 and 6.2 outline the process followed to date.

6.1 Public Participation during Scoping

The public participation process followed during Scoping is outlined in the Final Scoping Report (FSR). In summary this included the following activities:

- Notification of the application.
- Identification and registration of Interested and Affected Parties (I&APs) on the database.
- Announcement of the project in the media, distribution of a Background Information Document and placement of an on-site notice board.
- Various individual stakeholder meetings were held.
- A public meeting was held on 3 December 2014 during the project announcement phase.
- The draft Scoping Report was made available for public review for a period of 40 calendar days (29 April 2015 – 9 June 2015).
- A public meeting was held on 12 May 2015 to present and discuss the findings of the draft Scoping Report.
- The Final Scoping Report (FSR) was made available on the website and all I&APs were notified of the availability of the report via personalised letters and emails.

The public participation process undertaken during Scoping was accepted as sufficient by DEA, as verified by DEA's acceptance of the Scoping Report and directive to proceed with the Impact Assessment (Appendix 1 contains DEA's letter of acceptance of the Final Scoping Report).

Issues and concerns raised by I&APs were captured in a Comments and Responses Report (CRR), which was appended to the FSR. This CCR has been updated during the Impact Assessment phase and is included in Appendix 3.

6.2 Public Participation during Impact Assessment

6.2.1 Stakeholder Database

The stakeholder database (Appendix 4) was updated during the Impact Assessment phase as required.

6.2.2 Stakeholder consultation and discussions

During the Impact Assessment phase, stakeholder consultation included engagement between the EAP and I&APs as well as between I&APs and specialists.

This included meetings between the Social/Spatial Planning, and Tourism and Economic Development specialists with:

- Representative of the Natal Lion Park/Zoological Gardens.
- Aloe Wildlife Estate developer.
- Mkhambathini Municipality.
- Mayibuye Game Reserve representative.

In addition, there has been a range of email and telephonic discussions between the Tourism and Economic Development specialist and representatives of the African Bird of Prey Sanctuary/Raptor Rescue.

The Tourism and Economic Development specialist also liaised with RCL Foods and their representative, Eversheds, on the following dates:

- 18, 25, 26 and 29 June 2015.
- 7, 8, 9 and 22 July 2015.
- A conference call on 23 July 2015.
- 19 and 25 August 2015.

Eskom and the EAP arranged specific key stakeholder meetings with the following stakeholders:

- Rainbow Chicken Limited on 12 November 2015.
- Mkhambathini Local Municipality on 12 November 2015.

The purpose of these meetings was to discuss and present the preliminary specialist findings, the envisaged impacts and to discuss the feasibility of mitigation measures. The minutes of these meetings are contained in Appendix 3.

6.2.3 Announcement of DEIAR for public review and availability of draft report

I&APs were provided with an opportunity to review and comment on the DEIAR for a 40 day period between **31 October 2016 to 15 December 2016**. The DEIAR, including a CRR and Comment Sheets, was distributed for comment as follows:

- Distributed letters (in English), including an executive summary of the DEIAR, to all registered I&APs informing them of the availability of the DEIAR and comment period (Appendix 2) as well as the public meeting to be held.
- Distributed hardcopies and CDs of the DEIAR to the following public places for public review and comment:
  - Camperdown Public Library.
  - Cato Ridge Public Library.
  - Msunduzi Local Municipality.
- Placement of the draft EIAR on the ACER website (www.acerafrica.co.za).
- Advertisements were placed in local and provincial newspapers announcing the availability of the DEIAR, how it could be accessed and details of public meetings.

6.2.4 Meetings to present the findings of the DEIAR

The findings of the DEIAR were presented at a public meeting held on 16 November 2016.

During the DEIAR public comment period, the following key stakeholder meeting were arranged with specific stakeholders:

- RCL Foods on 7 November 2016.
- Aloe Wildlife Estate developer on 8 December 2016.
- ABOPS and Raptor Rescue on 8 December 2016.

The minutes of these meetings are included in Appendix 2.

6.2.5 Obtaining and dealing with DEIAR comments from I&APs

The following opportunities were provided to I&APs to contribute comments on the DEIAR:

- Completing and returning Comment Sheets.
- Providing comments by telephone, fax or email.
- Commenting during the public meeting.
- Commenting during Key Stakeholder meetings.

The comments submitted in response to the DEIAR and responses thereto, are provided in the updated Comments and Responses Report (Appendix 3).

Importantly, not all correspondence relating to this project was submitted to ACER's public participation office. Eversheds, in their representation of RCL Foods, at times submitted correspondence to ACER, at other times submitted correspondence directly to Eskom whilst at other times submitted correspondence directly to National DEA. Not all of their correspondence was addressed or copied to ACER. Thus, ACER cannot be held responsible for any correspondence or concerns raised which were not submitted as part of the EIA process to the public participation office.

6.2.6 Public participation after DEIAR public comment period

After the public review period, additional comments were still received and addressed in the FEIAR and included in the CCR.

An Authorities' site visit was held on 14 March 2017 in response to their submission on the DEIAR.

In addition, a further stakeholder meeting was held with ABOPS' representatives on 13 March 2017 to discuss relocation and their terms of reference.

I&APs were informed of the FEIAR 21 days prior to the report being submitted to DEA. I&APs were directed to submit any comments on the FEIAR directly to the DEA with a copy to the EAP.

6.2.7 Notification of registered I&APs following a decision by DEA

Registered I&APs will be notified about DEA's decision on whether or not to authorise the project, as well as the appeal procedure which should be followed should a member of the public wish to appeal the decision. Notification will be via personalised letters, electronic communication and media advertisements.

7. STRATEGIC ELECTRICAL PROJECT PLANNING AND STAKEHOLDER PARTICIPATION

7.1 Electrical projects and stakeholder responses

South Africa has various legislative requirements which aim to ensure that the biophysical and social components of the environment are sufficiently considered during project planning. The environmental impact assessment process is one of these requirements. In order to ensure I&APs are provided with an opportunity to raise concerns and comment on proposed plans, the environmental impact assessment process includes mandatory public participation.

However, a common and almost universal response to any proposed project is for the majority of surrounding stakeholders to object to having any project affect part of their own environment, own neighbourhood, own property or plans, etc. This response is generally referred to as the 'Not in my Backyard' or NIMBY response.

Few stakeholders state outright that their objection is solely because they personally do not want a particular project near them and usually back up their objections with reasons and apparent or perceived facts. Conversely, stakeholders do raise valid concerns that either lead to a project concept being reconfigured, additional mitigation measures being incorporated into the design or in some instances the project being abandoned. Sometimes the reasons and objections submitted by stakeholders can be both a combination of valid concerns mixed with personal objections. Personal objections can be disguised under spurious reasons included to try and add weight to the overall objection.

Given that the environmental impact assessment process is a scientific one, it falls to the assessing EAP and the specialists to evaluate the legitimacy of all the issues and concerns raised by stakeholders.

An objection, no matter how carefully worded or supported by petitions etc, still needs to be evaluated and examined. Furthermore, an objection does not necessarily constitute a fatal flaw to any proposed project.

If the latter were the case, there would be no electricity coverage in South Africa, as it is noticeably apparent that when it comes to large electrical infrastructure, there are no stakeholders who wish to reside next to either sub-stations or transmission lines. Yet, due to a lack of generation capacity over the past decade, all South Africans now recognise clearly the need and economic importance of reliable electricity supplies.

As stated in Section 4.6, the electricity supply nationwide has been under pressure, with a recent history of rolling blackouts and load shedding, as a direct result of the lack of generation capacity in the country. The new Medupi and Kusile coal fired power stations, the first to be built for 20 years, will come on line over the next few years and will address this lack of generation capacity.

However, if Eskom were to focus only on the generation capacity for the country and not also on the transmission capacity to different parts of the country, it could result in a similar risk of load-shedding and blackouts, albeit for a different technical reason.

Since 2009, Eskom has been investigating options to strengthen the transmission capacity into KZN. As shown in Figure 3, this KZN Strengthening Programme aims to strengthen the network bringing power into two key areas of KZN and to link them to improve reliability. Thus, should there be maintenance or repair issues required on the transmission lines between Mpumalanga and Richards Bay, electricity can still be transmitted to Richards Bay via the KZN Midlands, and alternatively, power could still be routed to Pietermaritzburg, Durban and the south coast if maintenance or repair is required on the Mpumalanga to Pietermaritzburg transmission lines.

In addition, this link into the KZN Midlands is also the link for strengthening supply to Durban, the KZN south coast and parts of the Eastern Cape.

7.2 Particular challenge of the KZN Midlands

The KZN Midlands is a relatively unique area of KZN in that there is a range of land-uses, economic sectors and stakeholders all situated in close proximity. This has made the identification of suitable transmission line routes and sub-stations sites more challenging.

Previously, stakeholders in the forestry sector raised concerns as to why electrical infrastructure should not be placed within forestry areas. The Midlands cane growers raised concerns about their challenges associated with burning sugarcane under transmission lines and the impact upon the sector, and proposed that a transmission corridor to the west of Albert Falls Dam be considered along with sub-stations sites south of the cane growing region.

This additional corridor to the west was duly considered but stakeholders in this area objected citing negative tourism impacts and formed a ‘No Eskom Blue Route’ committee which set about raising numerous issues and objections, some valid, some not. This corridor was not recommended primarily because of the impact upon the Shafton Airfield (a key airfield used in the fighting of wildfires in the KZN Midlands).

The feasible sub-stations identified at that stage south of the Midlands cane growing area were in the industrial area of Cato Ridge. Here, the general objections raised by others and the municipality were in regard to sterilising valuable and scarce industrial land.

With the current Isundu sub-station proposal, the nature of the responses is again one of various stakeholders presenting facts and figures as to why this area should not be considered for the sub-station.

These claims and figures also needed to be investigated and verified, which forms part of this impact assessment process.

The key overarching issue, which both the EAP and stakeholders need to keep in mind is that this infrastructure is aimed at benefiting the whole of KZN over the long-term. In this regard, all KZN stakeholders will recognise and want to have the infrastructure in place, but it is not likely that Eskom will ever be able to find a location where those adjacent to the site will not consider the proposed site unsuitable.

7.3 Unique challenge of the proposed Ashburton site

Added to the challenges discussed above is that some of the local objections raised to the siting of the proposed Isundu sub-station are based on possible impacts on planned or proposed projects.

Both locally and internationally there are numerous planned and proposed projects, both in the form of individual projects or regional developments in a specific economic direction or extent. However, history shows that the reality is that many of these projects or concepts never materialise as a host of factors can influence economic decisions and the development direction of an area or project. The Tete region of Mozambique is a recent example. Over the past decade there was significant mining interest in this region, which for various reasons has now reduced considerably from previous expectations and promises.

This assessment needs to consider the impact of the proposed sub-station on both existing and future plans, while also considering the impact upon the rest of KZN, if the capacity to meet electricity demands is delayed for a proposed project which potentially may never materialise as envisaged, either because of overstated expectations or other economic, investment or socio-political issues.

8. DESCRIPTION OF THE RECEIVING ENVIRONMENT

The following section provides a brief overview of the general characteristics of the receiving environment that may affect or be affected by the proposed sub-station and turn-in transmission lines. More detailed descriptions of specific aspects are contained in Chapter 10, which covers the findings of the specialist studies.

8.1 Biophysical environment

8.1.1 Topography and geology

The proposed Isundu Sub-station site is situated near Ashburton, KwaZulu-Natal (Plates 8 – 11). The topography of the site is undulating with local high points along the south-east and north-west borders. From here, the ground slopes down with gradients of between 1:50 and 1:15.

The site is underlain at a relatively shallow depth by Diamictite sedimentary rock layers and boulder shales belonging to the Dwyka Formation within the Karoo Sequence. These occur as a very soft to soft rock tillite, which is overlain by a horizon of medium dense to dense residual soil. A thin colluvial horizon, on average 0.7 m thick, covers the entire site (Geopractica, 2012).

The slopes in the area are essentially gently sloping and the Tillite bedrock is generally known to be a fairly stable rock formation. There is no evidence of existing slope failures. The soils on site are essentially firm/stiff and commonly vary between clayey sands and sandy clays, often cemented in places. No deep soft consolidating soil profiles were encountered in valleys within the site footprint. Loose, low cohesion sandy soils (i.e. the more sandy Hillwash/Colluvium where present) are susceptible to erosion via wind and flowing water especially given the undulating topography of the site (Drennan Maud, 2016).

8.1.2 Hydrology

The annual rainfall in this area is approximately 860 mm, mainly occurring over the summer rainfall period between October and March. There are small seasonal streams with associated riparian vegetation on the north and north-east side on the Isundu site. These include several rivers and drainage lines that are tributaries of the uMsunduze, Mpushini and Mshwati Rivers, which ultimately form part of the greater uMngeni River system.

There are a range of small farm dams on and surrounding the proposed site. The largest of the farm dams is located in the north-east portion of the Isundu site, whilst a smaller dam is situated on the northern drainage line. These dams have been excavated within the riparian area to intercept surface and groundwater flow.

Four depression wetlands and three hillslope seepage wetlands occur on site.

8.1.3 Vegetation

The Isundu Sub-station is situated within the vegetation type described by Mucina & Rutherford (2006) as KwaZulu-Natal Hinterland Thornveld.

Plate 8	**Isundu site – southern views**		**Plate 9** **Isundu site – southern views**

Plate 10	**Isundu site – northern views**		**Plate 11** **Isundu site – northern views**

This vegetation unit falls within the Savannah Biome and occurs in KwaZulu-Natal in patches scattered immediately above Eastern Valley Bushveld, at altitudes of 450 - 900 m. This vegetation type mainly occurs in the Mpisi, Mvoti, Umgeni, Mlazi, Lufafa and Mtungwane Catchments. The climate is summer rainfall with some winter rain and infrequent frost. The vegetation is characterized by open thornveld dominated by *Acacia* spp. on undulating plains found on upper margins of river valleys. None of this vegetation type is conserved in statutory conservation areas. Twenty two percent has been transformed for cultivation and urban development (Mucina & Rutherford, 2006).

Seven plant communities were identified on the sub-station site, together with two plant associations. These include a range of terrestrial, riparian and wetland communities, both herbaceous and woody. The riparian areas support hydrophilic vegetation ranging from reedbed through to hydrophilic and terrestrial grasses, forbs and sedges.

MINSET biodiversity priority areas were investigated and informed the specialist findings.

8.1.4 Fauna and Avifauna

The site supports a low to moderate diversity of fauna, primarily as a result of the vegetation type being predominately disturbed grassland. However, the wetland and aquatic habitats provide suitable habitat for a variety of amphibian species. Two mammals of conservation concern include the Oribi (*Ourebia ourebi)* and Rough-haired Golden Mole (*Chrysospalax villosus).*

8.2 Socio-economic environment

The proposed Isundu Sub-station site falls within the Mkhambathini Local Municipality. Camperdown, to the south, is largely regarded as the main growth and economic centre in the municipality. The population of this local municipality has fluctuated over the past decade, which is possibly due to the in- and out-migration that takes place in the area. Household incomes have increased since 2001 but still are well below the South African average.

The proposed site is on land zoned in the Mkhambathini SDF as ‘Agricultural Tourism’ (or Agricultural Eco-tourism) and falls within a rural/urban fringe area that has a mixture of agricultural enterprises and rural farmland.

Agriculture is an important contributor to the economy and the region has the second highest concentration of poultry producers in the world, supported by a network of service providers. Pig, beef and vegetable farming are also undertaken (Mkhambathini IDP, 2013/14).

Tourism is a sector which has been identified as a potential area of economic growth and the area surrounding the proposed sub-station site consists of a mixture of agricultural and tourism-related enterprises. Future development plans focus on tourism and eco-residential estates. Large tracts of land surrounding the sub-station site, and the site itself, are subject to land-claims and, thus, new developments are being undertaken in conjunction with surrounding communities (land claimants).

The important surrounding land uses and enterprises are:

- African Bird of Prey Sanctuary and Raptor Rescue approximately 800 m to the south of the sub-station site.
- The Natal Zoological Gardens and Natal Lion Park, just over 1 km to the north-east of the sub-station site.
- RCL has various chicken farms, some within 500 m of the site to the north and north-west.
- To the south, directly across the road from the proposed sub-station site, is the developing Mayibuye Game Reserve.
- Approximately 800 m further to the south-west of the sub-station site are farms with plans currently being drawn up for the environmental authorisation of the proposed Aloe Wildlife Estate, with aero and equestrian facilities.

Note
The African Bird of Prey Sanctuary and Raptor Rescue are two separate organisations. The African Bird of Prey Sanctuary is a commercial company and is focused on the public display, education, flying and breeding of raptor species. Raptor Rescue is an NGO permitted to collect, transport, rehabilitate and release birds of prey. Raptor Rescue does not fly any birds and is also not open to the public. Both are permitted separately by EKZN Wildlife.

However, both organisations share the same property and there is synergy that allows the two entities to leverage from one another. Raptor Rescue receives a large portion of its funding from the commercial revenue generated by the Sanctuary, whilst Raptor Rescue has facilities (near the Natal Zoological Gardens) for breeding quail and obtaining meat from the Natal Lion Park for both Raptor Rescue and the Sanctuary.

Thus, throughout this report and the specialist studies, unless specifically stated otherwise, reference to the African Bird of Prey Sanctuary (ABOPS) also includes a reference to Raptor Rescue.

The establishment of a sub-station will invariably be associated with future transmission lines which need to reach the sub-station. These future transmission lines (which are not part of this application, such as the planned Mbewu-Isundu 2 x 400 kV transmission lines), can have an indirect or cumulative impact on these enterprises. These potential indirect and cumulative impacts as a result of the proposed sub-station have been considered as part of this application.

8.3 Existing infrastructure and services

Existing infrastructure and services to note within the Isundu study area include the National Route 3 highway (N3) and the existing P477 Lion Park road which runs past the sub-station site.

Transnet has an existing fuel pipeline within the Isundu study area, running to the south-east of the proposed sub-station. The 2 x 400 kV transmission lines will need to cross this pipeline in order to connect into the existing Hector-Ariadne 400 kV double circuit line.

Umgeni Water recently constructed a 350 mm diameter water pipeline along the P477 on the same side as the proposed Isundu Sub-station. Umgeni Water has registered a 6 m servitude along the southern portion of the Isundu site. Whilst this is not affected by the sub-station layout, it will need to be taken into consideration, particularly during the construction of the access road. Also, the 2 x 400 kV transmission lines will need to cross this water pipeline in order to connect into the existing Hector-Ariadne 400 kV double circuit line.

9. METHODOLOGY USED TO DETERMINE SIGNIFICANCE OF POTENTIAL ENVIRONMENTAL IMPACTS

9.1 Assessment methodology

Issues and potential impacts of the project on the environment (and *vice versa*) were identified during Scoping by way of field investigations, desktop studies and interaction with I&APs.

Key issues and impacts requiring further investigation were addressed by specialist studies and/or further detailed input from the environmental and technical team. Specialist studies were guided by Terms of Reference[7] to ensure that issues and associated impacts were correctly identified, understood and addressed, thereby enabling an integrated assessment of the development proposal.

However, it is important to recognise that each specialist study is primarily a short-term study providing input only on what can be a relatively specific component of the project and/or its impact upon an aspect of the environment or stakeholder. In this regard, specialists provided a qualitative assessment of the relevant issues identified in their assessment, according to the assessment conventions outlined in Table 9.

Thereafter, it was the role of the EAP, with assistance from the specialists, to collate, evaluate and integrate the information provided by the different specialist studies, in order to gain a holistic understanding of the various potential impacts and the relationships between them. The EAP also applied the assessment conventions (Table 9) qualitatively, based on an understanding of the receiving environment, the proposed project components and activities, and the information gathered from different sources, including specialists and the public.

Overall, the significance of an impact is based on a range of important criteria and principles. These include aspects listed in Table 9, such as the frequency, extent and probability of the impact, etc. Other aspects taken into account include:

- Level of public concern.
- Irreplaceable loss or deterioration of biodiversity, valued resource stocks or ecosystem services.
- Foreclosure of land and resource use opportunities.

The important principles taken into account are those of NEMA, viz.:

- Development must be socially, environmentally and economically sustainable.
- Sustainable development must consider, among others, that:
  - The disturbance of ecosystems and the loss of biological diversity are avoided or, where they cannot be altogether avoided, are minimised and remedied.
  - That pollution and degradation of the environment are avoided, or, where they cannot be altogether avoided, are minimised and remedied.
  - That a risk averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions.
  - Responsibility for the environmental health and safety consequences of a policy, programme, project, product, process, service or activity exists throughout its life cycle.

[7] Terms of reference for each specialist are contained in the relevant reports (Appendix 5).

Table 9 Conventions applied to the impact assessment

Criterion	Description
Nature	An impact is either positive or negative. Importantly, even after mitigation, few negative impacts become positive. Most negative impacts will remain as negative impacts. However, after mitigation, significance should reduce.
Extent	Describes the spatial scale of the impact: ❑ Local – limited to the immediate area(s) around the project site. ❑ Regional – extends over a larger area that would include a major portion of an area or province. ❑ National/International – an even wider area that would have national or international implications.
Duration	Provides a prediction of whether the duration of the impact would be: ❑ Short-term (0 to 3 years) – or confined to the construction period. ❑ Medium-term (3 to 10 years). ❑ Long-term (> 10 years). ❑ Permanent (beyond the anticipated lifetime of the project).
Intensity	This provides an order of magnitude of whether or not the intensity (magnitude/size/frequency) of the impact would be high, medium, low or negligible (no impact).
Frequency	This provides a description of any repetitive, continuous or time-linked characteristics of the impact(s) as: ❑ Continuous (i.e. without interruption). ❑ Intermittent (occurring from time to time, without specific periodicity). ❑ Periodic (occurring at more or less regular intervals). ❑ Once-off (occurring once over a specific period of time)
Probability	This provides a description of the probability of the impact actually occurring as: ❑ Improbable (very low to low likelihood). ❑ Probable (distinct possibility). ❑ Highly probable (most likely). ❑ Definite (the impact would occur regardless of prevention or mitigation measures).
Reversibility	This describes the ability of the impacted environment to return to its pre-impacted state once the cause of the impact has been removed as: ❑ Low (impacted natural, cultural or social functions and processes will never return to their pre-impacted state). ❑ Medium (impacted natural, cultural or social functions and processes will return to their pre-impacted state within the medium to long term). ❑ High (impacted natural, cultural or social functions and processes will return to their pre-impacted state within the short-term).
Irreplaceable Loss of Resources	This describes whether an irreplaceable resource is impacted upon or not: ❑ Yes. ❑ No.
Significance	The significance of the identified impacts on components of the affected environment (and where relevant, with respect to potential legal infringement) will be described as: ❑ Low, where the impact will not have a significant influence on the environment, and, thus, will not be required to be significantly accommodated in the project design. ❑ Medium, where it could have an adverse influence on the environment, which would require modification of the project design or alternative mitigation actions. ❑ High, where it could block the project regardless of any possible mitigation.
Confidence	Provides a measure of confidence in the assessment expressed as low, medium or high.

9.2 Assumptions, limitations and gaps in knowledge

9.2.1 General assumptions

- It is assumed that technical data supplied by the applicant are correct and valid at the time of compilation of the EIAR.
- It is assumed that data supplied by external institutions (for example, EKZNW C Plan and municipal reports such as IDPs and SDFs) were correct and valid at the time of compilation of the specialist reports and the DEIAR.
- It is assumed that the estimated numbers (tourists, production figures, etc.) provided by stakeholders are an accurate and a true reflection of actual figures.

9.2.2 Specialist assumptions, limitations and gaps in knowledge

The assumptions, limitations and gaps in knowledge stated in each specialist report are listed below.

AVI-FAUNA

This study made the assumption that the listed sources of information are reliable. The following factors may potentially detract from the accuracy of the predicted results:

- The SABAP1 data covers the period 1986-1997. Bird distribution patterns fluctuate continuously according to availability of food and nesting substrate. Data from the SABAP2 are becoming more abundant, are more recent, and are collected on a smaller spatial scale.
- Bird behaviour cannot be reduced to formulas that will hold true under all circumstances. By virtue of their mobility, birds are able to adapt and relocate rapidly, changing the location of predicted impacts. However, based on the experience of the avi-faunal specialist through the investigation of many localities in southern Africa where birds have interacted with existing power lines since 1999, the specialist has fairly high confidence to assess where impacts will occur.

VEGETATION AND WETLANDS

- Due to the large size of the study area, the assessment of transmission line alignment options was undertaken using existing biophysical data on the study area, available from various sources. The scale of enquiry was coarse and no detailed field survey and mapping of plant communities was undertaken for the transmission line corridor options. Eskom has indicated that once a preferred alignment has been selected, further detailed specialist surveys will be undertaken to inform the placement of towers along the route.
- It is important to note that the field survey of the sub-station site was undertaken in winter (May and June 2015) and the true botanical diversity present is under-represented by this study. In addition, parts of the study area had been mowed or burnt before being surveyed. However, the vegetation specialist surveyed the sub-station site in detail to identify Red Data, specially protected and other important species, as well as wetlands. The surrounding land use and condition of natural vegetation were surveyed to identify levels of disturbance and potential biodiversity issues.

FAUNA

- This study is based on a one-day investigation of the Isundu site and the broader study area (this includes the transmission line areas). Therefore, it was not possible to assess the full extent of the study area in detail and, thus, certain features may have been overlooked, particularly within the broader study area. However, the assumption applied is based on the representation of available habitats supporting fauna as opposed to detailed surveys of taxonomic groups.
- The fauna and aquatic/riparian specialist undertook site visits during June (fauna) and September (aquatic and riparian). A more appropriate time for frog assessments is between October and February, following rainfall events (as recommended as a mitigation measure during the pre-construction surveys should a positive environmental authorisation be received)[8].

ELECTRO-MAGNETIC FIELDS

- None listed.

SPATIAL PLANNING OVERVIEW

- All GIS data provided by the uMgungundlovu District Municipality Planning Department are accurate.
- All information received from Government Departments (Regional Land Claims Commission of KZN and Department of Cooperative Government and Traditional Affairs) is accurate.
- SDF shapefiles were not available for the Msunduzi LM.

SOCIAL IMPACT

- All information provided by other specialists (in particular, the visual, tourism and noise specialists) is accurate.
- A breakdown of skilled and unskilled labour was not available.

NOISE

- The exact modus operandi and equipment to be used during the construction phase of the project were not yet available and typical conditions were estimated from works at similar sites.
- The exact final layout of machinery and plant to be used for the sub-station works was unavailable and typical noise levels were predicted from measurements taken at similar sites.
- Corona: the cumulative effect of corona was not possible to predict. Some initial findings based on noise measurements taken at Zeus Sub-station were included in this report.

TOURISM AND ECONOMIC DEVELOPMENT

- None listed.

VISUAL IMPACT

- None listed.

[8] A species survey was subsequently undertaken during the summer season, the findings are included in Section 10.15.

CULTURAL HERITAGE

- The description of the proposed project, provided by the client, is accurate.
- The public consultation process undertaken as part of the Environmental Impact Assessment is sufficient and adequate, and does not require repetition as part of the heritage impact assessment.
- No subsurface investigation (including excavations or sampling) were undertaken, since a permit from Amafa is required to disturb a heritage resource.
- A key concept in the management of heritage resources is that of non-renewability: damage to or destruction of most resources, including that caused by bona fide research endeavours, cannot be reversed or undone. Accordingly, management recommendations for heritage resources in the context of development are as conservative as possible.
- Human sciences are necessarily both subjective and objective in nature. The specialist's staff members strive to manage heritage resources to the highest standards in accordance with national and international best practice, but recognise that their opinions might differ from those of other heritage practitioners.

AIR QUALITY

- No onsite weather data were available for analysis. Instead, meteorological data collected at Pietermaritzburg were sourced from the South African Weather Services (SAWS). It was assumed to be similar to the conditions at the proposed site for the sub-station and some motivation for this assumption has been provided in the specialist report.
- In the absence of detailed construction schedules and equipment, a generic emission factor was used to estimate inhalable and respirable particulate emissions. Furthermore, the size of the construction activities may vary during the course of this phase and a relatively small 5 ha to a larger 21 ha construction area, which could be active at any one time, were assumed in the calculation of impact distances. Furthermore, although Eskom estimated the average number of vehicles travelling along access roads to be two trucks per hour, a worse-case (peak-hour) of six vehicles per hour was assumed, thereby, for example, catering for early morning worker arrivals and evening departures.
- Having considered the potential negative effect that construction activities may have on the nearby chicken farms, particulate matter (specifically the inhalable fraction) was identified as the most significant. Benchmark concentration criteria were developed based on typical particulate concentrations in chicken houses and recommended occupational levels, as well as surrogate concentrations based on the National Ambient Air Standards of South Africa.

POULTRY/VETERINARY SPECIALIST

- None listed.

AQUATIC AND RIPARIAN ECOSYSTEM SPECIALIST

- The reference benchmark vegetation for the site is considered to be KwaZulu-Natal Hinterland Thornveld (SVs 3) (Rutherford *et al.,* 2006) and the bioregion is considered to be Sub-Escarpment Savanna (SVs) Bioregion (Nel *et al*., 2011). It is classified as least threatened at a provincial scale (Scott-Shaw and Escott, 2011).
- The assessment of Present Ecological State (PES) for each system was based on a rapid visual assessment of modifications to the biophysical drivers, and was principally based on the localised portion of the system observed.
- It was assumed that the identified systems within the site will be appropriately rehabilitated, particularly in terms of an alien invasive plant control programme.
- Post-construction monitoring of the systems will be conducted.
- The assessment techniques used in this study were developed relatively recently and in some instances, such as highly modified/transformed systems, they may have shortfalls.

However, such techniques have been compiled based on international best practice to apply to South African conditions, undergoing a peer review process during their development. They should, therefore, be seen as the most appropriate tools for assessments at this time.

- It was not possible to access all of the riparian systems within the study area, in particular, the systems east of the MR477 road due to the recent construction of a fence and gate for the Mayibuye Game Reserve. However, these riparian systems are less likely to be affected by the proposed project as they fall within an adjacent catchment area.
- This study included a description of the small farm dams located within the study area. Although classified as aquatic ecosystems, these systems are essentially artificial in nature, and no methods are available to assess the present ecological state of these systems.

BLASTING

- Considering the stage of the project, the data observed were sufficient to conduct the study. The study intended to address all aspects regarding the drilling and blasting process. Assumptions, where needed, were made based on best practice specifically for ground vibration, air blast and fly rock. These factors can be controlled and are manageable. The exact levels of noise were more difficult to predict but estimated indications of anticipated noise levels have been provided. It must be considered that surface surroundings change continuously and this should be taken into account prior to any final blast design and review of this report. The report was based on data provided and internationally accepted methods and methodologies were used for calculations and predictions.

HYDROLOGY AND GEOHYDROLOGY SPECIALIST

- None listed.

10. SUMMARY OF SPECIALIST FINDINGS AND RECOMMENDATIONS

Fifteen specialist studies were undertaken (Table 10), the results of which are summarised in this chapter. Copies of the specialist reports are provided in Appendix 5. The individual reports contain the qualifications and experience of the specialists.

During this assessment, the EAP held a joint field trip, including both day and night time visits, with a number of the specialists. This allowed for inter-disciplinary discussion between the specialists and sharing of relevant information. The EAP also facilitated ongoing interaction between specialists and held an integration meeting to discuss and analyse findings.

Table 10 Details of specialist studies undertaken and names of specialists

Specialist Study	Name of Specialist
Avi-fauna	Mr J. Smallie WildSkies
Vegetation and Wetlands*	Mr B. Patrick ACER (Africa) Environmental Consultants
Fauna	Mr G de Winnaar GroundTruth
Noise	Mr D Cosijn Jongens Keet Associates
EMFs	Dr. R. Wolhuter Dr. J.P. Holtzhausen Dept. of Electrical and Electronic Engineering Stellenbosch University
Tourism and Economic Development	Ms Mariette Steynberg/Ms Elena Broughton Urban-Econ Development Economists
Visual	Mr J. Marshall Environmental Planning and Design
Air Quality/Dust	Dr L. Burger Airshed Planning Professionals
Social and Spatial Development*	Mr D. Keal ACER (Africa) Environmental Consultants
Aquatic and Riparian Ecosystem	Mr G. de Winnaar GroundTruth
Cultural Heritage	Mr L. van Schalkwyk eThembeni Cultural Heritage
Poultry Veterinarian	Dr R Horner
Blast Impact	Mr J.D. Zeeman Blast Management & Consulting
Geohydrology and Hydrology	Mr J. du Preez/Mr C. Orchard Engeolab & GCS
Species Survey	Mr Barry James Brousse-James & Associates

*These internal specialist reports were externally peer reviewed by Ms J Adams, Exigent, (*Pri Sci Nat* 400088/02)

Readers are alerted to the following:

- Not all specialists considered layout alternatives 1 and 2 because they were not relevant to their particular study, for example, the poultry specialist.
- Not all specialists considered layout alternatives 1 and 2 to the same level of detail because alternative 1 was shown to have significantly higher impacts, from transmission lines, on surrounding landowners.

10.1 Avi-fauna

A total of approximately 400 bird species have been recorded in the broader area within which the proposed project is situated (Southern African Bird Atlas Project 1 and 2 (SABAP1) and (SABAP2). Of these, 27 species are currently Red Listed. Nineteen of these Red List bird species have at least a possibility of occurring on the proposed site itself, although for almost all these species, the site is of medium importance.

In determining how suitable the study area is to various bird species, it was necessary to look at the habitats available to birds to determine where the relevant species will most likely occur. These "micro habitats" do not always correspond to vegetation types and are determined by a combination of vegetation type, topography, land use, food sources and other factors. The study area is a prime example of this, whereby most of the area is classified as Thornveld by Mucina *et al.* (2006) but functionally, large areas are effectively grassland for the purposes of the avifaunal study.

Importantly, birds will, by virtue of their mobility, utilise almost any areas in a landscape from time to time. The preferred micro-climates of each species are where most of the birds of that species will spend the majority of their time and, hence, where impacts on those species will be most significant.

Investigation of this study area revealed the following bird micro habitats:

- Grassland.
  Grassland is one of the most threatened habitat types in South Africa, and the study area is no different. Areas of untransformed grassland exist, mostly on the proposed sub-station site itself, and immediately to the south and west of the site. Several of the Red Listed bird species to be found in the area are grassland dependent.

- Thornveld.
  Thornveld is a mixed vegetation type, with both woody (tree) and grassy components. As such, it provides attractive habitat to a wide diversity of bird species, which are attracted to either of these two vegetation components, or the combination thereof.

- Wetland.
  The conservation status of many of the bird species that are dependent on wetlands reflects the critical status of wetlands nationally, with many having already been destroyed. Several small patches of wetlands exist in the study area.

- Dams.
  Many thousands of earthen and other dams exist in the southern African landscape. 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. These include the pelicans, darters and cormorants. Many species from these families occur in the study area. Several smallish dams exist on the site.

During February 2015, a specialist Grass Owl survey of the sub-station site and surrounds was conducted as the African Grass-Owl (*Tyto capensis*) is listed as Vulnerable. No species or signs thereof were found; however, some vegetation exists on and around the site that could be considered fair Grass Owl habitat.

10.1.1 General impacts of electrical infrastructure on avifauna

Due to their size and prominence, electrical infrastructure constitutes an important interface between wildlife and man. Wildlife interactions with power lines are almost all negative, with the two main problems caused by electrocution of birds (and other animals) and birds colliding with power lines. Other issues are electrical faults caused by bird excreta when roosting or breeding on electricity infrastructure, and disturbance and habitat destruction during construction and maintenance activities.

Collision with power lines is a well-known conservation problem for many bird species, and for some species, can be a significant source of mortality. The reasons for collisions are complex, with each case involving a variety of biological, topographical, meteorological and technical factors. Although all birds have the potential to be affected by collisions, those most heavily impacted are generally large, flocking species which fly, with waterfowl, game birds, cranes, bustards and storks usually among the most frequently reported casualties. Mitigating bird collisions with power lines typically involves the installation of line marking devices on the conductors in order to make them more visible to approaching birds. A variety of marking devices are used, but very few have been adequately field-tested. Great uncertainty remains about which are best, as they vary enormously in effectiveness between species and in different conditions. Generally though, marking seems to be fairly effective, with a recent meta-analysis showing a 78% decrease in mortality rates on marked lines.

During the construction phase and maintenance of power lines and sub-stations, some habitat destruction and alteration inevitably take place. These activities have an impact on bird breeding, foraging and roosting in or in close proximity of the servitude, both through modification of habitat and disturbance caused by human activity.

Construction and maintenance activities also impact upon birds through disturbance. The reaction of birds to disturbance depends on a variety of factors and is species and situation dependent. Disturbance effects are believed to be most significant when birds are breeding close to the source of the disturbance. In these instances, disturbance may result in loss of breeding productivity, failed breeding, and short term or permanent abandonment of breeding sites. An interesting and uncommon aspect to consider in this study is that some of the receptors are captive birds, unable to move away from sources of disturbance, as wild birds would do.

Electromagnetic Fields (EMFs) are present everywhere in the environment and have increased steadily over the last century. The potential adverse effects of EMF exposure on human health has received much attention and been widely researched, resulting in approximately 7,000

publications on the subject (Bhattacharya *et al.*, 2013) as well as the development of international guidelines. A very small percentage (3%) of the above mentioned 7,000 publications relate to the impact of EMFs on the natural environment, particularly birds (Bhattacharya *et al.*, 2013). In addition, the majority of these publications detail the effects of EMF radiation from mobile phone masts which operate at frequencies in the 900 and 1,800 MHz range (Balmori, 2005; Everaert & Bauwens, 2007) which far exceed that of power lines (50 Hz) and sub-stations.

A review of the available literature revealed that the impacts of EMF exposure in birds appear to be technology and species specific in most cases. The results of the limited number of published studies detailing the risk of power line EMFs to birds are inconclusive and species specific.

Ortega (2012) presents a useful summary of the effects of noise on birds. According to this author, noise affects birds in the following ways: physical damage to ears; stress responses; fright–flight responses; avoidance responses; changes in other behavioural responses, such as foraging; changes in reproductive success; changes in vocal communication; interference with the ability to hear predators and other important sounds; and potential changes in populations. Relevant characteristics of noise include: type; frequency; loudness; duration and consistency. Birds react differently to noise, with colonial or gregarious birds thought to be particularly affected since when one bird reacts to a noise, the others follow suit (Burger 1998). Naguib *et al*. (2013) showed that even individual birds also react differently to noise stimuli.

A 2011 study by O'Connor *et al.* investigated the physiological and behavioural responses of chickens to continuous noise (60 and 80 dB) and light intensity (5 and 150 lux) exposure particularly during the critical laying stage. Results suggested that, while low light intensity and continual high background noise have a detrimental effect on egg production and cause the birds to rest more frequently, there was no conclusive evidence of a physiological stress response to either of these conditions or their combination (O'Connor *et al.*, 2011). However, another study published in the same year suggests a decrease in body weight in broiler chickens that are exposed to intermittent noise levels of 70 and 80 dB during the fattening period (Voslarova *et al.*, 2011). In addition, a significant negative influence of noise exposure (80 vs. 100 dB) on the stress and fearfulness of broiler chickens has also been documented (Chloupek *et al.*, 2009). The typical reaction of domestic fowls after exposure to sudden, intense noise is a short-term startle response. The reaction ceases as soon as the stimulus is ended, and within a few minutes all activity returns to normal. This suggests that the birds habituate relatively quickly (Gladwin *et al.*, 1988).

Many of the available published papers studied loud sounds in excess of 90 dB. Campo *et al.* (2005) provide a summary of these studies. Stadelman (1958, in Campo *et al.,* 2005) reported that sounds in excess of 115 dB interrupted brooding of hens and that growth of young chickens exposed to noises of 80 to 118 dB was not affected (1958b). Campo *et al.* (2005) showed that a single short stress due to aircraft noise did not affect poultry egg production, but longer periods of stress (three or more days) reduced egg production. He attributed the loss to a change in behaviour (hens kept away from feed and water due to noise stress) and not to a physiological change. McFarlane *et al*. (1989, in Campo *et al.,* 2005) found that noise did not influence weight gain, feed intake, or behavioural traits in broiler chicks. Campo *et al.* (2005) concluded that sonic booms did not initiate abnormal behaviour that would result in decreased productivity in wild turkeys.

10.1.2Key risks and findings

The following aspects were identified as potential risks to avifauna:

- Electrocution of birds on loop in lines and within the sub-station.
- Bird collisions with overhead conductors, in particular, the earth wire.
- Habitat destruction.
- Disturbance of birds during construction.
- Nesting of birds on towers.
- Impact of birds on quality of electrical supply.
- Effect of electromagnetic fields on birds.
- Effect of light associated with the sub-station on birds.
- Effect of electrical interference on radio tracking of African Birds of Prey Sanctuary birds.
- Effect of noise associated with sub-stations and power lines on birds.

The majority of these impacts were rated medium to low significance apart from the traffic noise impact upon the future breeding of Bearded Vultures at the African Birds of Prey Sanctuary. However, in terms of cumulative impacts, the sub-station was found to make a highly significant contribution to negative impacts on birds in the area, on account of its size, the planned construction of five transmission lines and space for more lines linking into the sub-station in future.

A basic principle of impact assessment is to compare the levels of impacts under current (pre-development) conditions, with those levels anticipated post development. The relative change in impact levels attributable to the development is the key factor to assess. This principle was applied during the avi-faunal study to the various receptors. In the case of the ABOPS, it should be noted that the Sanctuary chose to develop at this site (nine years ago) in full knowledge of the two existing 275 kV power lines to the south-west and the adjacent registered vacant servitude. However what is proposed represents a significant increase in impact when compared to the status quo. This is because the construction and operation of high voltage overhead power lines and electrical sub-stations is a land use that is not compatible with public education, flight displays, rehabilitation, release, and captive breeding of critically endangered indigenous raptor species.

The owners of the African Bird of Prey Sanctuary are driven by conservation imperatives and concern for the wellbeing of their birds. At best, the development of the Isundu project will limit the Sanctuary's ability to expand its activities in future through additional flight displays and other activities. Also, this will likely include the decision to abandon Bearded Vulture captive breeding. The Bearded Vulture is listed as critically endangered and is the subject of a Government Gazetted Biodiversity Plan, which includes implementing a captive breeding programme. In this regard, it should be noted that the ABOPS was selected to conduct this captive breeding for good reasons, and few if any other facilities are capable of such a programme. The abandonment of this programme could therefore have significant conservation implications for the Bearded Vulture. At worst, the development of the Isundu project will also constrain already existing activities, compromising the objectives and viability of the Sanctuary. For example, this could result in the closure or curtailment of flight displays; the downscaling of raptor rehabilitation; the downscaling of raptor captive breeding; the inability to effectively raise funds as potential donors will be put off by the mismatch between the Sanctuary and surrounding land use; and the discontinuation of the currently planned Bearded Vulture captive breeding programme.

10.1.3 Mitigation measures

The following mitigation measures to reduce impacts on birds were recommended:

- The cumulative impact of the proposed developments on the ABOPS is judged to be of high significance. The risk cannot be mitigated to acceptable levels at the current site and, therefore, it is recommended that the ABOPS is relocated out of this area to a more suitable location elsewhere. The selection of this new location should be undertaken carefully, particularly with respect to potential future developments, as it would be senseless for the ABOPS to face similar development risks in the future at the new location. Given that the ABOPS was in place first; Eskom are proposing to develop the Isundu project at the proposed location; and on site mitigation is unlikely to be fully effective, it is Eskom's responsibility to negotiate financial compensation for the relocation.
- Proactive mitigation of any electrocution risks should be undertaken and, in the event that a problem is detected once the sub-station is operational, reactive.
- To reduce collisions, mitigation should take the form of marking the earth wires of the proposed power lines with a suitable anti- collision marking device, according to Eskom Transmission guidelines:
  - The device used should preferably be a dynamic device, i.e. one that moves as it is believed that these are more effective in reducing collisions. It will be Eskom's responsibility to ensure that these line marking devices remain in working order for the full lifespan of the power line.
  - It is important that these devices are installed as soon as the earth wires are strung, not only once the line is commissioned, as the cables pose a collision risk as soon as they are strung.
  - The devices should be installed, alternating a light and a dark colour, to provide contrast against dark and light backgrounds, respectively. This will make the overhead cables more visible to birds flying in the area (note that 100% of the length of each span needs to be marked (i.e. right up to each tower) and not the middle 60%, as some guidelines recommend).
  - It is recommended that an avifaunal walk-through be conducted as part of the site specific EMPR. This walk through will identify the exact sections of line requiring marking, once final tower positions have been determined.
- It is recommended that any altering of vegetation be kept to an absolute minimum through correct access road selection, strict people, vehicle and machinery control, and careful management of construction in particularly sensitive areas.
- In particular, it is essential that the sub-station access road both during construction and operation be at the current farm access road location, and not moved further south as this would intrude into more important grassland and wetland habitat.
- Erosion and the spread of invasive alien vegetation must be prevented.
- The recommended avifaunal walk through will identify areas of specific concern prior to construction, so that these can be dealt with carefully.
- Any likely breeding sites for key species will be identified during the avifaunal walk through as part of the site specific EMPR. Case specific recommendations on how best to manage the situation can then be developed. These may include timing construction activities at certain towers or sections of line to avoid the species breeding seasons.
- It is recommended that any nests which are built once the line is operational be managed according to Eskom's nest management guidelines. For example, bird impacts on the electrical infrastructure should be mitigated reactively in the form of Eskom Transmission approved Bird Guards, to deter birds from perching directly above live conductors.
- No mitigation is required for EMFs on wild birds other than Eskom conforming to ICNIRP guidelines.

10.2 Vegetation and wetlands

During the site visits, a qualitative botanical survey was undertaken at the sub-station site, where vegetation types were identified, species composition noted, and vegetation structure recorded. Important plant species and sensitive areas of vegetation were noted and opportunities for mitigation of impacts identified.

10.2.1 Sub-station site

10.2.1.1 Vegetation

The sub-station site is occupied by a farm under natural vegetation (mostly grassland) which is mowed regularly, baled for hay production and sold as the main economic activity on the farm. This takes place across the whole site, excluding areas under thicket/bush (Figure 11). In the past, the site was used for grazing of cattle and, currently, wild game traverses the farm as well as neighbouring farms (Boswell, pers. comm.). There are also a number of wetlands, dams and riparian areas on site and within 500 m of the site. The provincial vegetation type that would typically occur on the sub-station site under natural conditions is KwaZulu-Natal Hinterland Thornveld.

To refresh, KwaZulu-Natal Hinterland Thornveld (SVs 3) falls within the Savannah Biome and occurs in KwaZulu-Natal in patches scattered immediately above SVs 6 Eastern Valley Bushveld, at altitudes 450 - 900 m in river valleys of mainly the Mpisi, Mvoti, Umgeni, Mlazi, Lufafa and Mtungwane catchments. The climate is summer rainfall with some winter rain with infrequent frost. The vegetation is characterized by open thornveld dominated by *Acacia* spp. on undulating plains found on upper margins of river valleys (Mucina & Rutherford, 2006). The provincial conservation status of this vegetation unit is described as least threatened (Scott-Shaw & Escott, 2011)[9].

Seven plant communities were identified on the sub-station site, together with two plant associations. These include a range of terrestrial, riparian and wetland communities, both herbaceous and woody. Natural vegetation present includes a range of facultative wetland[10] and obligate wetland[11] hydrophytes, and other plants commonly associated with wetlands.

The following plant communities were identified on site and are described in detail in the specialist study:

- *Aristida junciformis-Sporobolus pyramidalis* tall closed grassland.
- *Panicum maximum-Acacia nilotica* tall closed grassland//short thicket mosaic.
- *Buddleja saligna-Acacia robusta* short thicket.
- *Imperata cylindrica-Chloris gayana* tall closed grassland.
- *Eleocharis dregeana-Cyperus platycaulis* low closed sedgeland.
- *Pycreus polystachyos-Chloris gayana* tall closed grassland.
- *Persicaria senegalensis-Cyperus dives* tall closed reedbed.

Figure 11 and Plates 12 to 16 show these plant communities.

9 Provincial assessment which is more recent than the national assessment which describes the vegetation unit as vulnerable.
10 Species that occur 50% of the time in wetland or water saturated areas.
11 Species that occur for >99% of the time in wetland or water saturated areas

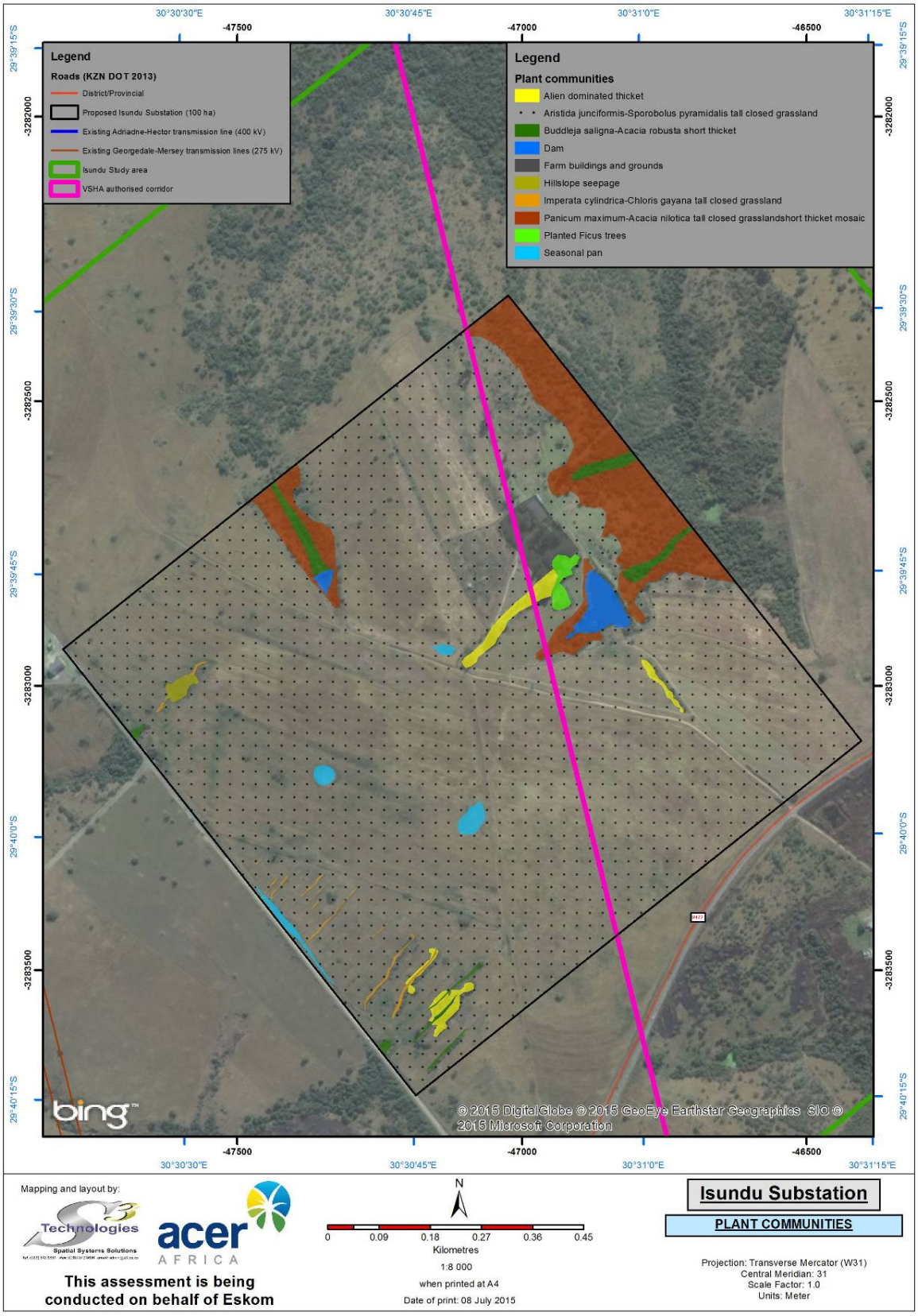

Figure 11 Plant communities and associations identified on the sub-station site

Plate 12 ***Aristida junciformis-Sporobolus pyramidalis*** **tall closed grassland**

Plate 13 ***Panicum maximum-Acacia nilotica*** **tall closed grassland//short thicket mosaic**

Plate 14 ***Buddleja saligna-Acacia robusta*** **short thicket**

Plate 15 ***Imperata cylindrica-Chloris gayana*** **tall closed grassland in the centre**

Plate 16 ***Eleocharis dregeana-Cyperus platycaulis*** **low closed sedgeland in the mid-ground**

Notable species found within these communities include:

- The geophytes *Boophone disticha* and *Hypoxis hemerocallidea* which have a status of Declining (species of conservation concern) in the National Red List of South African Plants.
- *Boophone disticha, Androcymbium longipes, Asparagus* cf. *africanus* and a terrestrial orchid (Orchidaceae – identification during summer months required) which are designated as specially protected under the Natal Nature Conservation Ordinance (15 of 1974) and the KwaZulu Nature Conservation Act (29 of 1992).
- *Asparagus virgatus* and cf. *Chlorophytum sp.* which are designated as specially protected under the Natal Nature Conservation Ordinance (15 of 1974) and the KwaZulu Nature Conservation Act (29 of 1992).
- *Nymphaea nouchali* (an emergent water lily) is designated as specially protected under the Natal Nature Conservation Ordinance (15 of 1974) and the KwaZulu Nature Conservation Act (29 of 1992).

Typical construction impacts upon vegetation include the removal of vegetation, habitat fragmentation, edge effects, increase in alien invasive plants and the excavation and compaction of soils. Impacts are likely to be lowest in areas where the natural vegetation is already transformed (associated with roads and farm buildings), followed by areas where natural vegetation has become degraded, for example tall closed grassland. Impacts are likely to be higher in areas dominated by less disturbed natural vegetation, such as the low closed sedgeland.

10.2.1.2 Wetlands

The following wetland hydrogeomorphic types were identified on the sub-station site and within 500 m of the sub-station site.

- Four pans/depression wetlands.
- Three isolated hillslope seepage wetlands.

The sizes of the various pan and hillslope seepage wetlands identified within the sub-station site, taken from the outer edge of the temporary zone of wetness, are shown in Table 11.

Table 11 Size of pan and seepage wetlands within the sub-station site

Unit	Pan 1	Pan 2	Pan 3	Pan 4	Seep 1	Seep 2	Seep 3
Square Meters	1818	524	1033	1470	1525	5372	1175
Hectares	0.1818	0.0524	0.1033	0.1470	0.1525	0.5372	0.1175

In addition, twelve shallow farm dams were identified, some with standing water, others dry at the time. These have been excavated mostly within riparian areas to intercept surface and groundwater flows, and depending on current wetness, support hydrophilic vegetation ranging from reedbeds through to hydrophilic and terrestrial grasses, forbs and sedges. They possess inlet and outlet channels, although flow through the dams is only likely to occur during the summer months.

Reedbeds occur within the two dams on the sub-station site as well as in a number of dams within 500 m of the site (Figure 12). Towards the north-western part of the sub-station site, a shallow farm dam with a low, long earth wall has been excavated within the riparian area to

intercept surface and groundwater flows. Excavation has led to more permanently wet conditions towards the centre of the dam where taller (1.5 m) emergent sedges, particularly *Cyperus dives,* have become established around the deeper, open water in the centre. Surrounding this is a seasonally wet zone which supports a range of hydrophilic forbs, grasses and sedges which are well grazed. Given that this is an artificial impoundment, a very small temporarily wet zone surrounds the seasonal zone.

Within the main dam adjacent to the farm buildings (Figure 12) a discontinuous, thin strip of reedbed (about 0.5 m wide) fringes the deeper open water of the dam. The periphery of the dam provides permanently wet conditions for emergent reeds and sedges such as *Typha capensis* and *Cyperus dives,* together with a range of other hydrophilic plants. Given that this is an artificial impoundment, seasonal and temporary zones of wetness are not well developed owing to the steep drop-off around the dam edge.

Other floristic associations shown on Figure 13 include patches of thicket dominated by alien trees such as *Acacia mearnsii*, Eucalyptu*s sp.* and *Jacaranda mimosifolia**; and a stand of large *Ficus burkei* trees planted between the farm house and main dam. Alien invaders and early successional species are associated with the farm buildings and grounds.

Wetland and riparian area boundaries were determined in the field in accordance with the *Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas* (DWAF, 2008). Wetlands and riparian areas within 500 m of the sub-station site were also delineated. Due to similarities in characteristics and disturbance regimes, a combined health assessment was undertaken for Pans 1 to 3 and hillslope seepages 1 to 3. A separate assessment was performed for Pan 4.

Of major importance was the characterisation of the hydro-geomorphic type, based on geomorphic setting (for example, valley bottom or depression; whether drainage is open or closed), water source (surface water dominated or sub-surface water dominated) and how water flows through the wetland unit (diffusely or channelled). The method allowed for a rapid assessment based primarily on readily described indicators, ranging from hydrological characteristics, nutrient assimilation, erosion control, biodiversity characteristics and human use (Kotze *et al.*, 2007).

Important ecosystem services provided by the four pans delineated include biodiversity maintenance and erosion control. Suitable habitat for Red Data fauna (particularly frogs) is provided by the wetlands, while the underlying soils are being well protected by a dense cover of wetland vegetation. A major influence in the scores of the remainder of the benefits is the restricted human access to the site, which is a privately owned commercial farm (hay production is the main economic activity) as well as the hydro-geomorphic characterisation of these wetlands as pans.

Low values were provided for direct benefits, including provision of water for human use, harvestable resources, cultivated foods, cultural heritage, tourism and recreation, and education and research. Benefits provided for biodiversity maintenance and erosion control were high for Pans 1-3, and moderately high for Pan 4. Wetland conditions in Pan 4 are a result of altered ground levels due to road construction (Figure 14).

Important ecosystem services provided by the three hillslope seepages delineated include nitrate removal, erosion control and biodiversity maintenance. Low values were provided for direct benefits including provision of water for human use, harvestable resources, cultivated foods, cultural heritage, tourism and recreation, and education and research. Benefits provided for nitrate removal, erosion control and biodiversity maintenance were moderately high for Seepages 1-3, with the exception of nitrate removal for Seepage 1 (as it is on a steeper slope), which was intermediate.

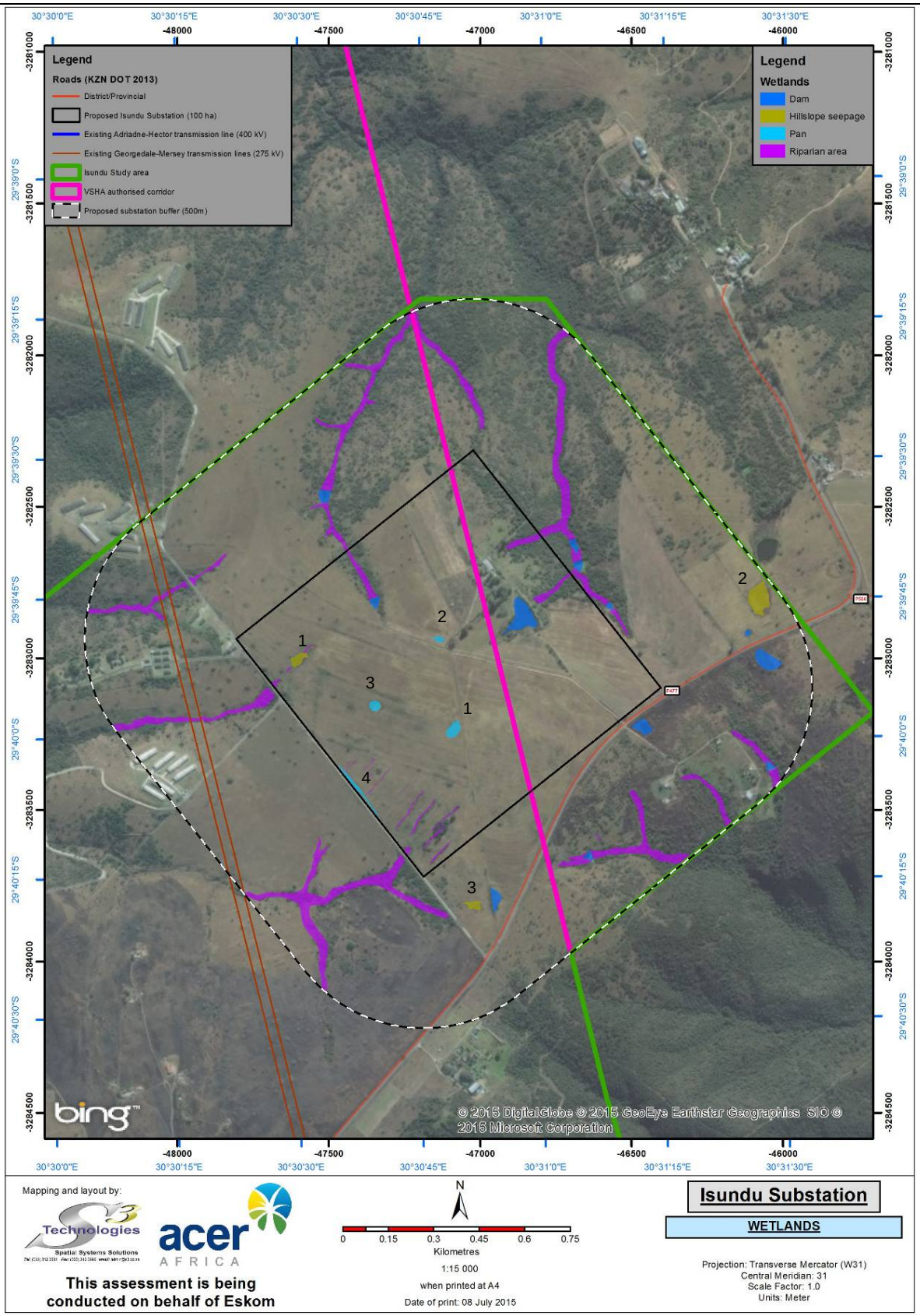

Figure 12 Wetlands, riparian areas and dams found on site and within 500 m of the site

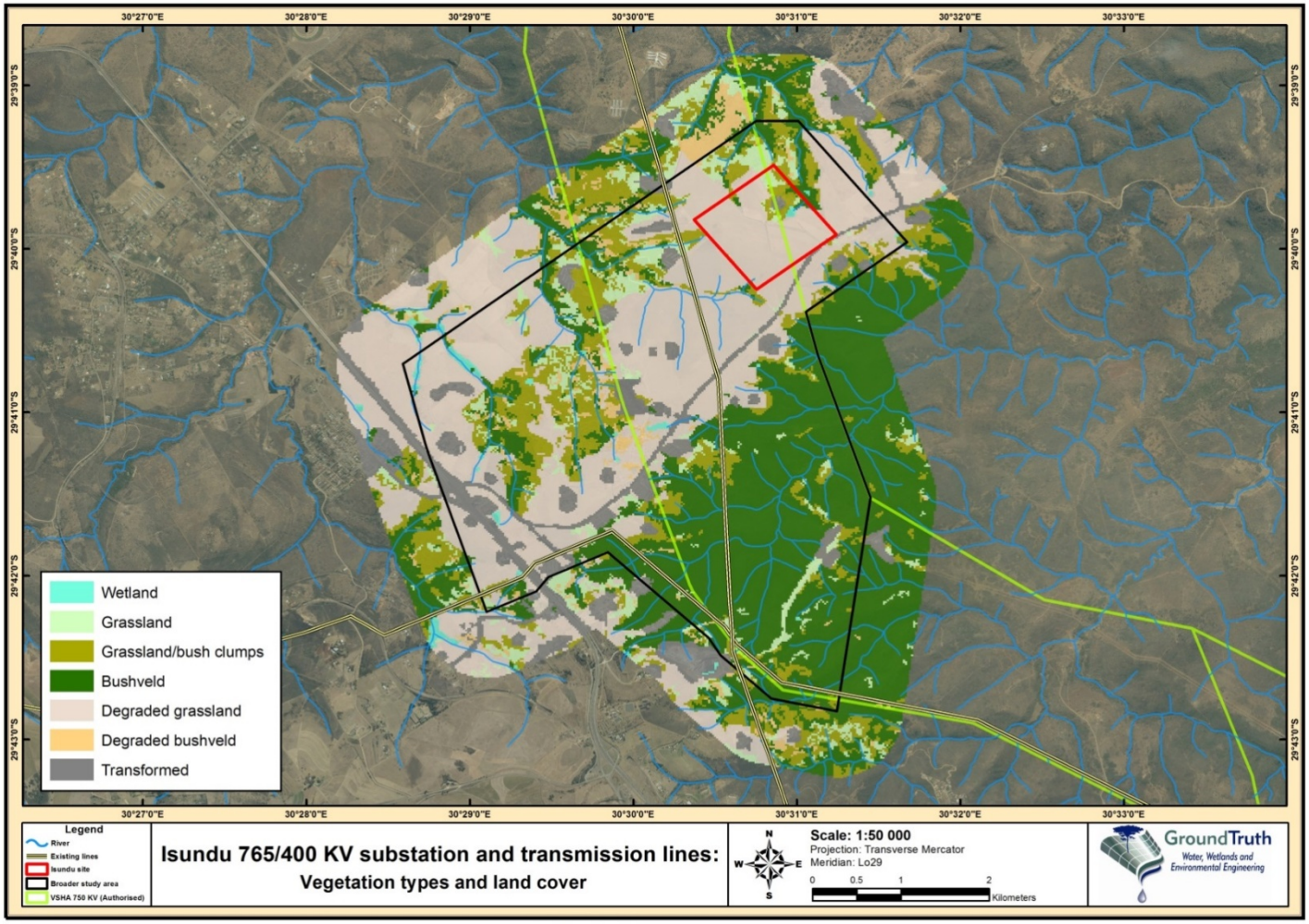

Figure 13 Map of the extent and distribution of vegetation types/natural habitats for the broader study area

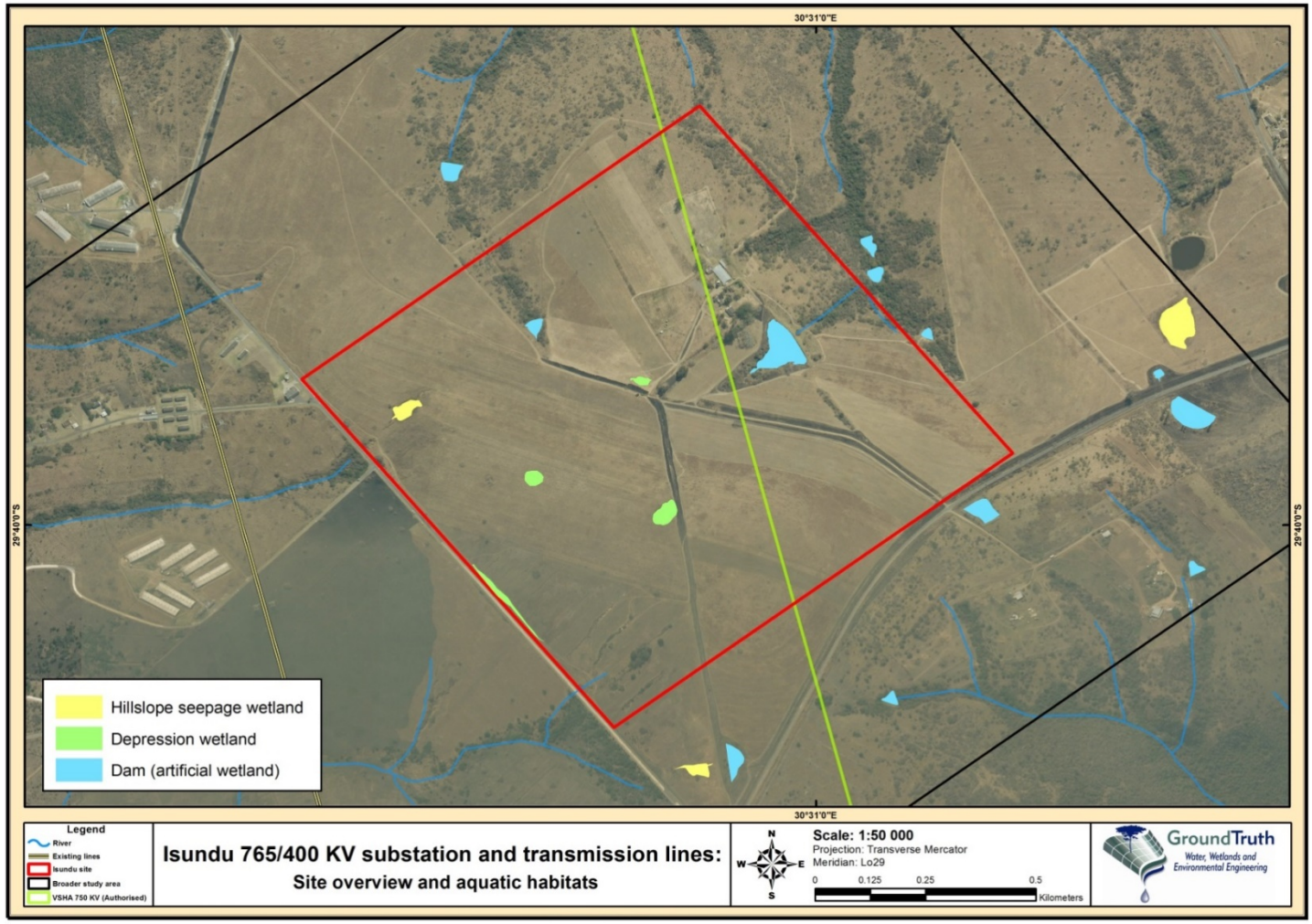

Figure 14 Map showing the extent and distribution of aquatic habitats within the Isundu site

The Wet-Health tool (Macfarlane *et al.,* 2007) is designed to assess the health or integrity of a wetland. Wetland health is defined as a measure of the deviation of wetland structure and function from the wetland's natural reference condition. The overall impact of activities that affect hydrological, geomorphological or vegetation health was calculated for wetland units within the substation site and 500 m buffer zone, and this resulted in the Present Ecological State (PES) score (Tables 12 and 13).

Table 12 Present Ecological State categories used to define health of wetlands (taken from Macfarlane *et. al*., 2007)

Description	Combined impact score	PES Category
Unmodified, natural.	0-0.9	A
Largely natural with few modifications. A slight change in ecosystem processes is discernable and a small loss of natural habitats and biota may have taken place.	1-1.9	B
Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact	2-3.9	C
Largely modified. A large change in ecosystem processes and loss of natural habitat and biota and has occurred.	4-5.9	D
The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.	6-7.9	E
Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8 - 10	F

Table 13 Condition scores for pans and hillslope seepages showing PES values

Wetland Units	Hydrology		Geomorphology		Vegetation		Overall	
	Score	Category	Score	Category	Score	Category	Score	Category
Pans 1-3	0	A	0	A	1	B	0.29	A
Pan 4	0	A	0	A	1	B	0.29	A
Hillslope Seepages 1-3	0	A	0	A	1	B	0.29	A

It is important to note that, although the terrestrial grassland surrounding the wetlands is considered to be degraded and their loss found to be of relatively low significance, the wetlands are in good condition. With unmodified hydrological and geomorphological health conditions, the hydric vegetation present strongly reflects the underlying environmental determinant, specifically, wet soil conditions. Wild game traverses the farm and there are no cattle grazing on the farm. The terrestrial grassland surrounding the wetlands is mowed regularly and baled for hay production during the winter months. The only major direct impact on the wetlands is the mowing of the flatter, more accessible portions during the baling operation. However, this temporary reduction in roughness was not rated as a large, intense impact due to the natural die-back of vegetation in winter and that herbaceous vegetation in the savannah biome is well adapted to regular defoliation through fire. The key factor is that the wetlands are well covered with hydrophilic vegetation with little bare soil visible. The loss of some of the wetland areas is unavoidable due to the size of the sub-station footprint and is considered significant if not mitigated.

10.2.2 Transmission lines

The main issues of concern related to the transmission lines are:

- Removal of vegetation.
- Habitat fragmentation.
- Edge effects.
- Alien invasive plants.
- Soil erosion and compaction.
- Wetland impacts.
- Harvesting of indigenous plants.
- Pollution and dumping.

In order to minimise habitat fragmentation and edge effects, it is preferable to select a route along an existing linear development. Where not possible, such as within parts of the wooded valley of Mayibuye Game Reserve, more substantial mitigation will be required to re-establish the original woody vegetation cover, including ongoing alien plant control (for at least two years post-construction) and erosion control.

The transmission lines will avoid wetlands because of the distance between towers and the ability to span the wetlands with no impacts.

10.2.3 Mitigation measures

Two sub-station layout alternatives have been proposed for the Isundu sub-station. Alternative 2 is the preferred layout due to lower impacts on riparian areas and MINSET biodiversity priority 1 areas.

There are a number of impacts identified and after mitigation were assessed as low to medium significance. A range of mitigation measures was recommended which have been incorporated into the EMPR. Specific mitigations measures to note are:

- Once a preferred route has been selected, and prior to construction of the towers, input should be obtained from a vegetation and wetland specialist on the final location of the towers, and sensitive areas of vegetation to avoid (including tower site, access routes, the vegetation removal required for stringing and the final servitude, where relevant).
- Where protected or rare/threatened species are suspected to occur on the basis of habitat characteristics and distribution records, targeted surveys should be undertaken during the appropriate time of year for flowering. These targeted surveys occur during the walk down prior to construction.
- An appropriate off-set mitigation plan will need to be put in place to compensate for the loss of wetlands and riparian areas on the sub-station site.
- It is suggested that, if significant areas of natural grassland remain intact within the sub-station boundary after construction (and with the relatively shallow water table present), the creation of pans within the grassy matrix is considered as an offset contribution. The combination of pans with surrounding terrestrial grassland may provide habitat suitable for frogs of conservation concern (Natal Leaf-folding and Spotted Shovel-nosed Frogs) which are likely to occur within the Isundu Sub-station site (GroundTruth, 2015), if grassland buffers of adequate size can be secured.

10.3 Terrestrial fauna impact assessment

The vegetation that characterises the broader study area is largely KwaZulu-Natal Hinterland Thornveld, a "Vulnerable" vegetation type as described by Mucina and Rutherford (2006)[12]. This vegetation type comprises of open thornveld dominated by *Acacia* species on undulating plains found on upper margins of river valleys. There is a small section of the study area, along the northern boundary that contains Eastern Valley Bushveld (Mucina and Rutherford, 2006). This vegetation is of least concern from a conservation perspective, and is characterised as semi-deciduous savanna woodland in a mosaic of thickets, often with succulents and dominated by species of *Euphorbia* and *Aloe*. Lower order vegetation units (e.g. grassland and wetland) are also nested within areas of KwaZulu-Natal Hinterland Thornveld and Eastern Valley Bushveld (Figure 11).

Fauna, listed according to respective taxonomic groups that may potentially occur within the broader study area under natural/reference conditions are summarised as follows:

- **Amphibians.** Approximately 28 species of amphibian potentially occur within the area under natural conditions. This represents about 40% of the frog diversity in KZN. A small fraction of the potential amphibian diversity includes species of conservation concern, viz.: Natal Leaf-folding Frog (*Afrixalus spinifrons* subsp. *spinifrons*) (Near Threatened) and Spotted Shovel-nosed Frog (*Hemisus guttatus*) (Vulnerable) (Minter *et al.*, 2004).
- **Reptiles.** Approximately 57 species of reptile potentially occur within the area under natural conditions, and represents about 30% of the diversity in KZN. The list of potential reptiles includes 31 snakes, 18 lizards and one terrapin. According to Bates *et al.* (2014), three of these species are Red Listed, viz.: Stripped Harlequin Snake (*Homoroselaps dorsalis)* (Near Threatened), KwaZulu Dwarf Chameleon (*Bradypodion melanocephalum*) (Vulnerable) and Large-scaled Grass Lizard (*Chamaesaura macrolepis)* (Near Threatened).
- **Mammals.** Approximately 60 species of mammal potentially occur within the area under natural conditions. This represents about 30% of the mammal diversity in KZN. About 60% of this diversity is made up of small and/or crepuscular/nocturnal species that are generally difficult to detect (e.g. rodents, shrews and bats). Of the potential diversity, 24 are Red Listed (Friedmann and Daly, 2004; Monadjem *et al.*¸ 2010). Nineteen of these are rodents, shrews and bats that are listed as Data Deficient and Near Threatened.

The vegetation cover of the Isundu site is predominantly disturbed grassland, which occupies approximately 85% of the site. The grassland areas are largely managed for the harvesting of grass and, as a result, are subjected to frequent mowing and disturbance. Approximately 10% of the site contains thicket vegetation (including grassland/bushclumps). The thickets are generally confined to the drainage lines along the north-eastern and north-western boundaries of the site. There are several, small aquatic ecosystems scattered across the site, which together only make up 1% of the site. These aquatic ecosystems are defined as farm dams, depression wetlands and hillslope seeps as mapped and assessed by ACER (2015). The farm dams provide a permanent source of water for most of the time, and tend to contain well-defined marginal and emergent wetland vegetation. Figure 13 shows the spatial extent and distribution of the aforementioned vegetation/ecological units, as well as the extent of grassland utilised for the harvesting of grass.

[12] National assessment which is more dated than the provincial assessment which describes the vegetation unit as least threatened.

The proposed Isundu site is expected to support a low to moderate diversity of fauna, with few conservation important species expected to occur. This is largely attributed to the general lack of suitable habitat supporting the various fauna groups, as well as the high levels of habitat disturbance, particularly within the grassland areas. Consequently, the potential for conservation important species occurring on-site is likely to be low.

However, the aquatic habitats (including the several small farm dams) that are located within the Isundu site provide suitable habitat for a variety of frog species. This includes two species of conservation concern, viz.:

- Natal Leaf-folding Frog (*Afrixalus spinifrons*) currently listed as Near Threatened.
- Spotted Shovel-nosed Frog (*Hemisus guttatus)* currently listed as Vulnerable.

Given the habitat availability on-site, both the Natal Leaf-folding Frog and the Spotted Shovel-nosed Frog are likely to occur within the Isundu site. Thus, it is probable that these conservation important species will be negatively impacted by the project.

Reptile diversity and abundance within the Isundu site is expected to be relatively low, with only widespread and common species likely to occur. This is largely the result of limited suitable habitat (i.e. mostly disturbed and mown grassland).

The Isundu site is only likely to support a small diversity of mammals, including two species of conservation concern, viz.:

- Oribi (*Ourebia ourebi).* The broader study area, including and surrounding the 100 ha sub-station site is known to support a small population of Oribi comprising two or three individuals. These individuals would be restricted to the grasslands and open savanna woodlands associated with the north-western half of the study area. The greatest threat to the Oribi in the area is from illegal poaching and hunting, and the proposed Isundu Project is unlikely to have a significant impact on the small population. Oribi is currently listed as Endangered.
- Rough-haired Golden Mole (*Chrysospalax villosus*) which inhabits sandy soils in grasslands, and along edges of wetlands in areas of savanna and grassland. It has very specific habitat requirements and is generally uncommon. The Rough-haired Golden Mole is currently listed as Critically Endangered but it is unlikely that it occurs on the site due to existing disturbances and utilisation of the grasslands within the larger part of the Isundu site.

10.3.1 Faunal impacts arising from the proposed sub-station and turn-in transmission lines

Project activities resulting in negative impacts on fauna associated with the Isundu Sub-station and turn-in transmission lines include:

- Removal of and/or disturbance to vegetation and habitats (including habitat fragmentation).
- Access and servitude requirements (including towers).
- Construction camps.
- Generation of waste and pollution (including noise and light disturbances).
- Continued servicing and maintenance activities.
- Alien plant infestations.
- Poaching and hunting.

Habitat loss and disturbance are key impacts that will negatively affect fauna, both in terms of the sub-station footprint as well as the turn-in transmission lines. This in turn increases habitat fragmentation whereby faunal populations become more isolated, resulting in a reduction of inter-population connectivity.

Two layout alternatives have been proposed for the Isundu Sub-station, namely Option 1 and Option 2. Both options are approximately 45 ha in extent. The difference between the two options in terms of vegetation/habitat loss is not significant in terms of available faunal habitats. The greatest loss will be in the form of degraded grassland (~80%), followed by grassland/bush clumps (~7%), grassland (~2%) and wetlands/dams (~2%).

In the case of the turn-in transmission lines, additional habitat losses will be incurred as a result of clearing of vegetation for the following:

- Construction of new access road/tracks to construct and/or maintain towers and transmission lines.
- Construction of the towers on a working area of up to 400 - 900 m^2 at intervals of every 300 to 500 m.
- Stringing of conductors between towers the initial removal of vegetation during construction as well as routine vegetation clearing to maintain the required clearance distance between conductors and vegetation (approximately 4 m and 10 m for 400 kV and 765 kV lines, respectively). The extent of habitat loss, will, however, depend on the type and height of the vegetation.

Impacts from illegal hunting/poaching by construction personnel, casual labour or work seekers, although unlikely, may occur during the construction phase for the sub-station and transmission lines, and during maintenance of the transmission line servitudes, with a greater risk to sensitive species such as Oribi. However, within the context of this project, impacts from illegal hunting/poaching are unlikely to be significantly high as the area is currently easily accessed by the N3 national road and provincial roads.

10.3.2 Mitigation measures

The following recommendations need to be considered to avoid and/or mitigate impacts on fauna that may arise from the construction and/or operation of the Isundu Sub-station and turn-in transmission lines:

- It is likely that the sub-station footprint will negatively affect sensitive areas, notably the aquatic ecosystems and associated 30 metre buffer areas. From a faunal perspective, these wetland features have the potential to support Red Listed amphibians such as Natal Leaf-folding Frog and Spotted Shovel-nosed Frog. It is, therefore, recommended that a focused amphibian survey is carried out prior to construction to determine the presence/absence of conservation important amphibians[13]. The survey should be planned to correspond with periods of peak activity, i.e. October to February following rainfall, to maximise detection. Should it be confirmed that sensitive amphibians occur on site, appropriate interventions will need to be investigated to account for any impacts. This may be in the form of focused relocations to suitable habitat in the broader area. Additional elements including buffering should be considered to ensure the protection of core breeding habitat and to maintain terrestrial habitats for foraging, hibernation and dispersal. This will most likely be off site.

[13] This survey has been done and no conservation important amphibians were found (Section 10.16).

- Alignment of turn-in transmission lines should, as far as possible, follow existing linear infrastructure such as existing lines and roads in order to limit the extent of habitat fragmentation.
- Ensure that the towers for the associated turn-in transmission lines are correctly positioned, preferably on land that is already transformed and/or degraded. This applies also to other activities that will impact natural habitat, such as construction camps, site offices and other facilities.
- Once the alignment of the turn-in transmission lines has been finalised, it is advisable that a more comprehensive investigation of natural habitats be undertaken to define habitat areas of particular importance. For such areas, it would be ideal to minimise access to individual tower sites and to limit construction activity to the immediate tower site. This will be by way of a specialist walk down which is standard Eskom procedure.
- Ensure minimal or no disturbance outside of footprint areas, both during construction and operation of the Isundu Sub-station and turn-in transmission lines. Prior to construction, the Environmental Control Officer, tasked with implementing the EMPR should delineate all sensitive areas.
- Restrict and control the movement of people and vehicles outside of designated areas. Ensure that personnel and contractors are aware of the site's biodiversity sensitivities (e.g. aquatic habitats, sensitive species, etc.) and the potential impacts that may result from the project (e.g. damage to habitat, mortalities, etc.).
- Devise and implement management plans to deal with solid waste, accidental spills, and the recovery and relocation of fauna. All waste generated during construction should be contained and disposed at facilities licensed to accept particular waste streams. All stock piles, waste, rubble, etc. are to be kept clear of the sensitive areas (i.e. aquatic habitats and intact vegetation) and confined to designated areas within already degraded/transformed areas. In the event of accidental spills, immediate action must be carried out to contain the spill, followed by a thorough clean-up operation. In addition, cement waste should not be left on the soil and disposal should be to licensed facilities. Mixing of cement should preferably be done on self-contained surfaces so as to avoid any unnecessary cement contamination.
- Light pollution from the sub-station site must be kept to a minimum to minimise interference with insect life cycles and nocturnal vertebrates. For this reason, it is recommended that low pressure sodium vapour lights/or LED lights with wavelengths of limited attractiveness to insects be used. These should face into the sub-station and associated infrastructure or downwards but not outwards. Infrared and/or sensor lights and security systems should be used as far as possible to limit requirements for permanent lighting at night.
- Develop and implement an alien plant control programme to manage problematic plant species, and to prevent further spread and establishment. Allowance should be made for routine follow-ups until the time that there is either no presence or a negligible presence of these plants. Alien plant control work needs to be carried out by competent contractors.
- Revegetation and habitat restoration activities should commence as soon as possible to establish vegetative cover over bare/exposed soils. Indigenous plant species suited to local conditions should be used for the rehabilitation of disturbed areas.
- As far as possible, existing grassland areas within Eskom-owned land should be managed according to a fire management plan to maintain and/or improve habitat integrity and functioning, as well as to limit bush encroachment into grasslands.
- Any ToPs and/or protected fauna as listed according NEMBA (Act 10 of 2004) and the KZN Conservation Ordinance (Act 15 of 1974) that need to be removed and/or relocated will require licences.

- Incorporate monitoring during and after the construction period to ensure that the integrity of habitat systems is maintained and/or enhanced along the transmission line servitudes.

The actual footprint of the Isundu Sub-station and associated turn-in transmission lines is relatively small. Thus, impacts on faunal features are expected to be fairly low, particularly since the majority of the directly affected areas comprise already disturbed habitat. Therefore, provided sufficient mitigation measures are employed and towers are correctly sited, it can be expected that impacts from the proposed project will be minor. Furthermore, threats to important fauna may be reduced considerably if destruction and loss of sensitive faunal habitats is avoided as far as practically possible, particularly the aquatic habitats associated with the sub-station site.

The overall impact to the faunal environment may be minimised to well within acceptable limits, should the above recommendations and proposed mitigation measures be implemented. Thus, from a faunal perspective, the project does not impose any fatal flaws.

10.4 Electromagnetic fields

The circuits on high voltage power lines and in substations consist of three phases (conductors). These conductors are at high voltage (400 or 765 kV in this case) and conduct electric currents of typically 1,000 to 2,000 ampere. On Alternating Current (AC) power systems both voltage and current oscillate at a frequency of 50 Hz (cycles per second, each cycle constituting a complete swing in the opposite direction and back). Whereas the magnitude (maximum value of the 'swing') of the voltage remains reasonably constant, the magnitude of the current depends on the power (in MW) delivered.

The voltage induces electric charge on nearby objects and on earth, resulting in an electric field[14] between the line and the objects. Likewise, the currents cause a magnetic field surrounding the conductors. Both the electric and magnetic fields oscillate at 50 Hz. Fields that oscillate at frequencies between 0 and 300 Hz are termed Extremely Low Frequency Fields (ELF) and have the property that they could induce small electric currents in nearby conducting objects, including living organisms. ELF fields, including 50 Hz fields, have been the focus of research due to reports of possible deleterious health effects of fields, especially the magnetic field, at these frequencies.

High frequency fields are less penetrating than ELF fields, hence, the emphasis on ELF fields. The fields caused by the three phases vary (time-wise) such that some distance from the line the sum of the fields approaches zero, causing a sharp drop off in field strength as one moves away from the line.

Power line electric and magnetic fields (EMF) are classified as non-ionizing fields for the reason that they, unlike X-rays or gamma rays, normally do not directly cause ionization of atoms or molecules. The effect of EMF is to induce currents in objects that find themselves in these fields, due to the action of the electric and the magnetic field.

[14] Michael Faraday described a field as "action over a distance". The presence of an electric field can be demonstrated by holding a fluorescent tube in an electric field. The tube lights up, although not connected to a voltage source. The person holding the light suffers no discomfort. The glow is caused when electrons inside the tube are accelerated by the effect of the field and collide at the fluorescent wall of the tube, similar to the screens of television sets and computers of a decade ago. See https://www.youtube.com/watch?v=cXhZvyGtMrk.

ELF fields should not be confused with radio waves, radiated by antennas when the frequency exceeds about 3 kHz. Although power lines operate at 50 Hz, high frequency phenomena also occur on power lines due to secondary effects. One such phenomenon is corona. Corona occurs when the electric field strength on the conductors exceeds the corona inception level. Small discharges (sparking) occur on the line, causing high frequency current spikes. The line then acts as an antenna, radiating radio interference waves. Corona noise is aggravated by wet conditions when discharges form on water droplets on the line. Corona noise occurs typically in the frequency range 200 kHz to 20 MHz. The corona interference and interference due to sparking may interfere with some radio communication systems. Corona discharges also cause audible noise due to the movement of air molecules during the discharges.

The limits for electric and magnetic fields as set by the International Commission for Non-Ionising Radiation Protection (ICNIRP) are given in Table 14. These levels were obtained scientifically, taking into account the way the fields couple with the vulnerable parts of the human body.

Table 14 Reference values for 50 Hz electric and magnetic field guidelines (ICNIRP Guidelines 2010: 827)

Exposure	Electric Field (kV/m)	Magnetic Field (μT)
Occupational	10	1000
Public	5 (10)*	200

* Eskom increased this value to 10 kV/m within the line servitude – see below.

It is Eskom policy to adhere to these guidelines. The World Health Organisation decided to retain these guidelines despite the fact that the magnetic field has been declared "possibly carcinogenic to humans" (WHO 2007).

Electromagnetic interference (RI) is measured in dB (1 μV/m, CISPR). There are no statutory limits for RI and utilities base design values on experience. For wet conditions, Eskom uses 72 dB at the servitude boundary, based on experience with previous designs that were found to be compatible with local broadcasting services.

The possible link between EMFs and the health of living organisms has been a topic of active research during several decades. The most important references are summarised in the specialist report and the following conclusions can be drawn from the literature:

- There are no substantive health issues related to ELF *electric fields* at levels generally encountered by members of the public.
- Similarly, no substantive evidence exists regarding *magnetic fields*, excluding the inconclusive evidence of a marginally increased evidence of the occurrence of childhood leukaemia when exposed to 0.3 to 0.4 μT. On these grounds, the International Agency for Research on Cancer (IARC) declared the ELF magnetic field as “possibly carcinogenic to humans". This classification is used to denote an agent for which there is limited evidence of carcinogenicity in humans and less than sufficient evidence for carcinogenicity in experimental animals (other examples include coffee and welding fumes).
- Power frequency magnetic fields not only originate from high voltage power lines, but are also caused by low voltage power distribution networks and other household appliances.

From an EMF perspective, although the fields inside the sub-station are high (but less than occupational limits), the fields outside the sub-station decrease with distance, as is the case with power lines. Based on data obtained from the literature and from measurements (including measurements at a typical Eskom sub-station), and if the contribution by the sub-station alone is considered, it can be expected that the electric and magnetic fields external to the sub-station should be less than 0.5 kV/m and less than 1 μT respectively, compared to the ICNIRP reference values for public exposure of 5 kV/m and 1000 μT.

The contribution to the electric and magnetic fields will originate mainly from the high voltage lines passing surrounding premises, rather than from the sub-station itself. Field strengths at the premises of surrounding stakeholders were calculated.

- RCL Farms.
  The present situation is that the existing double circuit 275 kV lines pass very close to some of the chicken farms. As seen on Google Earth, the corner of one farm is actually in line with the outer phase of the line. The route of the 765 kV transmission line is still to be negotiated. Currently, there does not appear to be space between the existing 275 kV and some of the RCL Farms on the east on which to construct the 765 kV line. Thus, it is probably likely that the 765 kV line will run to the east of the RCL Farms in this area, thereby avoiding any cumulative impact with the 275 kV line near the chicken houses. With the proposed 2 x 400 kV double circuit lines coming out from the sub-station to the south of RCL, it is likely that there will be little to no new EMF impact from the transmission lines upon RCL (Figure 32).

  The closest farm to the sub-station is approximately 420 m from the proposed substation. The EMF of the sub-station would be completely masked by that of the existing 275 kV lines.

- African Bird of Prey Sanctuary and Raptor Rescue.
  Calculations show that the electric field contribution of the 275 kV lines at the ABOPS is currently only 0.0004 V/m. The addition of the double circuit 400 kV lines would increase the value to 0.004 V/m. The contribution of the 275 kV lines is only to 0.02 μT and this value will rise to 0.025 μT when the two double circuit 400 kV lines are added. These are well within the guidelines for exposure limits (Table 14).

  On the north-eastern side of the ABOPS, the Isundu-Mbewu 2 x 400 kV lines would also contribute to the EMF exposure at ABOPS. Regardless of the layout alternatives, the EMF effects on ABOPS will be negligible.

  However, the presence of power lines could affect the use of the bird tracking receivers used by ABOPS. If the tracking devices' frequency band overlaps with the corona generated interference, then when the receiver is pointed towards a transmission line, interference occurs. This electromagnetic interference could negatively affect the tracking of raptors if lost during the flying displays. One solution may be to acquire a more sophisticated receiver to minimise the effect of the corona interference. However, even this will not guarantee there will be no tracking interference, which depends on the physical location of the bird and handler, relative to the power lines.

10.5 Spatial planning overview

The proposed site falls entirely within the Mkhambathini LM, which is located along the south-eastern boundary of the uMgungundlovu DM. The primary urban node in the municipality is the town of Camperdown, located along the N3 Highway.

The proposed Isundu Sub-station site is located to the east of Ashburton, and north of Camperdown. Land use in the surrounding area is dominated by existing tourism establishments and agricultural activities, in particular, chicken houses owned by RCL Foods and used for breeding. In addition, there are tourism/residential estates that are currently being developed as well as a proposed housing estate development currently in the planning phase (Figure 15).

The district and local municipalities are mandated with the responsibility of coordinating development and planning activities within their districts and local municipalities, in which they are supported by Provincial and National Government. The proposed site is on land zoned in the Mkhambathini SDF as 'Agricultural Tourism' (or Agricultural Eco Tourism).

In addition, the adjoining Msunduzi LM SDF has the area bordering on Mkhambathini zoned for agriculture, conservation, and open spaces. However, the proposed site does not fall within the Msunduzi LM or the Camperdown (Mkhambathini LM) town planning scheme. In accordance with the KwaZulu-Natal Planning and Development Act (Act No. 6 of 2008) (PDA), approval must first be obtained from the municipality for a development of this nature. There is, however, a municipal by-law in preparation, which, when adopted, will streamline the PDA process.

There are currently four planned projects in the vicinity of the proposed Isundu Sub-station site:

- Mayibuye Game Reserve (construction just commenced) – there is potential land use conflict with the proposed sub-station.
- Aloe Wildlife Estate – there is potential land use conflict with the proposed sub-station.
- Lion Park Pipeline Augmentation (Umgeni Water) – there is no land use conflict with the proposed sub-station (now constructed).
- Transnet New Multi-Product Pipeline (NMPP) PL1 Truck Line – there is no land use conflict with the proposed sub-station because it is located further south-west than the existing NMPP Pipeline which lies south-west of the proposed Isundu site.

There are also large areas within and surrounding the project area that are currently under an unsettled land claim. In this regard, Eskom will negotiate with the current landowner and the Department of Rural Development & Land Affairs until such a time as the property right has been transferred to the claimant.

During this study it has emerged that various incompatibilities between the proposed project and the existing planning environment exist, such as:

- The municipal SDF and IDP. The proposed sub-station site, which will be an industrial land use, is zoned in the municipal SDF for agriculture and tourism.
- Existing and planned projects (Figure 15). Existing projects and activities surrounding the proposed sub-station site are reliant on the maintenance of the 'rural nature' of the area. It is believed that the construction of the sub-station and turn-in lines will alter the nature of the area, which may affect the viability of existing and planned projects.

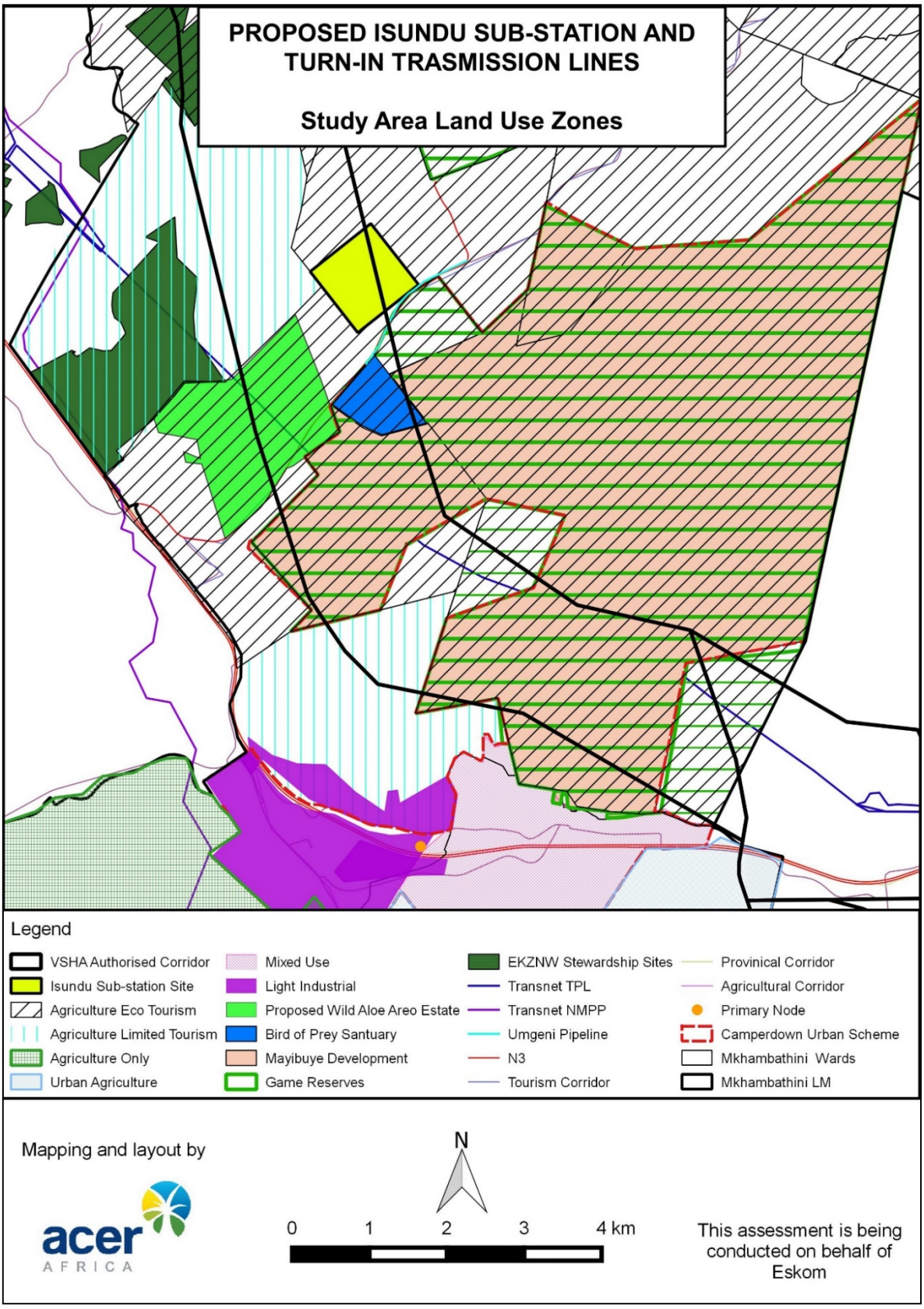

Figure 15 The proposed Isundu Sub-station and surrounding land use zones

There is also uncertainty concerning land ownership as the land where the proposed sub-station site is located is under land claim.

While incompatibilities with the planning environment exist, it must be noted that such incompatibilities are not necessarily fatal flaws. The findings of other specialist studies being conducted, in particular, the visual, noise, social, and economic and tourism assessments, provide a good indication of the significance of these incompatibilities. The assessment of impacts detailed in the specialists' reports indicate how and to what extent the proposed project will alter the nature of the project area and whether or not there are fatal flaws.

The Mkhambathini Municipality's Spatial Planning and Land Use By-law came into effect on 15 January 2016. Thus, Eskom will not be required to submit a PDA application to the local municipality. However, it is believed that Eskom will still need to obtain planning approval, in terms of the KwaZulu-Natal Planning and Development Act 2008, for the zoning and development of the land as the area is not currently zoned for service infrastructure.

10.6 Social assessment

The social assessment should be read in conjunction with the tourism and economic development assessment where potential impacts on the economic environment (existing and planned are quantified) (Section 10.7).

For the social assessment, both qualitative and quantitative data analysis techniques were applied (using primary and secondary data sources).

KZN is the third smallest province in South Africa (94,361 square kilometres) accounting for 7.7% of the entire country. Despite being the third smallest province, KZN has the second largest population, with a total population of 10,267,300 people (StatsSA, 2012a).

The population growth rate in the Mkhambathini LM is reported to have fluctuated since 2001. The Mkhambathini IDP states that the growth rate decreased from 2001 to 2007 and increased between 2007 and 2011, with the average growth rate between 2001 and 2011 reported to be 0.7%. The unstable nature of the population could be due to the high levels of in- and out-migration that is reported to have taken place in the area (Mkhambathini IDP, 2014/2015).

Between 2001 and 2011, the average household income within the Mkhambathini LM increased by 7.6% (higher than the annual inflation rate of 5.4%[15]). This trend was experienced throughout KZN, with the average household income per annum increasing by 7.9% annually between 2001 and 2011. However, despite the increase, the average income level for Mkhambathini LM remains well below the South African average annual household income of R 103,195 (StatsSA, 2012a).

Community services are the biggest contributor to both the local economy and employment in the Mkhambathini LM. While growth in employment numbers is being seen in this sector, reliance on community services suggests that government is a significant employer in the LM (Mkhambathini IDP, 2014/2015). Agriculture, while experiencing a decline in its contribution to employment and the local economy, remains of importance and is the second biggest economic sector in the LM. The agricultural sector is based around sugarcane farming, forestry and, in particular, the poultry sector. The region has the second highest concentration of poultry producers in the world, and is also responsible for the employment of a network of service

15 http://www.inflationcalc.co.za/

providers. Pig, beef and vegetable farming are also undertaken within the municipality, albeit on a smaller scale. Other significant contributors to the local economy and employment are the manufacturing and finance sectors (Mkhambathini IDP, 2014/2015).

The percentage of the population within the Mkhambathini LM that is non-economically active is higher than that for the DM and province as a whole. In addition, while the DM and province experienced an increase in the percentage of the population between 15 and 64 reporting to be formally employed, the Mkhambathini LM experienced a decrease.

Projects can initiate various social change processes. These processes can lead to social impacts depending on the local social setting and mitigation processes that are put in place. Social change processes identified as a result of the proposed sub-station and turn-in lines are as follows:

- Demographic processes.
  - In-migration.
- Economic processes.
  - Waged labour.
- Socio-cultural processes.
  - Deviant social behaviour.
- Geographical processes.
  - Conversion and diversification of land use.

The social impact report identified and considered the following possible social impacts which may occur as a result of these social change processes.

During pre-construction and construction

- Health and social wellbeing.
  - Increased spread of disease.
- Quality of the living environment.
  - Increased criminal activity.
  - Increased dust.
  - Reduced road safety.
  - Increased pressure on existing infrastructure and services.
  - Increased danger of fire.
  - Aesthetic impacts.
  - Increased noise.
- Economic impacts and material wellbeing.
  - Permanent loss of private land and housing.
  - Increased employment opportunities.
  - Increased opportunities for Small Medium Enterprises (SME)s.
  - Reduced property values.

During operations

- Quality of the living environment.
  - Aesthetic impacts.
  - Increased noise.
- Economic impacts and material wellbeing.
  - Increased opportunities for SMEs.
  - Damage to private properties.
  - Restrictions to future development.
  - Loss of income.

No fatal flaws were identified from a social perspective for the proposed Isundu Sub-station and turn-in transmission lines. There may be impacts of medium significance both as a direct or indirect result of the proposed sub-station and transmission lines. During both the construction and operational phases it is likely that the aesthetic nature of the area will be transformed. This is of specific concern as many of the existing enterprises and planned enterprises in the immediate area are tourism based and are, thus, reliant on the rural nature of the area. It has, however, been concluded by the visual impact assessment that with suitable mitigation measures these impacts can be reduced to a level which should not have a significant impact on the local aesthetics of the area. This is excluding cumulative impacts associated with multiple transmission lines which will negatively affect the visual landscape over time.

10.6.1 Recommendations

In terms of social impacts, the following recommendations are made:

Criminal activity. During construction, the possibility of crime in the study area escalating, especially poaching, is a concern. Eskom as part of the servitude negotiations must liaise with the surrounding landowners and a protocol for gaining access to private land should be established and distributed to all parties. The impact of possible careless conduct by contractors must be acknowledged and the contractors should receive induction in terms of the relevant codes of conduct to which they should adhere. Construction teams should be clearly identified by wearing uniforms or identification cards that should be exhibited in a visible place on their body. Should any staff be caught in criminal activities of any kind, they should face instant dismissal and prosecution. The possibility of criminal opportunists moving through the area should also be noted and local police and community policing forums should be informed prior to construction commencing.

Employment. The study area is characterised by high levels of unemployment, particularly in the rural communities. Therefore, it is recommended that Eskom should source as much local labour as possible during construction.

SMEs. As is the case with employment, the proposed project has the potential to generate opportunities for locally based SMEs. It is recommended that, in conjunction with the local and district municipalities, a database be developed with details of services provided by local companies. As far as feasibly possible, Eskom should be required to make use of local service providers.

Nuisance disturbances. During the construction and operational phases of the proposed project, there should be measures put in place to prevent nuisance disturbances from impacting surrounding. These nuisance disturbances include, noise, light, dust and fire.

10.7 Tourism and economic development assessment

This investigation undertook a review of the policies and strategies applicable to the area, to identify the spatial development vision for the area and the planned economic activities. Data were collected through site visits, surveys, and interviews with local businesses and land owners, or their representatives.

To predict potential economic impacts arising as a result of the project, the sensitivity maps produced by other specialists were reviewed in order to identify the extent to which various potential environmental impacts may affect each of the economic activities situated within the study area. Assessments focussed on the effects of the proposed project on these local economic activities.

Overall, the project is not in line with the current policies and land use plans of the study area, which has been zoned for the following uses: agriculture with some tourism, agriculture potential, conservation, and also an urban scheme where the project crosses into the Mayibuye development.

The economies of the province, district, and even that of the Msunduzi LM are similarly structured to that of the country, with the finance, real estate and business services, government services, and trade industries contributing at least half of the economy's GDP in all cases. The economy of the Mkhambathini LM, where the bulk of the project footprint will be, is structured differently. In this LM, the importance of the agricultural sector increases. In 2013, it was estimated that 22% of the local economy's GDP was created by the agricultural sector.
The local economy is heavily reliant on the agriculture and agro-processing sectors for GDP generation. The manufacturing sector, together with the agricultural sector, is the dominant employment creators in the Mkhambathini LM, comprising 38.6% of the opportunities in the local economy.

Apart from the high reliance on agriculture and agro-processing, the rest of the Mkhambathini LM is relatively well diversified when compared to other economies, which rely on tertiary industries for the creation of GDP. The Mkhambathini economy's tertiary sector comprised approximately 48% of the economy's GDP in 2013, significantly lower than the 69% and 72% recorded in the district and province, respectively (Quantec, 2015). Tertiary industries making significant contributions to the Mkhambathini GDP include the finance, real estate, and business services industry; as well as transport, storage and communication services; and the wholesale, trade, catering, and accommodation services sectors (Quantec, 2015).

10.7.1Potential impacts

10.7.1.1 Positive economic impacts

Based on data provided by Eskom, construction of the sub-station will take approximately three years with the following estimated costs:

- R 2,904 million will be spent on construction of the sub-station.
- R 6.7 million will be spent per km for construction of a single 400 kV transmission line (this project is considering two double circuit 400 kV transmission lines).
- R 12.29 million will be spent per km for construction of the 765 kV transmission line.

Considering the above, the project is likely to create a significant injection into the domestic economy, assuming that the majority of equipment and services are procured from businesses located in South Africa. For comparison purposes, the construction costs associated with the sub-station alone equates to 0.1% of South Africa's GDP, and 2.5% of the GDP generated by national construction activities.

As a result of multiplier effects, the expenditure on procurement of machinery, equipment and services in the country would stimulate production along backward linkages and would increase the overall economic benefit of the project to the national economy. Manufacturing industries and business services are likely to be the biggest beneficiaries of these effects.

Local businesses may also benefit from the construction activities by providing transportation, accommodation, and personal services to the construction workers who would need to temporarily move to the area.

The most significant positive economic impact to be observed during the operational phase is associated with the strengthening of the KZN transmission network. Various developments planned across KZN, which require access to electricity, may not be realised should the transmission infrastructure not be expanded.

10.7.1.2 Farm Lange Hoop

The proposed sub-station site is on the Farm Lange Hoop. Currently, the farm produces 700 – 800 bales of hay per season, with an annual turnover of approximately R 24,000 (when half of the farm is baled). The farm is primarily a residential farm, with two part-time labourers who are employed three days a week to assist with the management of the farm.

The direct economic impact of the proposed Isundu sub-station on the impacted farm is, estimated to be negligible as follows:

- Loss of between R 24,000 to R 48,000 per annum.
- Loss of two part-time employment opportunities.

10.7.1.3 African Bird of Prey Sanctuary/Raptor Rescue

The African Bird of Prey Sanctuary and the Raptor Rescue rehabilitation centre are located approximately 800 m to the south of the proposed sub-station.

The centre functions as a Closed Corporation (CC) and earns its income primarily from the sale of entrance tickets. The flight demonstrations are included in the price of the tickets and are considered the prime attraction at the facility. The Centre also includes a small café - the “Africa Trading” gallery that contains African artwork from all over the continent; a curio shop and a self-guided nature trail (40 minute walk) suitable for the whole family. It also provides a children’s’ playground and contains small farm animals that children can feed.

The Sanctuary has approximately 18,000 – 22,000 paying visitors per annum, excluding free tours for school groups. This ticket sale income roughly equates to half of the income received by the centre, with as much income being earned through transactions at the restaurant, shop and café on site. Based on the figures provided, it is evident that the centre does not cover its running costs completely and also relies on donations and funds received from the national lottery.

Findings from the avi-fauna specialist study indicated that the flying demonstrations may be negatively affected. Should these stop, in addition to losing entrance revenue, it is likely that there will also be financial losses at the café, shop and restaurant, which, collectively, produce the bulk of their income. The centre’s running costs are more than its daily tourism revenue taking, and grants and donations cannot be seen as a regular, constant income stream. The centre is not receiving ongoing government support and, therefore, cannot afford to lose any of its current income.

10.7.1.4 Natal Lion Park and Zoological Gardens

The Natal Lion Park and Zoological Gardens experience semi-seasonal tourism visits. School holidays, weekends and the December holiday period are the busiest and, consequently, the most profitable times. In the 12 months between July 2014 and June 2015, 33,706 (22,513 adults and 11,193 children) visitors entered the zoo generating a turnover of approximately R 1,798,500 from the sale of tickets.

The review of the specialists' findings suggests that during the construction of the sub-station, there is the possibility that construction traffic could lead to an increase in dust and noise, which will represent a short-term change in sense of place and nuisance to the tourists visiting these facilities. As far as the operational phase is concerned, the visual impact of the sub-station is envisaged to have a significant negative impact on the sense of place at the entrance to the two facilities, if left unmitigated. However, once inside the park and the zoo, the tourists are unlikely to see the sub-station, although some portions of it or the transmission lines could be visible. No other operational phase impacts have been identified.

The effects of the project's visual impact on the revenue of the two facilities over the entire operational period are difficult to monetise; however, it is rated as an impact of low significance.

10.7.1.5 RCL Farms

RCL operates as a fully integrated production chain. Pedigreed breed stock (grandparents) is sourced from the United Kingdom and Europe from Cobb. These animals are then used to breed the parent stock. The parent stock lay broiler chickens, which are eventually slaughtered, and the derived poultry meat is then used to manufacture a variety of products that are then distributed to supermarkets, restaurants and fast food chains. Seven of RCL's laying farms and four of its broiler farms are located in proximity to the proposed site (the closest farm is approximately 420 m and the furthest over 1.5 km from the proposed sub-station site). The poultry farming value chain is perceived to be highly sensitive to any effects that could cause changes and disruptions at any of its stages.

RCL's production figures were examined and are believed to be realistic. RCL produced approximately 78 million broiler birds from their KZN production in 2014, with their KZN operation accounting for about 31.7% of their nationwide production.

It is estimated that one laying farm, comprising 41,500 laying hens, contributes to the generation of R 616,194 of turnover or R 154,636 of gross profit for the entire RCL operations per day. Considering the approximate production and the number of layer farms, the calculations seem to indicate that each of the layer farms in the Isundu area (and rest of KZN) operate for at least one layer cycle each year, which coincides with the information supplied by RCL. More specifically, assuming that each of the 14 KZN layer farms has the same capacity (41,500 laying hens) it seems likely that some of the layer farms are being used for a longer period than 39 weeks (with new hens being brought into the applicable farms after the first 39 weeks cycle has ended to start the next cycle) or their capacity exceeds that of 41,500 chicks.

The review of specialists' studies suggest that the three laying farms closest to the proposed Isundu sub-station site may be negatively impacted during the construction period, possibly as a result of dust or loud, startling noises, for example, from blasting. Light intrusion could also be problematic particularly during operations.

Based on these economic estimations any impact resulting in interruption at these three farms could mean, in the worst case scenario, that about 77,315 eggs are not being laid and put through the value chain, equating to a potential loss of about R 1.8 million in revenue and R 464,000 of gross profit per day for RCL.

10.7.1.6 Mayibuye Game Reserve

Mayibuye Game Reserve is a developing tourist/residential initiative directly across the road from the sub-station.

The main concern of Mayibuye Game Reserve management is the negative visual impact the sub-station will have on the Reserve and how this might affect the viability of the enterprise. According to the developer, R 25 million has been spent on the development to date. In addition to the costs that have already been incurred, the development's business plan indicates that the total project cost will be approximately R 265 million. This is inclusive of all the game acquisitions, construction of the lodges, admin buildings, and all community/consumer buildings, the provision of bulk infrastructure; and salaries and professional fees over the five-year construction period.

Considering that the project cost includes the acquisition of game, including charismatic game such as elephant and rhino, the costs as per the business plan and feasibility study seem reasonable.
The business plan's brief feasibility study estimated the following income to be derived from various project components:

- Real estate: residential plots will sell for R 1.5 million and R 3 million for the 1 ha and 5 ha plots, respectively bringing in a total income of R 385.5 million.
- Accommodation: the Mayibuye Game Reserve is envisaged to have three lodges. The largest lodge, with a capacity of 40 rooms of 45 m^2 each, will be located closest to the entrance and, therefore, closest to the proposed Isundu sub-station site. The other two lodges are to be located deeper into the reserve area and will consist of 12 rooms each. Income from the lodges is expected to be derived from year four of the development. It is envisaged that a total of R 10.5 million will then be earned during two years (i.e. year four and five). Considering that income will be earned proportionally to the number of rooms included in each lodge, it can be estimated that the lodge closest to the sub-station is expected to generate about R 3.2 million per annum.
- Game reserve operations: operations of the game reserve are expected to generate an additional income of R 8 million during Phases 2 and 3 of the development, which is expected to span about four years. Thus, game reserve operations are envisaged to have a turnover of about R 2 million per annum.

According to Wildlife Ranching SA (Wildlife Ranching in South Africa, 2012), the average game ranging activity generated approximately R 220 per hectare in economic output in 2012. Considering that 3,340.5 ha will be allocated towards the game reserve, the estimated revenue that could be derived based on the above parameter would have been about R 735,000 in 2012 prices, which is approximately R 875,000 in 2015 prices. Compared to the developer's estimate of annual revenue of R 2 million to be derived from game operations, the projected revenue might be overestimated.

Current vacant land prices in Pietermaritzburg are far below the prices of the stands that are planned to be sold by the developer in the game reserve. However, it must be kept in mind that the addition of the Big Five and other amenities will increase the exclusivity of these plots, suggesting that the prices could well be justified.

The business plan also contains some detail on current and projected employment at the Mayibuye development. Currently, 30 individuals from the local community are employed at the fencing operations, while it is estimated that up to 1,500 construction jobs could be created during the construction of the tourism and administration facilities. This does not include the possible jobs that would be created once individuals start the construction of their private residences.

The Mayibuye business plan estimated that roughly 700 permanent jobs in total will be created at Mayibuye Game Reserve once it becomes operational. These jobs would be in the game reserve, lodges and in private households. The number of employment opportunities to be created during operations appears also to be overestimated. In May 2015, Dr. GC Dry, ex-president of Wildlife Ranching SA, stated that the average sized game farm (800 to 3,000 ha) will typically create 14 employment opportunities (Dry, 2015).

Even if this figure is doubled for the Mayibuye Game Reserve, and assuming that 50 individuals are employed in shifts at the restaurant, education and craft centre, and the tea garden; the total employment directly created by Mayibuye is still less than two thirds of the projected permanent employment as per the Mayibuye business plan.

The potential economic impact on the Mayibuye development can be grouped under two types, viz. the “property value” potential from the sale of private homes, and the tourism value generation potential from the activities of the game reserve and lodges within the development.

Construction activities and increased road traffic may lead to an increase in noise levels and dust pollution in the area, which could negatively impact on the attractiveness of commercial tourism facilities located at the entrance to the game reserve. The impact will take place only if the noisy and dusty periods of construction of the sub-station overlap with the operations of the established commercial activities. If they do overlap, the increase in noise levels during construction could deter some tourists from visiting the facility. However, it would not jeopardise the entire Mayibuye project and specifically the tourism component to be derived from game reserve operations during construction.

It is likely, however, that the construction of the sub-station will precede or overlap with construction at the reserve itself; in which case, this negative impact is unlikely to take place at all.

The Noise Specialist Report found that, once operational, the Mayibuye facilities are unlikely to be negatively impacted by noise from the sub-station and should not impact on the success of the planned commercial tourism facilities. The proposed lodges are located even further away from the road and the proposed project site and, therefore, even less likely to be impacted. Thus, no negative economic or tourism impact is likely in this regard during operations.

In terms of visual impact, it is likely some tourists may be deterred, but it will not necessarily jeopardise the viability of the tourist-related business at the game reserve because the sub-station will not be visible from all areas and there are already chicken farms, industry, transmission lines and a quarry in the immediate area.

The upper structures of the sub-station may be visible from certain areas where Lodge 1 is proposed to be located. It will also be visible from the garden centre, the nursery, the tea garden, the craft centre, and the shop. It is estimated that potentially 40 out of 187 stands planned to be developed in the reserve may be impacted by the visual disturbance created by the upper structure of the sub-station. While visibility during the day may be less noticeable, lighting at the sub-station during night time will make it more prominent.

One can argue that the above change in aesthetics caused by the sub-station and possibly a transmission line may negatively impact on the property values of the stands planned to be developed in the reserve. Some studies in other countries show that depending on the distance from the transmission line, house prices could decrease by between 1% and 10%. Furthermore, the rate at which the real estate value decreases, increases for higher-end buyers, chiefly due to a bigger ability of such customers to choose (Wolfe, 2015), with an average decrease of

6.3%. Other studies found that transmission lines led to a decrease of property values by 2% and 9% (Pitts, 2010). The general consensus is that the decline in prices is chiefly due to the visual and space obstruction represented by the transmission lines.

Given that the proposed residential units are currently conceptual, it is difficult to comment on the likely impact of the sub-station on real estate value at the reserve. Since the target market for the stands to be developed at the reserve include highly affluent individuals and families, they are likely to be more sensitive to the visual disturbances than middle income households.

However, it is also important to recognise that there are numerous other high income areas and estates competing for highly affluent individuals, and Ashburton is not yet generally recognised as a prime destination. However, it is perhaps relevant to note that this development is aiming at a slightly different segment of the high-income market, namely those who wish to live within a game reserve.

10.7.2 Mitigation measures

The majority of recommended mitigation measures were to implement the recommendations of other specialist studies. However, the following specific mitigation measures were recommended:

- Where feasible, make use of local small businesses in the procurement process.
- Opportunities should be investigated to make contracts available to local businesses with regard to the transportation of goods and workers, where possible and financially feasible.
- Where possible, and feasible, the mitigation measures proposed by the various specialists should be strictly adhered to. This specifically refers to the mitigation measures proposed by the noise, visual and air quality specialists that are all aimed at minimising the negative effects of possible environmental impacts exerted by the project during construction.
- It is advisable that Eskom and the appointed construction crew engage with the four businesses that may be impacted prior to construction to take into account their recommendations or requests with respect to specific mitigation measures, and to inform them of when construction is to start and the key periods of greatest activity/disturbance.
- If any interruption to the production cycle at the nearby laying farms (L1, L2 and L14) occur during construction and it is proven with certainty that it was caused by the construction activity on site, RCL should be reimbursed for the losses accordingly.

10.8 Noise impact assessment

10.8.1 Overview of terminology and levels

Noise impacts can be categorised as disturbing or nuisance noise, as outlined below:

- **Disturbing noise:** means a noise level that exceeds the outdoor equivalent continuous rating level for the time period and neighbourhood as given in SANS 10103:2004 (Table 15).
- **Noise nuisance:** means any sound which disturbs or impairs or may disturb or impair the convenience or peace of any reasonable person considering the location and time of day. This applies to a disturbance which is not quantitatively measurable such as barking dogs, etc (compared with disturbing noise which is measurable).

Communities generally respond to a change in the ambient noise levels in their environment, and SANS 10103 provides guidelines for estimating their response to given increases:

- 3 dBA[16]. For a person with average hearing acuity, an increase in the general ambient noise level of 3 dBA will be just detectable.
- 5 dBA. For a person with average hearing acuity, an increase of 5 dBA in the general ambient noise level will be significant, i.e. he or she will be able to point to the source of the intruding noise. According to SANS 10103, the community response for an increase of less than 5 dBA will be 'little' with 'sporadic complaints'. For an increase of equal to or more than 5 dBA, the response changes to 'medium' with 'widespread complaints'.
- 7 dBA. In the model noise regulations distributed by the Minister of the Environment and which are applicable in KwaZulu-Natal, an intruding noise is defined as 'disturbing' if it causes the ambient noise level to rise by 7 dBA or more.
- 10 dBA. A person with average hearing will subjectively judge an increase of 10 dBA as a doubling in the loudness of the noise. According to SANS 10103, the estimated community reaction will change from 'medium' with 'widespread complaints' to 'strong' with 'threats of community action'.

Table 15 Typical noise rating levels for ambient noise in Districts (noise zones)

Type of District	Equivalent Continuous Rating Level for Noise (LReq,T) (dBA)					
	Outdoors			Indoors with open windows		
	Day-night ($L_{R,dn}$)	Daytime ($L_{Req,d}$)	Night-time (LReq,n)	Day-night ($L_{R,dn}$)	Day time ($L_{q,d}$)	Night-time ($L_{Req,n}$)
a) Rural districts	45	45	35	35	35	25
b) Suburban districts (little road traffic)	50	50	40	40	40	30
c) Urban districts	55	55	45	45	45	35
d) Urban districts with one or more of the following: workshops, business premises and main roads	60	60	50	50	50	40
e) Central business districts	65	65	55	55	55	45
f) Industrial districts	70	70	60	60	60	50

Noise level ranges in different typical environments are provided in Table 16.

[16] dBA - A-weighted decibel is an expression of the relative loudness of sound in air as perceived by the human ear. In the A-weighted system, the decibel values of sounds at low frequencies are reduced, compared with unweighted decibels, in which no correction is made for audio frequency.

Table 16 Typical noise levels

Noise Level dB(A)	Typical Environment	Subjective Description
140	30 m from jet aircraft during take-off	
130	Pneumatic chipping and riveting (operator's position)	Unbearable
>120	Hearing damage possible even for short exposure	
120	Large diesel power generator	
110-120	100 m from jet aircraft during take-off	
110	Metal workshop (grinding work), circular saw	
90-100	Printing press room	Very noisy
95-100	Passenger train at 200 km/h (peak pass-by level at 7.5 m)	Very noisy
95-100	Freight train at 100 km/h (peak pass-by level at 7.5 m)	Very noisy
75-100	7.5 m from passing motorcycle (50 km/h)	
75-80	10 m from edge of busy freeway (traffic travelling at 120 km/h)	
80-95	7.5 m from passing truck (50 km/h)	
80	Kerbside of busy street	
70	Blaring radio	Noisy
70	3 m from vacuum cleaner	Noisy
60-80	7.5 m from passing passenger car (50 km/h)	
65	Normal conversation	
65	Large busy office	
60	Supermarket/small office	
50	Average suburban home (day conditions)	Quiet
40	Library	
40-45	Average suburban home (night time)	
30-35	Average rural home (night time)	
25-30	Slight rustling of leaves	
20	Background in professional recording studio	Very quiet
20	Forest (no wind)	
0-20	Experienced as complete quietness	
0	Threshold of hearing at 1,000 Hz	

It should be noted that decibels (dB) are logarithmic values and cannot be simply added together. Adding two sources of identical values together will only increase the total value by 3 dB, for example 60 dB + 60 dB = 63 dB. When two sources of noise which differ by more than 10 dB are added together, the total noise will be almost the same level as the loudest of the two, for example 50 dB + 60 dB = 60.42 dB.

10.8.2Noise climate of the area

The existing noise climate of the core study area was initially determined by means of a field inspection and noise measurement survey. The measurement survey covered the whole of the study area node but focussed specifically on the identified noise sensitive, potential problem areas around the development site. Measurements were taken at seven main monitoring sites in the areas immediately surrounding the development. The day time and night time conditions were measured as shown in Figure 16 and provided in Table 17.

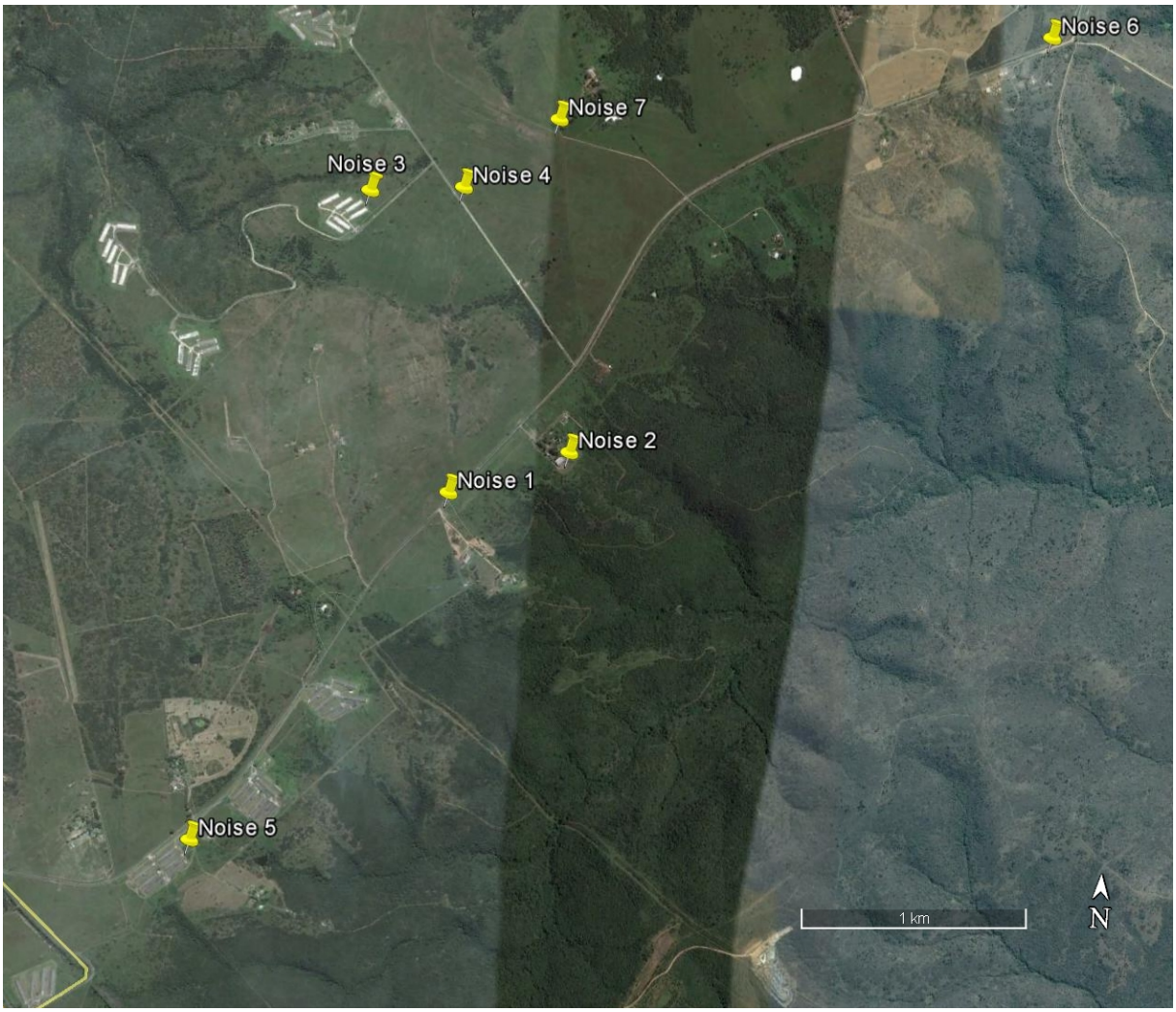

Figure 16 Noise measurement sites

Table 17 indicates the equivalent sound pressure (noise) level (L_{Aeq}), the maximum sound pressure level (L_{Amax}) and the minimum sound pressure level (L_{Amin}). The equivalent sound pressure (noise) level may, in layman's terms, be taken to be the average noise level over a given period. This "average" is also referred to as the residual noise level (excluding the impacting noise under investigation) or the ambient noise level (if the impacting noise under investigation is included).

Table 17 Measured current noise levels in the study area

Site No	Location Description	Measured Sound Pressure Level (dBA)					
		Day time Period			Evening Period		
		L_{Aleq}	L_{max}	L_{min}	L_{Aleq}	L_{max}	L_{min}
1	On the eastern side of Road P477 at the crossing with the overhead power lines and approximately 2,800 m north-east of the N3 national road	62.0	77.5	24.4			
2	In parking lot of African Bird of Prey Sanctuary	44.0	54.8	24.2	34.9	39.2	24.5
3	Onsite at RCL rearing and breeding chicken houses, approximately 15 m from nearest chicken house	50.2	54.9	46.8			
4	Approximately 100 m south of RCL breeding and rearing security entrance	50.2	62.3	31.0	33.3	39.9	28.5
5	On the eastern side of Road P477, 15 m from first chicken house at RCL and approximately 850 m from N3 national road	43.9	58.0	36.2			
6	Along Road P566, approximately 2,500 m to the east of the development site	57.6	74.2	27.2			
7	On farm Thorndale, approximately 800 m south-west from farm house	44.3	58.5	35.4			

Atmospheric temperature inversions also have a significant effect on the noise propagation character of an area. Temperature inversions tend to increase noise levels at some distance from a source. A temperature inversion is formed when air near the ground is cooler than the air above. This occurs mainly at night or to a lesser extent during cloudy days, away from large bodies of water. Stable conditions with high humidity and very low velocity wind conditions are necessary. As cool air is denser than warm air, sound rays are refracted towards the cooler air, i.e. towards the ground.

At each measurement site, a portable recording weather station was set up in the vicinity of the sound level meter and wind speed, temperature, humidity, barometric pressure, and altitude were recorded. The weather conditions were such that the measurements to establish the ambient noise levels were not adversely affected and no specific corrective adjustments needed to be made.

In order to complement the short-term noise measurements at and adjacent to the development site, the existing 24-hour residual noise levels related to the average daily traffic (ADT) flows on the main road in the area were also calculated. These roads either directly affect the noise levels at the development site and/or have some effect on the noise climate in the core study area in general. Traffic data were obtained from the KwaZulu-Natal Provincial Roads Department. These data provide a more accurate base for the SANS 10103 descriptors than do the short-term measurements.

The main roads in the area are as follows:

- National Road N3 is aligned in a north-west to south-east direction.
- Provincial Road R103 is a major road parallel to National Road N3.
- Road P477 is a north-south provincial road which is aligned along the southern boundary of the planned sub-station site.
- Road P566 is an east-west provincial road and is aligned through the north-eastern section of the study area.

The calculated noise levels provided in Table 18 are for generalised and unmitigated conditions. There will be greater attenuation than shown with distance, where there are houses, other buildings and terrain restraints in the intervening ground between the source and the receiver point. In particular, the thick vegetation in some areas will significantly reduce the noise with increasing distance from the road.

The planned sub-station lies between urban and rural land uses. The existing situation with respect to the noise climate in the Isundu sub-station study area was found to be as follows:

- The measured ambient noise levels in the study area range from a low of 44.0 dBA up to 62.0 dBA.
- The areas relatively far from the main roads are generally very quiet. The noise climate in the study area varies from a rural to urban residential character.
- The noise climate alongside the roads are degraded (i.e. the noise climate exceeds the recommended SANS 10103 standard) up to the following distances from the centreline of the road:
  - National Road N3 - 4,500 metres.
  - Road R103 - 700 metres.
  - Road P477 - 230 metres.
  - Road P566 - 110 metres.

From these findings and observations on site it was considered appropriate to apply the following noise standards and impact criteria to the study area:

- Rural residential: the noise impact on the farmhouse sites, and residences and guesthouses on farms in the area has been determined on the basis of rural residential district standards (SANS 10103), viz. the day time period ambient noise level should not exceed 45 dBA and that for the night time period should not exceed 35 dBA.

The residential, stewardship sites, animal rescue and rehabilitation sites and tourist areas are classified as noise sensitive receptors (NSRs).

NSRs falling within the distances from the roads listed above are exposed to noise levels higher than recommended in SANS 10103 for rural residential areas using the day-night metric as the standard. Technically, this means that no further sources of noise should be allowed in the area that would degrade the noise climate even further. However, the above indicates the ideal situation, where NSRs are not already degraded by the existing (residual) noise climate.

Table 18 Existing noise climate adjacent to main roads (Year 2015)

Road	Noise Climate Alongside the Main Roads at Given Offset from Centreline (SANS 10103 Indicator) (dBA)																																
	25 m Offset			**50 m Offset**			**100 m Offset**			**250 m Offset**			**500 m Offset**			**1,000 m Offset**			**1,500 m Offset**			**2,000 m Offset**			**2,500 m Offset**			**3,000 m Offset**			**4,000 m Offset**		
	L_d	L_n	L_{dn}	L_d	L_n	L_{dn}	L_d	L_n	L_{dn}	L_d	L_n	L_{dn}	L_d	L_n	L_{dn}	L_d	L_n	L_{dn}	L_d	L_n	L_{dn}	L_d	L_n	L_{dn}	L_d	L_n	L_{dn}	L_d	L_n	L_{dn}	L_d	L_n	L_{dn}
N3	74.3	68.4	76.1	71.3	65.4	73.1	68.1	62.2	69.9	63.7	57.8	65.5	59.9	54.0	61.7	55.4	49.5	57.2	52.3	46.4	54.1	50.1	44.2	51.9	48.2	42.3	50.0	46.8	40.9	48.6	44.3	38.4	46.1
R103	62.4	50.3	61.8	59.4	47.3	58.8	56.2	44.1	55.6	51.8	39.7	51.2	48.0	35.9	47.4	43.5	31.4	42.9	40.4	28.3	39.8	38.2	26.1	37.6	36.3	24.2	35.7	34.9	22.8	34.3	32.4	20.3	31.8
P477	55.8	43.5	55.2	52.8	40.5	52.2	49.6	37.3	49.0	45.2	32.9	44.6	41.4	29.1	40.8	36.9	24.6	36.3	33.8	21.5	33.2	31.6	19.3	31.0	29.7	17.4	29.1	28.3	16.0	27.7	25.8	13.5	25.2
P566	52.3	40.1	51.7	49.3	37.1	48.7	46.1	33.9	45.5	41.7	29.5	41.1	37.9	25.7	37.3	33.4	21.2	32.8	30.3	18.1	29.7	28.1	15.9	27.5	26.2	14.0	25.6	24.8	12.6	24.2	22.3	10.1	21.7

L_d = Day time equivalent continuous rating, L_n = Night time equivalent continuous rating, L_{dn} = Day-night 24 hr equivalent continuous rating

The residual noise level at some of the NSRs already exceeds the recommended maximum. Where the noise level for a particular site is presently lower than the maximum ambient allowed (as indicated in SANS 10103), the recommended maximum shall not be exceeded by the introduction of the intruding noise. Where the noise level for the site is presently at or exceeds the maximum level allowed, the existing level shall not be increased by more than that indicated in SANS 10103 as provided in Table 19.

Table 19 Categories of community/group response (criteria for the assessment of the severity of noise impact)

Increase in Ambient Noise Level (dBA)	Estimated Community/Group Response	
	Category	**Description**
0 – 10	Little	Sporadic complaints
5 – 15	Medium	Widespread complaints
10 - 20	Strong	Threats of community/group action
Greater than 15 dBA	Very strong	Vigorous community/group action

10.8.3Impact on NSRs

A worst case scenario basis was used for the analysis of the noise conditions on site. This scenario models a temperature inversion, where the inversion layer is sufficiently higher than the top of the range of hills surrounding the site, to allow for reflection off the layer to the far side of the hills.

Aspects of the pre-design field surveys and construction activities that potentially will have a noise impact were identified. The predicted noise levels at given offsets from the centroid of some of the noisiest construction activities are shown in Table 20.

Table 20 Predicted noise levels at given offsets from operations

Equipment	Sound pressure level at given offset (dBA)								Duration
	500 m	**1000 m**	**1500 m**	**2000 m**	**2500 m**	**3000 m**	**3500 m**	**4000 m**	
Concreting Operations	57.8	50.4	45.8	42.4	39.6	37.3	35.2	33.4	Continuous
Piling Operations	59.9	52.2	47.4	43.8	40.9	38.5	36.4	34.5	Short term
Rock drill	55.1	47.6	42.9	39.4	36.6	34.2			Short term

The loudest continuous source of noise was found to be concreting operations. Figure 17[17] indicates the area within which noise impact may occur during the construction phase.

There will, at times, be noise from the construction site that will be heard well beyond the indicated positions of the respective 35 dBA contours, specifically from single short-term events (such as blasting).

During operation, the main and loudest noise will be from the transformers (six transformers with cooling fans operational were calculated). This will be continuous during operation.

Predicted noise levels at the given offsets will be as follows:

- At 500 metres - 50 dBA.
- At 830 metres - 45 dBA.
- At 1,300 metres - 40 dBA.
- At 2,000 metres - 35 dBA.

Audible noise from transmission lines occurs primarily during rainy conditions when water drops on the conductors and produce corona discharges, creating acoustic noise. Design should ensure that in dry and fair weather conditions, the lines operate below the corona-inception level and very few corona sources are present.

From measurements taken at the existing Zeus Sub-station, the corona noise in the yard was found to be less than that of the transformers. Thus, it is assumed that the transformers will determine the noise footprint of the sub-station to a large extent.

Figure 18 provides the modelled operational noise impact for Alternative Layout 2[18].

10.8.3.1 RCL Farms

It has been calculated that the maximum ambient noise levels at the closest chicken houses during the construction phase will be less than 60 dBA and during the operational phase, less than 50 dBA. The measured residual (existing) noise levels at 15 metres from these buildings were in excess of 50 dBA. The existing noise levels closer to the chicken houses are even higher, due to the noise caused by the ventilation fans and the chickens themselves. It is, therefore, not foreseen that general construction and operational noise will have a significant impact on the chickens.

However, short-term loud noises may be heard during rock-drilling, piling and blasting (pre-construction and construction phases only) which can potentially startle the chickens. According to the calculations, noise from piling and drilling operations will not exceed 60 dBA at the closest chicken houses. The blast impact report deals with the maximum instantaneous noise level during blasting.

17 Generally the same for both layout alternatives for construction.

18 The modelled operational noise impact for Layout 1 is provided in the specialist report, but not included here because of transmission line constraints associated with this alternative.

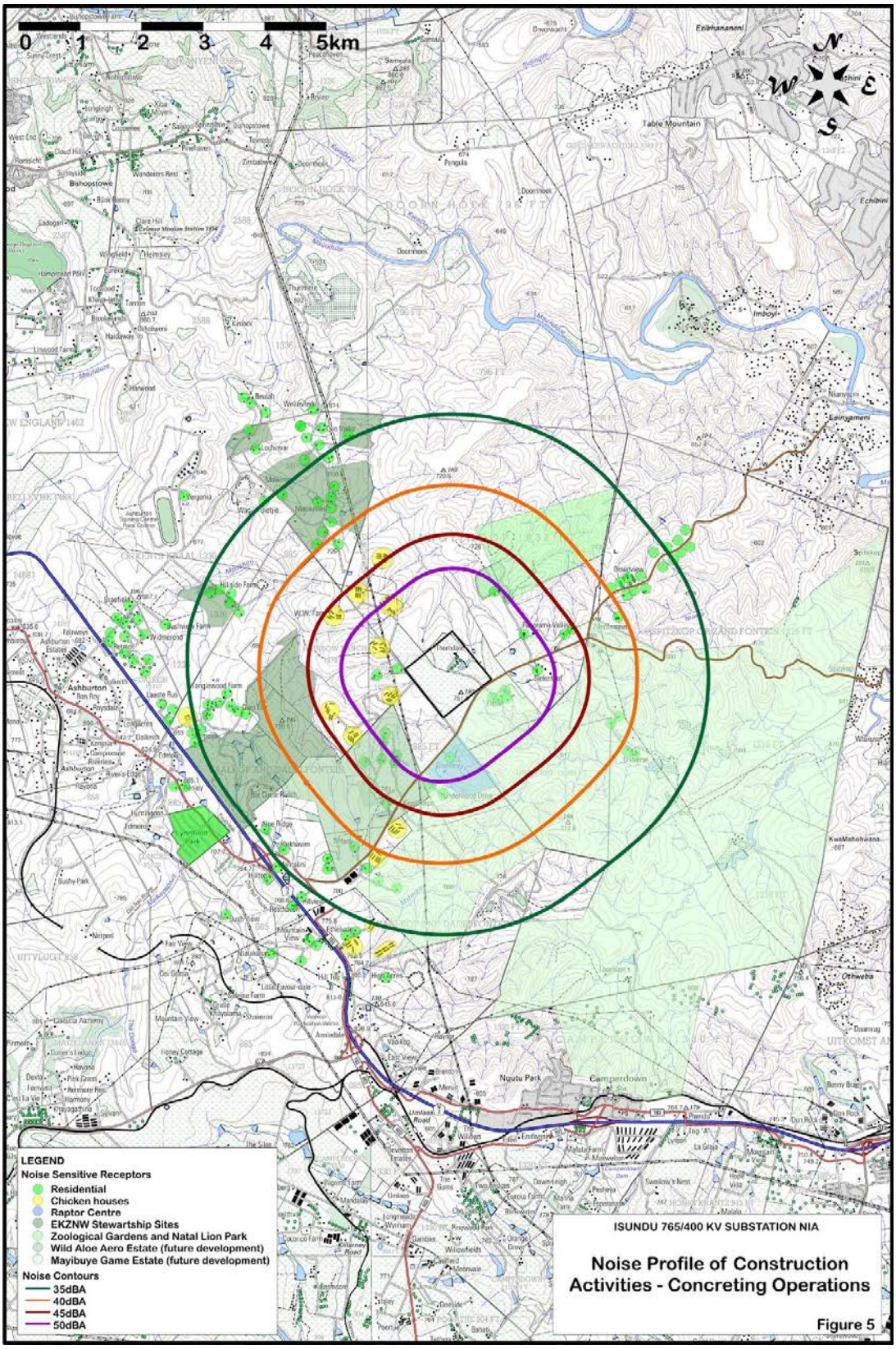

Figure 17 Noise profile during construction activities

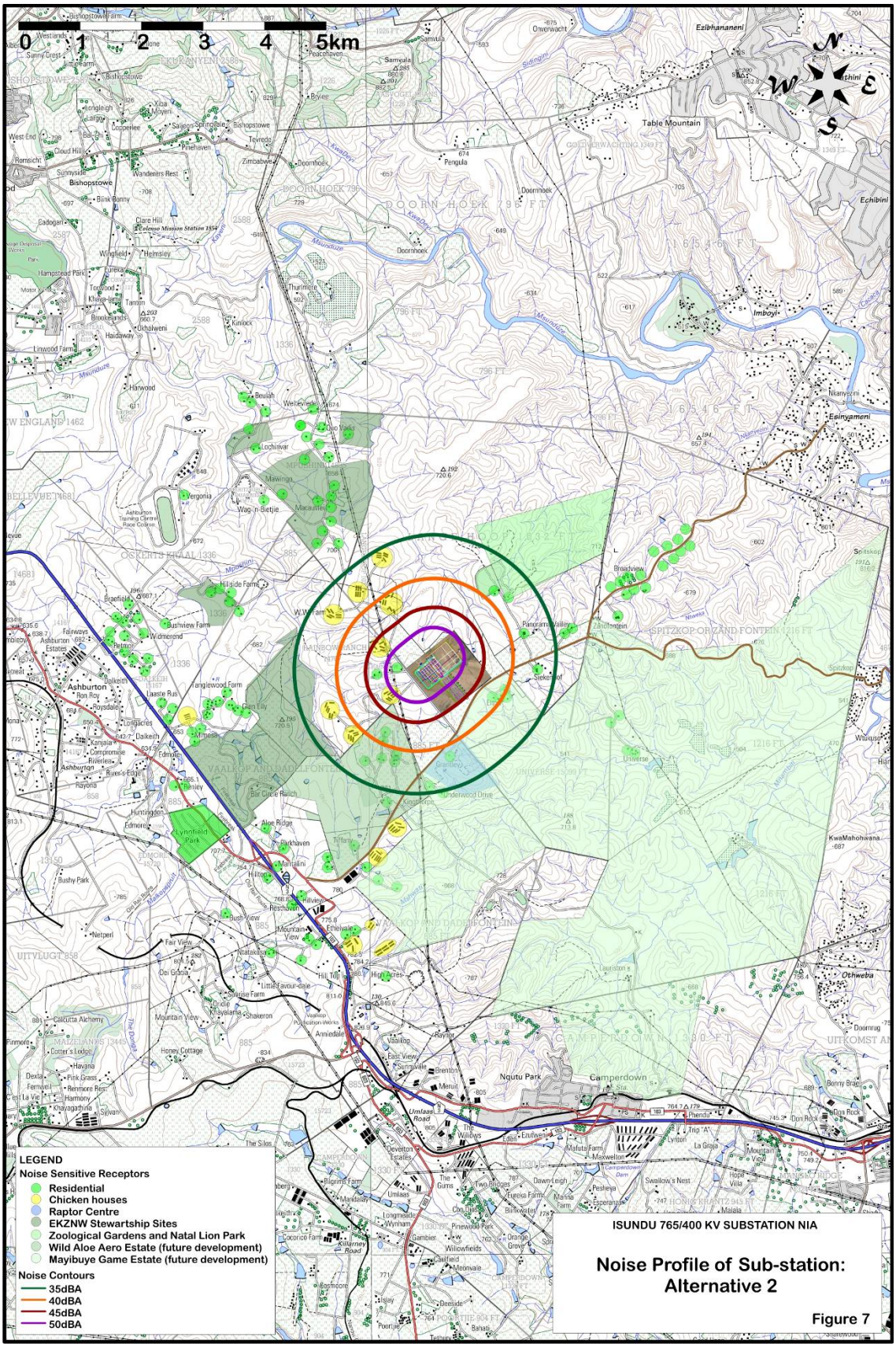

Figure 18 Noise profile during operation (Alternative Layout 2)

10.8.3.2 African Bird of Prey Sanctuary

It has been calculated that the maximum ambient noise levels at the ABOPS during the construction phase will be less than 60 dBA and during the operational phase, less than 50 dBA. The measured residual (existing) noise levels at 15 m from these buildings were in excess of 50 dBA. It is not foreseen that general construction or operational noise on the sub-station site will have a significant impact on speech communication during presentations if a microphone and loudspeakers are used.

However, the ABOPS' arena, where presentations take place, is at 250m offset from Road P477. The traffic noise level (L_{dn}) at this offset has been calculated as 44.6 dBA. It is estimated that there will be up to two trucks per hour (day time only) during the construction phase. The noise from the bypass of a single truck at this offset will be 60 dBA. This might make speech communication unintelligible for a brief period of time.

10.8.3.3 Mayibuye Game Reserve

The proposed commercial garden centre, nursery, tea room, craft centre and shop area are adjacent to Road P477. The traffic noise level (L_{dn}) at a 50 metre offset from the road has been calculated as 50.2 dBA. The operational noise of the sub-station is estimated to be 40 dBA to 45 dBA at this area. It is, thus, not anticipated that noise from the sub-station will affect this area significantly. However, during the construction phase, noise levels will be between 50 dBa and 60 dBA. In addition, it is estimated that there will be up to two trucks per hour (day time only) during the construction phase. The noise from the bypass of a single truck at this offset will be 75 dBA. This might make speech communication unintelligible for a brief period of time.

For the proposed Lifestyle Village Units, Frail Care Centre, community and sports facilities in this area the residual (existing) noise levels are between 40 dBA and 45 dBA (measured and calculated). This area will not be significantly impacted by noise from the sub-station as it lies between the 35 dBA and 45 dBA noise contours as calculated. During construction, noise levels will be elevated in excess of 50 dBA and the by-pass of a single truck may cause annoyance.

In general, it can be said that from a noise perspective, that the construction period may cause annoyance if the units are built and inhabited before construction of the sub-station is completed, but once the sub-station is operational, the noise impact will not be significant.

10.8.3.4 Aloe Wildlife Estate

During construction, noise levels in this area are anticipated to be 55 dBA on the northern side of the property, and less than 40 dBA on the southern side. However, the noise climate of the southern sector of the property is already severely degraded due to noise from National Road N3 and from Road P477 on the eastern boundary.

During the operational phase, the northern sector of the property lies between the 45 dBA and 35 dBA noise contour of the sub-station as calculated. This is not anticipated to cause a significant impact.

10.8.4Mitigation measures

In general, the development of the sub-station will alter the noise profile and character of the area. The impact will be varied as there is a wide variety of land uses in the area. It should be noted that the ambient values given are based on a general calculation of the area. There are measures that can be introduced to mitigate some of the impact of the construction and operational noise.

Since the sub-station will have to register as an industrial land use, the design of the sub-station is to incorporate all the necessary acoustic design aspects required in order that the overall generated noise level from the new installation does not exceed a maximum equivalent continuous rating level, namely a noise level of 70 dBA (just inside the *property projection plane*, namely the property boundary) as specified for industrial districts in SANS 10103. However, since the current land uses in the area adjacent to the proposed site have a rural noise character, the design also has to take into account the maximum allowable equivalent continuous day and night rating levels of the potentially impacted sites just outside the new installation's property. The noise levels, therefore, should ideally not exceed 45 dBA during the day time and 35 dBA during the night time.

To mitigate noise during construction the following measures are recommended:

- Construction site yards and other noisy fixed facilities should be located well away from noise sensitive areas adjacent to the development site.
- All construction vehicles and equipment are to be kept in good repair.
- Where possible, stationary noisy equipment (for example compressors, pumps, pneumatic breakers) should be encapsulated in acoustic covers, screens or sheds. Proper sound insulation can reduce noise by up to 20 dBA at a specific site. Portable acoustic shields should be used in the case where noisy equipment is not stationary (for example drills, angle grinders, chipping hammers, poker vibrators).
- Construction activities, and particularly the noisy ones, are to be contained to reasonable hours during the day and early evening.
- With regard to unavoidable very noisy construction activities in the vicinity of noise sensitive areas, the contractor should liaise with local residents on how best to minimise the impact.
- Machines in intermittent use should be shut down in the intervening periods between work or throttled down to a minimum.
- In general, operations should meet the noise standard requirements of the Occupational Health and Safety Act (Act No 85 of 1993).
- Construction staff working in areas where the 8-hour ambient noise levels exceed 75 dBA should wear ear protection equipment.

To mitigate operational noise, the design process is to consider, *inter alia*, the following aspects:

- The position and orientation of buildings on the site. The position of the surface facilities that generate the loudest noise should be located as far as possible from the noise sensitive sites on adjacent farms.
- The enclosure of noisy plant in buildings where possible and practical.
- The design of the buildings to minimise the transmission of noise from the inside to the outdoors.
- The insulation of particularly noisy plant and equipment.

- It should be noted that, due to the position and orientation of the sub-station, viz. that it is to be built on a geographically high point, any mitigation measures, such as berms or walls, will be more successful if applied at the site of the noise source, and not at the receiver point.
- If walls are to be built to shield the noise from the transformers, these need to be designed by an acoustic engineer, as there are often pure tones emanating from these that are difficult to block by normal constructed walls.

10.9 Visual impact assessment

Visual impacts can include general landscape change or degradation and/or a change in specific views for specific receptors for which the character of a view may be important.

The change in specific views can either be visual intrusions or visual obstructions. Visual intrusions are a change in a view of a landscape that reduces the quality of the view. This can be a highly subjective judgement. Subjectivity has, however, been removed as far as possible by classifying the landscape character of each area and providing a description of the change in the landscape that will occur due to the proposed development. The subjective part of the assessment is to define whether the impact is negative or positive. However, to make the assessment as objective as possible, the judgement is based on the level of dependency of the use in question on existing landscape characteristics. Visual obstruction is the blocking of views or foreshortening of views. This can generally be measured in terms of extent.

The main elements likely to contribute to the visual impact of the sub-station include the transformers which are probably the most visually solid element within a sub-station. The entire structure, including an oil reservoir can be in the order of 8 m high. In addition, the bus bars that carry the overhead conductors between the sub-station and the external power line make a large contribution and these will be approximately 22.5 m high for the 765 kV connections.

The associated transmission lines planned and considered will also contribute to the visual impact of the development. The possible alignment and direction of some of the envisaged lines were considered. No information exists on possible future line routes.

The proposed sub-station site is located within the N3 corridor between major local centres of Pietermaritzburg and Durban. This means that whilst the character of the corridor is predominantly rural in nature, urbanisation is occurring, leading to a land use mixture that is more akin to an urban fringe situation. The general corridor has a mixture of development much of which is transport and logistics orientated. Major infrastructure, agricultural buildings and, particularly, large scale chicken farm structures are also dominant features.

The development falls within two landscape character areas, the urban fringe corridor that runs beside the N3 and the traditional rural settlement that occurs in the valleys either side of the urban fringe corridor.

The proposed development is located within a predominantly commercial agricultural area within the urban fringe corridor. In the immediate vicinity of the proposed site, the dominant development is in the form of chicken farms. These present an agri-industrial character immediately to the south-west of the site. To the south-west, east and north formal development takes the form of occasional small scale structures including a farmstead, the Bird of Prey Sanctuary, and the Lion Park and Zoological Gardens. These are all relatively small in scale, resulting in commercial agriculture being the dominant development type.

The proposed site is also close to the upper slope overlooking the traditional rural settlement area. There is generally a high Visual Absorption Capacity but this does vary between the two landscape character areas, depending on the local topography.

The municipality is planning eco-tourism development in this general area. This is no doubt intended to build upon existing tourism uses and attractions in the area and to benefit from the area of rural agricultural use overlooking the Valley of 1000 Hills.

These existing tourism uses and their visual aspects are described below.

10.9.1 Bird of Prey Sanctuary

The Bird of Prey Sanctuary is a tourism attraction located on the P477, with local and regional importance as well as being a research and conservation facility of national importance. To a degree, the tourism operation finances the research and conservation activity. The natural setting and outlook over the Valley of 1000 Hills no doubt adds to the tourism attraction, particularly when it comes to seeing birds of prey being flown. Maintaining the slopes beneath the facility in a natural state is, therefore, likely to be important to the ongoing operation of this facility.

10.9.2 Mayibuye Game Reserve

The Mayibuye Game Reserve is also located on the P477 to the south and south east of the proposed site. It is proposed that Mayibuye's P477 Road frontage is developed with a commercial garden centre and tea room. Development of the reserve has commenced. The aesthetic surroundings of the Mayibuye Game Reserve are important for four reasons:

- It is being developed as a niche residential development with a small number of houses located in the natural bush.
- The natural hill slopes provide an important backdrop to the Bird of Prey Centre.
- Indications are that it will officially be granted nature reserve status.
- Part of the development includes a garden centre, tea room and craft shop facing on to the P477 immediately opposite the proposed sub-station site.

10.9.3 Lion Park and Natal Zoological Gardens

The Lion Park and Zoological Gardens are located approximately 1,000 m to the north, and north-east of the proposed site. Visitors are probably attracted by the natural environment. Should the development have a large industrial influence on the character of the area, it is likely that some people will be put off from visiting the area and this could impact on the economic viability of the attractions.

The P477 is the only access to all the areas listed above. As such, views from the road are a precursor to each activity. That the road frontage to all the attractions is predominantly rural and agricultural in nature is probably a benefit to the attractions. Whilst each of the attractions provides individual motivation for visiting them, should the character of the approaches be significantly modified through development, it is possible that visitors might be less inclined to visit the area. Whilst it cannot categorically be stated that the attractions would be negatively impacted by the initial impressions gained along the P477, visitors may be less inclined to visit a natural attraction if the overall setting becomes more industrial in nature.

10.9.4Key impacts

The study investigated the visual impacts upon key receptors as well as on the wider region. The following is a summary of the key impacts and their significance. Importantly, due to topography and the nature of the proposed development, significant visual impacts are likely to be limited to a focus on the ridgelines and higher ground immediately surrounding the proposed development.

In terms of the proposed sub-station, the investigation found that whilst the area is partly impacted by existing industrial elements such as chicken houses and power lines, the area immediately surrounding the proposed sub-station is one of the most intrinsic pieces of rural landscape in the area. It is a relatively small area that is impacted but its change in character could result in irreplaceable loss of opportunity in terms of a rural/agricultural outlook to one where industrial elements are likely to dominate the view.

The assessment found that the significance of this negative visual change would be high for the existing tourism enterprises on the same ridge, viz. the Lion Park/Zoological Gardens, the entrance of Mayibuye Game Reserve and the Bird of Prey Sanctuary. However, with mitigation, the visual impact of the sub-station on these areas could be reduced to one of low significance.

The impact of the sub-station on the wider Mayibuye Game Reserve was rated as one of medium significance for Alternative layout 2, and of low significance if mitigated. However, the potential impact of future transmission lines, particularly the Isundu-Mbewu 2 x 400 kV transmission lines, on either the Mayibuye Game Reserve or the Lion Park were identified as future negative visual impacts that could be substantial depending on where these lines are located.

The Zones of Theoretical Visibility analysis (as show in Figure 19) indicated that the proposed sub-station will be highly visible to a large proportion of area and, as the majority of the developable area is also along the P477, the sub-station is likely to industrialise the character of the area. The future 2 x 400 kV lines from the proposed Mbewu Sub-station near Empangeni are likely to exacerbate these impacts.

The municipality's future planning of eco-tourism in the area surrounding the proposed sub-station site is potentially a problem. If such development were to focus on areas overlooking the Valley of 1000 Hills and away from the sub-station, then impacts would be partially mitigatable with proposed screen planting. An eco-tourism development focus over the entire area, however, is likely to be put at risk by the proposed sub-station. It would probably be necessary to review this planning focus if the sub-station is developed.

The impact of night time lighting negatively affecting the breeding and laying cycles of chickens at the adjacent RCL farms was considered. If lighting were poorly designed, there is a possibility that light spillage could fall on the closest chicken houses[19]. This could result in problems associated with irregular lighting regimes causing breeding and laying issues. From inspection of the closest chicken house, it is obvious that the wall on the side facing the sub-station has no openings. The probability of the impact was considered improbable and the significance of this impact was considered low, with mitigation.

[19] Light is less likely to impact the other farms which are further away and/or have closed houses.

The proposed alignment of the 2 x 400 kV double-circuit transmission lines from the sub-station is to run parallel to the existing 275 kV line in order to tie into the existing Hector-Ariadne 400 kV double-circuit transmission lines approximately 4 km away. The visual impact of two intersection alternatives was considered:

- An intersection between the existing and proposed lines approximately 250 m outside the Mayibuye Game Reserve to the south but on the ridgeline.
- Deviating the last section of the proposed 2 x 400 kV double circuit lines to the west and tying into the existing lines below the ridgeline but inside the Mayibuye Game Reserve. This would also require a crossing of the existing 2 x 275 kV lines, which is likely to require the height of the proposed lines to be increased.

Given that there are likely to be additional height and structures associated with the second alternative and given that the simplest tie in position is likely to occur in the Reserve, the first alternative is favoured.

10.9.5Mitigation measures

Recommended mitigation measures to minimise visual impacts are:

- Screening vegetation.
  To plant a line of screening trees along the road edge of the P477 between the sub-station and the road, which would enable the development to be largely screened from the road frontage and areas adjacent to the road on the southern side (Figure 19). Planting on these properties would either be under the control of the applicant or subject to a separate agreement with the landowner of the subject properties.

  There should, therefore, be some confidence that the planting will be implemented and maintained in the long-term. These properties extend along the north side of the P477 from approximately 1 km west of the sub-station site to the entrance of the Lion Park/Zoological Gardens.

  Should the Lion Park owner be in agreement, it would be possible to implement screen planting extending along this road corridor and around the Lion Park enclosure area. This mitigation measure is fundamental to ensuring that visual impacts for current tourism related development at the Lion Park are reduced to an acceptable level. Without this, negative visual impacts are likely to result in knock on negative impacts on levels of business. However, with this mitigation the current views of the proposed sub-station will be lost.

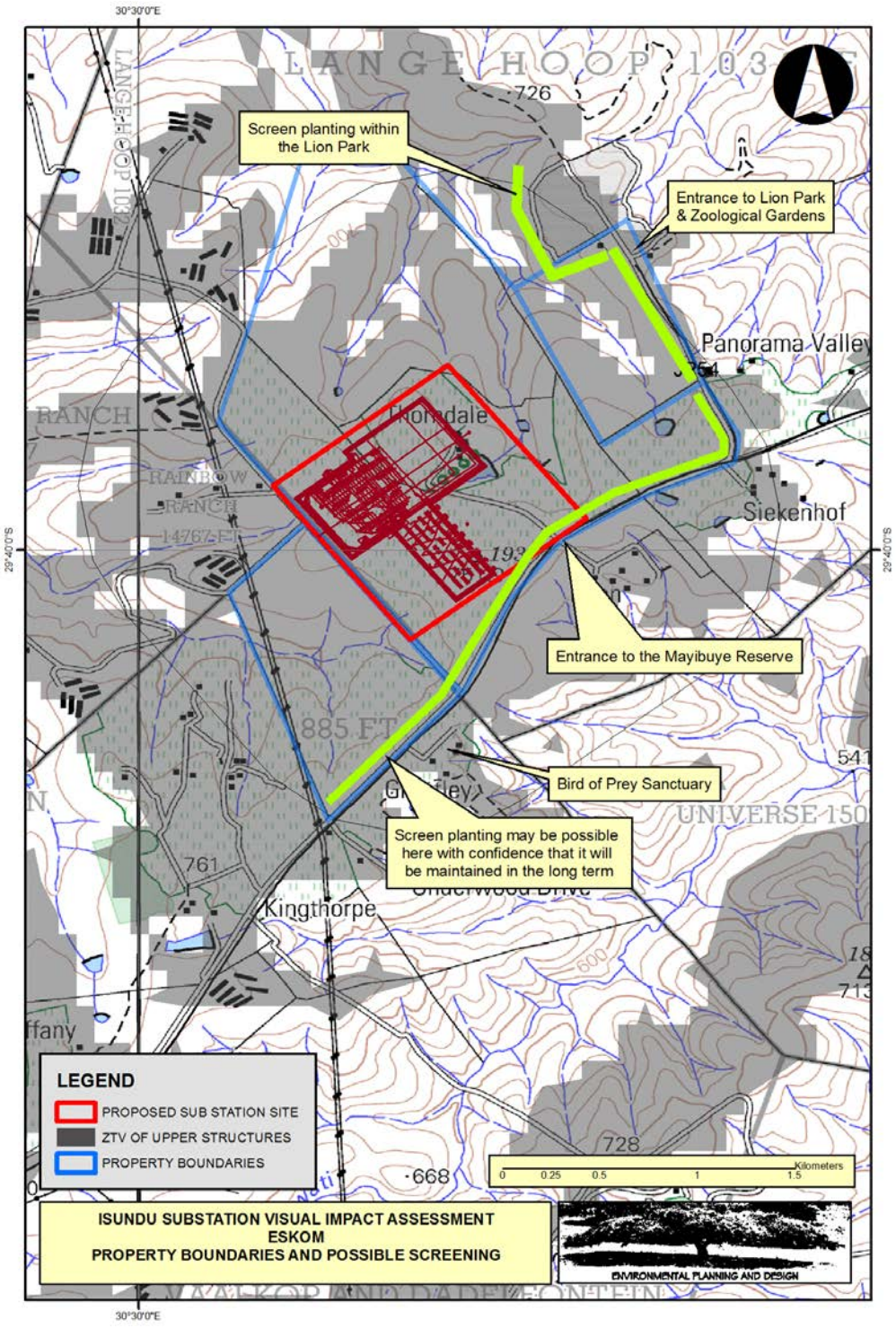

Figure 19 Possible screen planting required to mitigate visual impacts

- Night time lighting.
  It is recommended that lighting design is undertaken to minimise light spill on surrounding areas. Additional mitigation measures should be undertaken to ensure that the length of time that lighting is used is reduced to periods of absolute necessity. The following is to be considered:
  - The use of an infra-red system for general security monitoring.
  - Visible security lights to be used only when there is a security alert or fence alarm.
  - Break the High Voltage (HV) Yard lighting up into different circuits so only the area to be accessed or worked in is lit.
  - Ensure that all fittings are hooded to prevent glare.
  - It is known that even when light is controlled to a specific area, the lit area is visible from surrounding areas. It is possible that this could be problematic for the adjacent chicken farms where internal lighting is used to regulate production. It could also be problematic for ABOPS. However, if minimal light is cast over these facilities, as mitigation the use of a simple screen wall or blind system should be sufficient to negate this impact.

10.10 Cultural heritage assessment

In compliance with Section 38 of the National Heritage Resources Act 25 of 1999 (NHRA), a Phase 1 Heritage Impact Assessment was undertaken in order to address the following aspects in terms of legislated requirements:

- The identification and mapping of all heritage resources in the area affected.
- An assessment of the significance of such resources in terms of heritage assessment criteria set out in regulations.
- An assessment of the impact of the development on heritage resources.
- An evaluation of the impact of the development on heritage resources relative to the sustainable social and economic benefits to be derived from the development.
- The results of consultation with communities affected by the proposed development and other interested parties regarding the impact of the development on heritage resources.
- If heritage resources will be adversely affected by the proposed development, the consideration of alternatives.
- Plans for mitigation of any adverse effects during and after completion of the proposed development.

The geology of the study area is characterised by the sandstones of the Natal Group, which lie unconformably on the Basement Granite Suite. The sandstone rock itself is represented by variable composition relating to different formations within the Natal Group, ranging from a purple/mauve argillaceous form through to yellowish, brown quartzitic sandstone. Within this lithology the presence of fossil bearing strata is low. The SAHRIS palaeo-sensitivity mapping indicates the study area to fall within a blue demarcation and, therefore, no palaeontological investigations were required.

The farm house and ancillary agricultural buildings on the proposed sub-station site are older than sixty years and, therefore, protected in terms of the KZN Heritage Act. No other heritage resources were identified on site.

During the original VSHA EIA, the heritage specialist recommended either of two transmission line corridors to minimise the impact on visually sensitive heritage resources. In both recommended corridors the heritage specialist included the corridor

section in which the 2 x 400 kV transmission lines are proposed to tie-in from the proposed Isundu Sub-station to the existing Hector-Ariadne transmission line. Therefore, from a heritage perspective, the proposed 2 x 400 kV transmission lines do not pose a risk to heritage resources. This will be further investigated via a specialist walk down once a servitude has been negotiated with landowners.

However, it is possible that aboveground or sub-surface heritage resources could be encountered during the construction phase of this project. The Environmental Control Officer and all other persons responsible for site management and excavation should be aware that indicators of sub-surface sites could include:

- Ash deposits (unnaturally grey appearance of soil compared to the surrounding substrate).
- Bone concentrations, either animal or human.
- Ceramic fragments, including potshards.
- Stone concentrations that appear to be formally arranged, which may indicate the presence of an underlying burial or represent building/structural remains.
- Fossilised remains of fauna and flora, including trees.

In the event that such indicator(s) of heritage resources are identified, the following actions should be taken immediately:

- All construction within a radius of at least 20 m of the indicator should cease. This distance should be increased at the discretion of supervisory staff if heavy machinery or explosives could cause further disturbance to the suspected heritage resource.
- This area must be marked using clearly visible means, such as barrier tape, and all personnel should be informed that it is a no-go area.
- A guard should be appointed to enforce this no-go area if there is any possibility that it could be violated, whether intentionally or inadvertently, by construction staff or members of the public.
- No measures should be taken to cover up the suspected heritage resource with soil or to collect any remains such as bone or stone.
- If a heritage practitioner has been appointed to monitor the project, she/he should be contacted and a site inspection arranged as soon as possible.
- If no heritage practitioner has been appointed to monitor the project, the head of archaeology at Amafa's Pietermaritzburg office should be contacted (telephone 033 3946 543).
- The South African Police Services should be notified by an Amafa staff member or an independent heritage practitioner if human remains are identified. No SAPS official may disturb or exhume such remains, whether of recent origin or not.
- All parties concerned should respect the potentially sensitive and confidential nature of the heritage resources, particularly human remains, and refrain from making public statements until a mutually agreed time.
- Any extension of the project beyond its current footprint involving vegetation and/or earth clearance should be subject to prior assessment by a qualified heritage practitioner, taking into account all information gathered during this initial assessment.

The specialist recommended that the development proceeds and submitted the report to Amafa in fulfilment of the requirements of the NHRA.

10.11 Air quality assessment

RCL has have stated that their chickens are highly susceptible to air quality and that any increase in dust or pollutants is likely to increase the risk for respiratory diseases or other airborne micro-organisms. In terms of air quality, dust is the main concern associated with the sub-station, and only during construction.

Airshed undertook an analysis of relevant meteorological data including calculating the frequency of wind speeds and direction, ambient temperature, relative humidity, rainfall and atmospheric pressure.

Based on a literature review, benchmark concentration limits were developed which included the air quality/dust levels typically found in chicken houses. These limits were based on recommended air concentration guidelines in the poultry industry as well as regulatory requirements for public air exposure. Pollutants common to both chicken houses and construction activities were used to estimate impact distances and recommend emission control reductions in order to achieve these limits.

Air emissions were estimated for unmitigated and mitigated conditions, and screening level calculations completed of expected ground level concentrations during worse-case atmospheric conditions. Based on these calculations, recommended emission reduction values were proposed.

The size of the site undergoing construction activities may vary during the course of construction and calculation of impact distance was undertaken on two different size areas being open and bare, a relatively small 5 ha to a larger 21 ha construction area.

Particulate matter (PM), specifically the inhalable fraction, was identified as the most significant factor likely to be altered by construction. The impact of PM on human and animal health is largely dependent on particle characteristics, particularly particle size and chemical composition, and the duration, frequency and magnitude of exposure.

Respiration in chickens is different to that of humans and other mammals. Poultry have highly developed and sophisticated respiratory systems. Their heart and breathing rates are faster than humans, and their body temperature is 5°C higher. Their lungs are connected at the lower ends to a complex series of membrane-enclosed air sacs, which in turn, are connected to air cavities in their major skeletal bones. These features contribute to their lightness and flying ability. The disadvantage is extreme susceptibility to respiratory infections caused by a wide range of bacteria, viruses and fungi. These infections become more of a problem in domestication, which usually involves some degree of increase in stock density, even if only for overnight accommodation, which increases the risk of cross-infection (Sonalya and Swan, 2004).

The defence mechanisms of the chicken respiratory system are important because with each breath, a chicken's respiratory tract is exposed to the inside environment of a poultry house. Poor environments normally do not cause disease directly, but they do reduce chickens' defences, making them more susceptible to infection from existing viruses and pathogens. The bio-aerosols can act as an irritant to the respiratory system, and coughing is a physiological response designed to remove them. However, excessive coughing lowers a chicken's resistance to disease (Jacob and Pescatore, 2013).

As part of the avian immune system, the chicken respiratory tract normally is equipped with defence mechanisms to prevent or limit infection by airborne disease agents, to remove inhaled particles, and to keep the airways clean. Specifically, chicken respiratory health is protected by the function of three defensive mechanisms: cilia, mucus secretions, and the presence of scavenging cells that consume bacteria. Cilia are tiny hair-like structures in the trachea that are responsible for propelling entrapped particles for disposal. Mucus is produced in the trachea. Mucus secretions and movement of cilia are well developed in chickens. The consistency of the mucus produced is important for the efficiency of the ciliary activity. Cilia cannot function when the mucus is too thick. Scavenging cells in the lungs actively scavenge inhaled particles and bacteria that gain entrance to the lower respiratory tract. These cells consume bacteria and kill them, thus, preventing their further spread. The integration of cilia, mucus, and scavenging cells keeps chicken airways free of disease-producing organisms. The impairment of even one of these components permits an accumulation of disease agents in the respiratory tract and may result in disease (Jacob and Pescatore, 2013).

Based on the results of a broad European Union-wide study on bio-aerosols in pig, cattle and poultry farms, an inhalable PM (PM_{10}) air concentration of 3,600 µg/m³ was found to be the typical dust concentration in poultry houses, with higher concentrations regularly occurring in houses for laying chickens.

Li *et al* (2009) reported on observed PM concentrations from fifteen studies conducted in laying hen houses. Total suspended solids ranged from 700 µg/m³ to 8 780 µg/m³, whereas the smaller respirable PM_{10} fraction ranged from 30 µg/m³ to 1,260 µg/m³ and the $PM_{2.5}$ fraction 33 µg/m³to 39 µg/m³. This is a wide range which makes projections difficult.

According to the Poultry Production Manual produced by the University of Kentucky (UKAg 2014), air in poultry houses should have less than 5,000 µg/m³ dust at broiler level. Dust levels of 8,000 µg/m³ can be tolerated if the broilers are not being stressed by ammonia, heat or the presence of respiratory disease agents. Although these concentrations were not associated with a specific size fraction, it is assumed that it refers to PM_{10}. As a guidance, and in the case of a typical poultry farm with air concentrations of 3,600 µg/m³, additional levels of PM_{10} which may be introduced from outside the chicken house, should be kept below 1,400 µg/m³ to ensure levels less than 5,000 µg/m³. If a safety margin equivalent to a factor of two is introduced, this additional PM_{10} concentration burden would be limited to a maximum of 700 µg/m³. It should be noted, however, that this is only indicative and that it assumes an average PM_{10} concentration of 3,600 µg/m³ in the chicken house and that all particulates from outside have the ability to enter the building.

A target guideline is proposed, which is based on the daily average PM_{10} limit value, as stipulated in the National Ambient Air Quality Standards (NAAQS). The daily average PM_{10} limit value is 75 µg/m³. Using the Department of Environmental Affairs' (DEA) recommended extrapolation rule from daily average concentrations to hourly average concentration, a surrogate short-term concentration was determined, *viz.* 187.5 µg/m³.

A review of the local meteorology was based on observations made at a South African Weather Station located approximated 11 km north-west of the site in Pietermaritzburg. The prevailing wind directions occurred mostly from the east, south-south-east and south-east, with nearly no observations from the north-west. Wind speeds from the other wind directions were generally weaker, but with occasional strong winds (above 4 m/s) from the south-west during the day. An increasing number of south-easterly winds

occurred during the night. Given the predominance of easterly, south-south-easterly and south-easterly winds there is a very high likelihood that the area most impacted by moderate to strong wind conditions would be towards the west, west-north-west and north-west.

The frequency of calm-wind conditions (less than 1 m/s) were 39.44%; with 24.95% calms recorded during the day and 53.93% during the night. The site is expected to experience mostly very stable conditions (F-stability) during the night (approximately 46%) with slightly unstable conditions (C-stability) occurring mostly during the day (approximately 19%) (Table 21).

Screening dispersion simulations were performed using the US EPAs SCREEN3 model. The particulate emission source was inputted as an area source of 5 ha and 21 ha, respectively.

Four scenarios were simulated, namely 21 ha unmitigated and mitigated, and 5 ha unmitigated and mitigated, respectively. The mitigated scenarios assumed that effective mitigation can be achieved to reduce emissions by 75%. This would typically be done using a regular watering programme.

Figures 20 and 21 provide the predicted concentrations for a 21 ha unmitigated and mitigated site, respectively. Figures 22 and 23 provide the concentrations for a 5 ha unmitigated and mitigated site.

Each figure includes the results for the six atmospheric stability classes. However, given that the construction activities would only occur during the day, the results for very stable conditions may be less appropriate than the other stability classes.

Table 21 Frequency of air stability classes

Class*	Stability	Description	Frequency of Occurrence		
			All Hours	Day time	Night time
F	Very stable	Low winds, clear skies, cold night time conditions	46%		93%
E	Stable	Moderate wind, slightly overcast night time conditions	1%		1%
D	Neutral	High winds or cloudy days and nights	6%	6%	6%
C	Moderately unstable	Moderate wind, slightly overcast day time conditions	18%	37%	
B	Unstable	Clear skies, day time conditions	16%	31%	
A	Very unstable	Calm wind, clear skies, hot day time conditions	13%	26%	
*** Classes depicted in the same order as visually illustrated in the graphs below**			**100%**	**100%**	**100%**

RELATIONSHIP BETWEEN AIR STABILITY & AIR QUALITY

Similar to water pollution, the level of air pollution experienced depends on the quantity of air pollutants released into the atmosphere and the rate at which they dilute. Atmospheric stability (mixing of the air) influences the dilution of pollutants. Air movement and, thus, pollution dispersion can occur both horizontally and vertically.

During the day, when the heat causes air near the earth's surface to rise, there are unstable conditions at ground level. For a pollutant released at ground level, such as dust, these are ideal conditions for dispersing the pollutants quickly and high into the atmosphere. Therefore, the pollution concentration and risk decreases.

More stable conditions occur predominately at night when the temperatures drop and vertical air movement is less. When also accompanied by low winds, very stable conditions occur resulting in an increase in the concentration rate of pollutants near the ground. For this reason factories release air pollutants from high stacks in order to get the pollutants into the air above ground level and also why air pollution from household fires can be seen over townships in the early morning during winter.

Neutral conditions occur both during the day and night when high winds or cloudy conditions occur. High winds during the day can prevent dust from rising vertically and also mix it back down again, whereas in the night high winds will help to disperse pollutants. Cloudy conditions in the day reduce the heat and, thus, vertical dispersion, whereas clouds at night can keep the atmospheric temperature higher increasing vertical dispersion.

Wind erosion off bare surfaces only constitutes a very small fraction of dust pollution dispersed into the atmosphere. Dust is predominately caused by vehicles and other construction activities.

Hence, it is more important to consider potential exceedances in day time conditions, particularly for this area which has a relatively low average wind speed and high percentage of very stable night time conditions, reducing the risk of wind erosion.

The air quality model takes these various factors into account.

Nevertheless, there is always the potential that strong winds may occur at times during the night increasing wind erosion, particularly over the summer period. For this reason, mitigation by covering areas is still recommended.

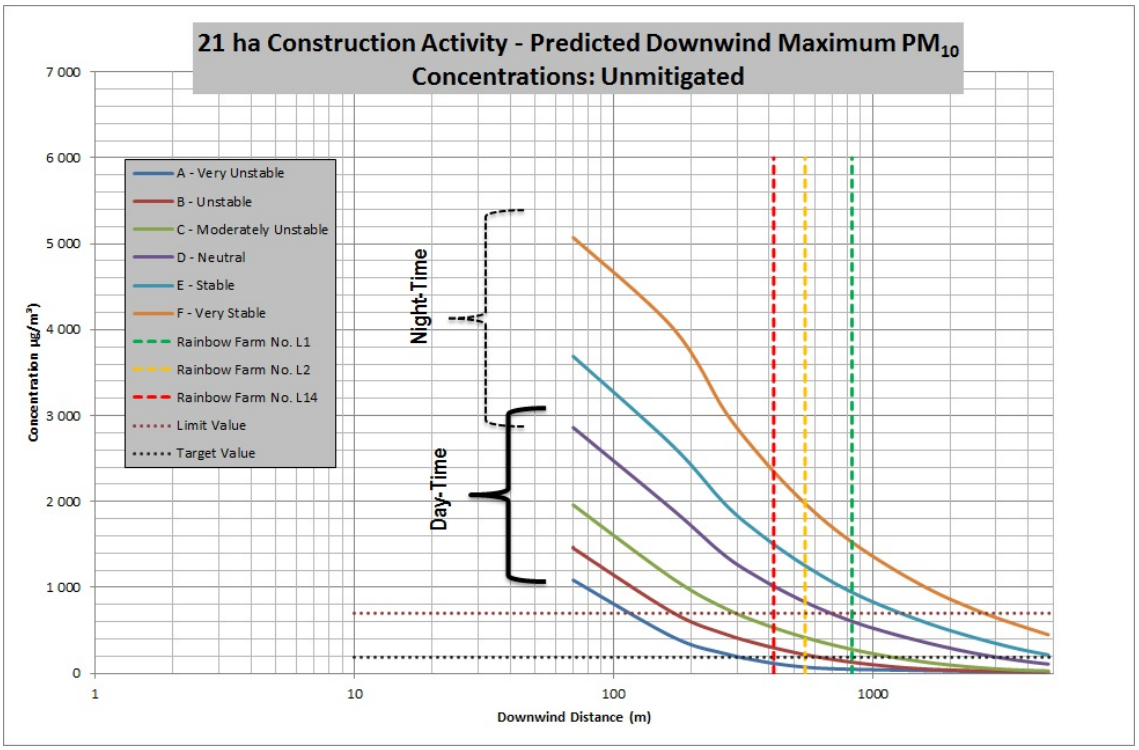

Figure 20 Predicted highest ground level concentration for PM_{10} assuming a 21 ha construction site active at any moment with no mitigation

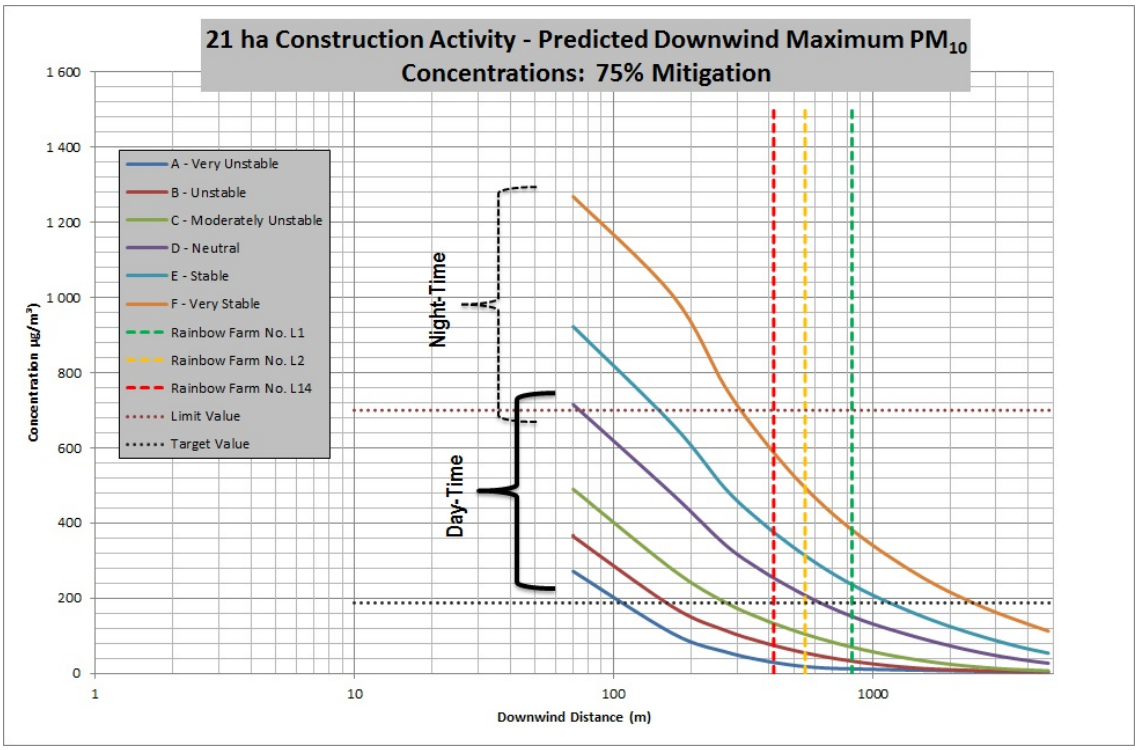

Figure 21 Predicted highest ground level concentration for PM_{10} assuming a 21 ha construction site active at any moment with 75% mitigation

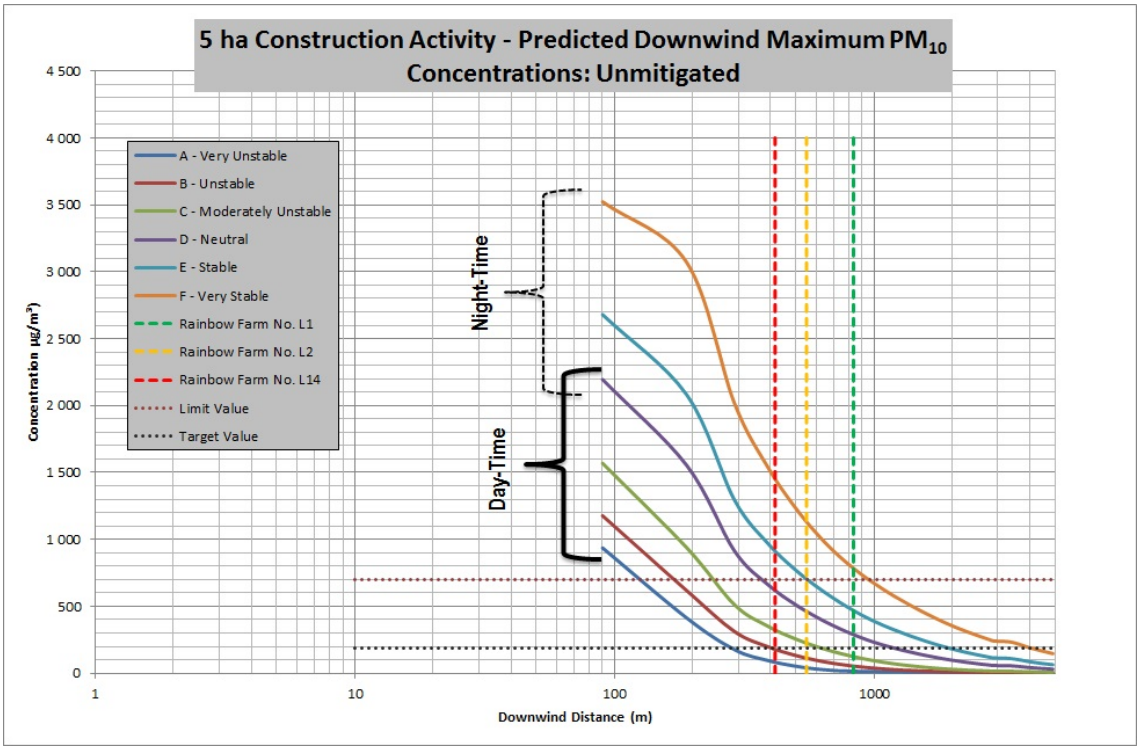

Figure 22 Predicted highest ground level concentration for PM10 assuming a 5 ha construction site active at any moment with no mitigation

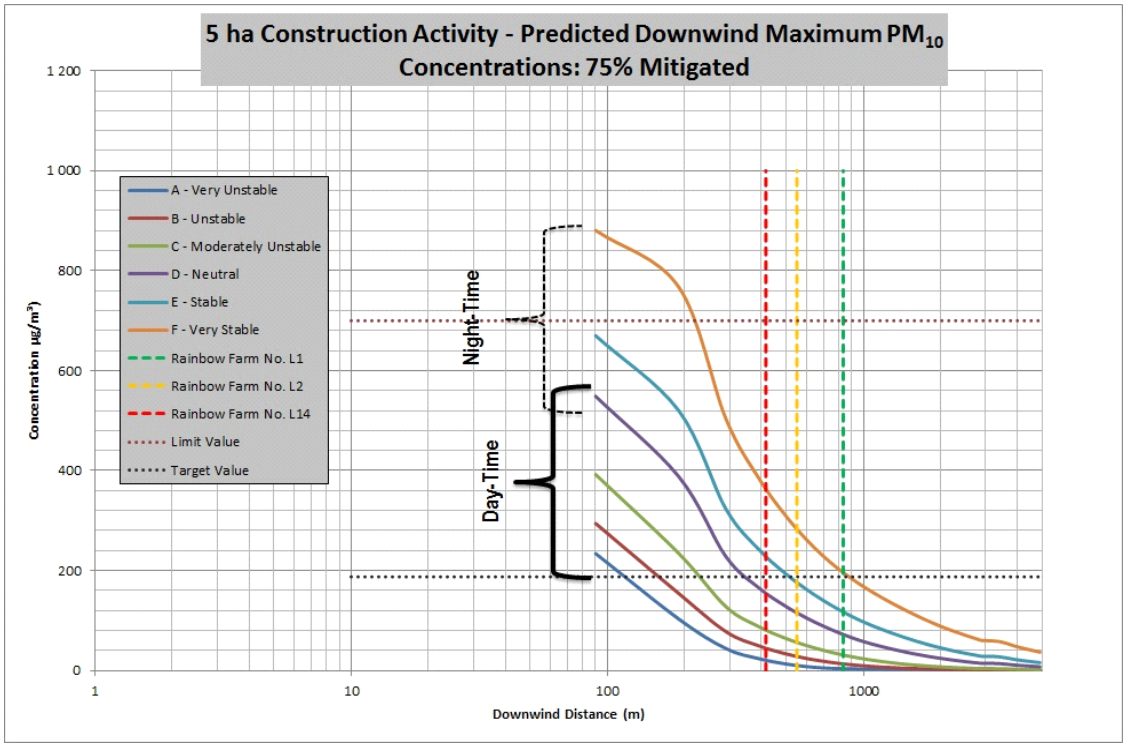

Figure 23 Predicted highest ground level concentration for PM10 assuming a 5 ha construction site active at any moment with 75% mitigation

The results of the model are summarised as follows:

- Unmitigated PM_{10} concentrations will exceed the 187.5 µg/m³ target limit during neutral and stable atmospheric stabilities, even for a relatively small, 5 ha active construction area.
- During day time conditions, there may be a possibility that very unstable (convective) conditions could result in conditions that fall below the target limit, at the closest RCL farms (L1, L2 and L14).
- With mitigation, only Farm No. L1 may have concentrations above the target limit value for the 5 ha active site during unstable conditions (day time) conditions.
- Comparing to the maximum limit of 700 µg/m³, day time unstable conditions generally indicate that the PM_{10} concentrations without mitigation would be lower than the limit for both of the active construction site sizes. Only the smaller 5 ha site would, however, result in concentrations below the limit during slightly stable conditions without mitigation. The limit value would be exceeded during very stable conditions.
- With appropriate mitigation measures which would reduce the emissions by 75%, the limit of 700 µg/m³ will not be exceeded at any of the farms and it will only be exceeded at a distance within about 130 m from the construction site.
- However, the target limit value of 187.5 µg/m³ may still be exceeded at all three farms (L1, L2 and L14) for neutral (D) and stable (E and F) conditions for the larger, 21 ha active construction case.
- For the 5 ha (mitigated) case, the PM_{10} concentration will be below the target limit for stable conditions (E and F) at farms L1 and L2, but not at farm L14.

10.11.1 Recommendations and mitigation

Good construction site practice can help to control and prevent pollution. The first step is to prepare environmental risk assessments for all construction activities and materials likely to cause air pollution. A range of specific mitigation measures have been outlined in the report.

The effectiveness of water spray to control the generation of airborne particulates from the access road surfaces may vary, depending on the soil type and particle sizes. However, an empirical model, developed by the US-EPA (US-EPA, 1996) was used to estimate the average control efficiency of certain quantifies of water applied to unpaved roads. Assuming on average six vehicles per hour[20], depending on the time of year and whether it has rained, the estimated watering rates required for 75% emission control varies between 0.08 and 0.30 ℓ/m² per 2-hour cycle. As an alternative, chemical suppressants may be used. These may range from petroleum-derived applicants to chemical additives in water. Dust-a-Side, a petroleum-derived applicant has proved fairly successful at mine operations and, according to literature, the control efficiency can be as high as 90%.

[20] Although Eskom estimated the average number of vehicles travelling along access roads to be two trucks per hour, a worse-case (peak-hour) of six vehicles per hour was assumed, thereby, for example, catering for early morning worker arrivals and evening departures.

Depending on the practicality of application, a method of reducing dust particles due to construction activities and wind erosion from entering the chicken breeding houses should be considered. This may for example consist of a filter medium (e.g. 80% shade cloth) which would cover a section over the air intake, large enough to avoid obstructing the airflow for sufficient ventilation.

In addition to the above preventative measures, continuous air quality monitoring of ambient air PM_{10} concentrations is suggested to manage trends of increased particulate emissions from the construction site. This instrument should be strategically located to ensure that unplanned episodes of excessive particulate emissions are timeously and adequately mitigated to minimise otherwise prolonged exposure to unacceptable particulate concentration levels. Given the high frequency of easterly winds, it is proposed that such an instrument be located on the western boundary of the proposed sub-station site. Alternatively, monitors should be located at the ventilation intake at each of the three closest breeding houses.

Whilst the above calculations and estimates have incorporated a level of conservativeness, and it was shown to be theoretically possible to minimise dust impacts at the closest receptors (RCL) to levels that would be within the proposed benchmark concentrations, these mitigation and management practices can only be effective if instituted and managed properly. Constraints to dust control at construction sites include non-commitment from construction contractors, climatic conditions, costs and know-how. If there is no or little commitment from the contractors, none of the mitigation measures would be effective since these include active participation. As discussed, climate poses an obvious problem which is particularly evident during periods of dry, windy weather when the likelihood of dust being picked up and blown about is increased. While these climatic parameters cannot be controlled, some measures to minimise climate-generated dust problems include:

- Checking weather forecast reports daily to enable preventative measures/actions to be taken immediately if conditions change.
- Implement control measures that ensure dust problems do not occur while the site is unattended, e.g. at night or weekends.
- Adopt a site ‘shut down and cover up’ policy during periods of extreme weather conditions, e.g. strong winds and low humidity. All site operations should cease and all exposed areas covered or treated to ensure dust does not become airborne.

Although cost is often seen as a constraint to effective dust control, this would only be the situation if some specialised dust control applications are required. The majority of dust control measures require minimal financial outlay. The development of a comprehensive dust management plan, based on the above recommendations, will further limit the lack of knowledge and improve the actions to be followed by the contractors.

Nonetheless, as the possibility that these recommendations may not be followed diligently, together with the close proximity of the nearest chicken breeding house to the construction site, as well as the prevailing winds being easterly, it is not possible to guarantee that there will be no adverse impact on the chickens. Such security can only be achieved with the implementation of passive measures, such as permanent enclosure of the site, which is obviously not practical.

10.12 Poultry veterinarian

Due to the large range of objections RCL raised to the proposed project, a poultry specialist was appointed to assist in separating out the key issues which could impact RCL and to provide comment on mitigation recommendations.

The following provides a summary of the key issues dealt with:

- EMFs.
  The specialist had no direct experience of the effects of EMFs on commercial poultry production nor was aware of definitive information on the effects of EMFs on commercial poultry production parameters in South Africa. The specialist stated that it was an uncertain risk and unlikely to significantly affect production.

- Light pollution.
  Light pollution was identified as an important factor as the birds are extremely sensitive to both light in respect of its intensity and duration. Controlled lighting programmes are used in commercial poultry production and any upset or sudden or unprogrammed change in lighting could have a detrimental effected on egg production.

  The type of housing used has an influence on the risk of light impacts and the ability to control them. With open type houses lighting can be extended using artificial lights but cannot be easily reduced or shortened. With closed 'light-tight' houses or controlled environment housing, light can be more easily managed and manipulated. Light, however, could still find its way into these closed houses through a fan or ventilation opening.

  L14, the closest RCL farm to the sub-station has open-type houses whilst the next two closest farms, L1 and L2, both have closed 'light-tight' houses.

- Noise and vibration.
  The specialist confirmed that chickens are extremely sensitive to any unusual activity and that noise and disturbance associated with the proposed activities could have a significant negative effect on the chickens.

  With sudden noises of 80 dBA and above, stress levels have been shown to increase significantly, These noises and stresses can also result in 'bundling up', where the chickens huddle together, causing suffocation and injury to some of the birds.

  Normal background sounds from the birds themselves as well as those from equipment and management procedures are constantly present in the poultry house. However, any sudden and strange loud noise or vibration can lead to an immediate reaction from the birds. Different flocks may well respond in different ways according to the type and magnitude of noises to which they are more familiar.

The important issues are unaccustomed noises or vibrations and those of a sudden onset. Blasting operations would create sudden noise and vibration readily detected by birds. Whether this could be considered different to that as would occur in a thunder storm is a debatable point. A close/overhead flash of lightning and thunder clap would certainly startle birds and could result in some losses from panic and piling, and perhaps a temporary small drop in egg production.

Different flocks and age groups may respond differently, some more tolerant than others and as this is a naturally occurring phenomenon, adult flocks would be exposed to this during their lifetime.

However, flocks do get used to and recognize sounds from in-house machinery, in-house staff activities etc. so acclimatisation to external stimuli appears to mitigate certain responses. An attempt at desensitising the birds to blasting by the gradual increase in blast noise may possibly help in this regard.

- Air quality and dust.
  The creation of dust within a poultry house occurs all of the time and arises from the litter material on the floor of the house, feed and feed delivery systems, dander from feathers and from faecal material deposited on the litter.

  Dust may also be drawn into the house through ventilation fans of controlled environment houses or natural side openings in open-sided houses. Internally developed dust is mainly of an organic nature whilst dust from outside may be from organic sources or “hard” dust from inorganic sources e.g. inorganic particulate matter from sands, rock excavations etc.

  The natural defence systems in the bird attempt to eliminate dust from the respiratory tract but in conditions of excess dust, damage to the system can occur. Damage may be physical and/or from entry of infectious agents carried on dust particles. House management, together with natural or artificial ventilation, is used to remove gaseous build-up (ammonia and CO_2) which occurs in the houses and provide fresh air over the birds. Excess levels of ammonia can result in physical damage to the respiratory tract and also allow infectious agents easier entry into damaged tissues.

  Hence, production of “excess” dust directly towards a poultry house from a nearby operation could have a detrimental effect on a flock and also on the bearings of the fan bank used to ventilate a house. The amount of dust to which a farm would be exposed would depend on distance from source, the material being excavated, weather conditions and season.

  There are no dust level guidelines recommended in the Cobb Breeder Manual[21]. However, the amount of dust in the air over the birds will be directly related to the age and number of birds in the house, type and quantity of litter used, age of litter, moisture content of litter, time of year and humidity (dry/wet season, Highveld/Lowveld), bird activity, use of in-house evaporative cooling systems, management activities and house ventilation.

[21] Cobb-Vantress Inc. is a global poultry research company engaged in the long term research, development, production, and sale of broiler breeding stock.

- Biosecurity.
  Biosecurity involves both physical and managerial methods to prevent the introduction of infectious disease agents onto a poultry farm and to prevent the spread of disease agents from an infected area to an uninfected area. This is basically achieved by the principles of isolation of farms, provision of physical barriers (perimeter fence and single access point) and entry control for all staff and vehicles, control of water supply, feed stuffs and all maintenance staff and materials.

  One of the largest risk areas is with staff and vehicles coming onto sites as they may have been in contact with infectious agents and unknowingly bring such agents onto a farm. Hence, the strict entry controls.

  Airborne transmission of infectious agents can also occur and this would relate to the presence of disease in an area being spread via wind/air movement, wild birds/animals, passing human and vehicular traffic, etc.

  In general, the more isolated a farm and the less staff and vehicle movements that occur, the better is the control. The principles of biosecurity apply to both breeder and broiler production farms. However, as the broiler has a very short cycle compared with the breeder, any breakdown in biosecurity on a broiler farm (e.g. a farm becoming infected with disease) is easier to control and eliminate than with the breeder farm.

  In this case, the sub-station construction and operation should not unduly increase risk, except for an increase in vehicular traffic and construction staff in the vicinity. All construction staff must keep away from RCL property and access roads and not wander from the site. Proper toilet facilities must be available and be used by all construction staff.

- Quantifying potential production impacts.
  As chickens are a biological entity, there is always the possibility of potentially significant or large losses, but in practice there could be temporary production issues which would be more dependent on the degree, suddenness and frequency of the offending action (e.g. noise or vibration). However, more prolonged stimuli such as light exposure and dust could have longer-term production effects.

  To monitor and determine whether a specific construction or operational related incident had any impact on production levels, Eskom will need to work in cooperation with RCL by examining production records up to and during any perceived dangerous operation. Links between incidents and sudden drops in production or sudden mortality from birds' piling/smothering, etc. could then be drawn.

  This same principle could apply to potential longer term effects. If previous production records were available for the previous year or so for particularly affected farms, this would allow comparison with "normal production parameters" and "parameters during construction/operation".

10.13 Blast impact assessment

In order to construct the sub-station, the initial phase of earthworks will need to level a platform for the infrastructure. As the site is located on the top of a small hill, there will be cut and fill earthworks required. The cutting areas are where blasting will be required.

The geotechnical report indicates that the initial layers of material can be machine excavated but in some areas, 'hard' excavation requiring blasting will be required in order to reach the required platform levels. The areas that will require blasting are depicted in orange in Figure 24.

Figure 24 Platform areas requiring blasting

The blasting required will be typical civil blasting and only during the first phase of construction. The total sub-station foot print is 443,900 m^2 whilst the total area to be drilled and blasted is 67,813.00 m^2, which is relatively large.

To evaluate the time required to conduct the blasting operation, Table 22 outlines the programme calculations based on a programme of two blasts per week. However, in order to accommodate standing time in the form of rain days, pay weekends, any other delays that may occur, blasts were rather scheduled to occur every three days. This excludes weekend days. The total time required for blasting will then take 6.4 months. However, if two platforms are done concurrently this timeframe could be brought down to approximately 86 days over a 12.3 week period (i.e. 4.3 months)[22].

Adding three days per month for rain delays will add an additional 9 to 10 days to the project schedule. The total project blasting days will then be 96 days – 13.7 weeks. This schedule is preliminary and will need to be finalised during the tender stage.

22 Eskom has since confirmed that Platform 4 would not be blasted until required. Thus, with blasting every second day and two areas being blasted in parallel, the total blasting duration could conceivably be brought down to approximately 10 weeks, or 2.3 months.

Table 22 Estimated duration of blasting

Description	Platform				Total Months
	1	2	3	4	
Programme estimate based on two blasts per week					
Quantity of Blasts	8	19	5	15	
Blast Frequency – two blasts per week	2	2	2	2	
Number of weeks to complete blasting	4	9.5	2.5	7.5	
Months to complete blasting	1	2.4	0.6	1.9	**5.9**
Programme estimate based on three days per blast					
Quantity of Blasts	8	19	5	15	
Working days per platform	24	57	15	45	
Months to complete blasting (based on 22 working days/month)	1.1	2.6	0.7	2	**6.4**

Alternatives to blasting are limited. The geological investigations indicate that there is rippable material and non-rippable material needing excavation. Thus, unavoidably, blasting will be required for certain areas to establish proper platforms for construction. The use of chemicals for a project of this size is not cost effective or logistically effective as the area to be drilled and blasted is too large.

Explosives are used to break rock through the shock waves and gasses yielded from the explosion. Impacts from blasting can result from either ground vibrations, air blast pressure (an inaudible pressure wave), audible noise and fly rock.

Ground vibration is a natural result from blasting activities. The far field vibrations (vibrations experienced beyond the blast area) are inevitable but undesirable by products of blasting operations. Ground vibrations attenuate over distance at a rate determined by the mass per delay[23], delay timing and geology.

Air blast is an inaudible pressure wave, also known as air over-pressure, a direct result from the blast process. Air blast is normally associated with frequency levels less than 20 Hz, which is the threshold for hearing. The three main causes of air blast can be described as the pressure pulse directly from the rock displacement, ground vibration causing pressure pulses some distance away from the blast and blast holes venting or blowing out during the detonation process. Air blast levels yielded may be influenced by external factors, such as wind strength, wind direction, meteorological conditions and topography.

Based on the blasting design provided, ground vibration and air blast values were calculated.

[23] Mass per delay is the quantity of charge detonated per 8 milliseconds. Each charge hole is detonated together or in sequence. The more holes and the greater the total charge detonated in each 8 millisecond window influences the level of vibration. The design proposed is based on one hole firing per 8 milliseconds to ensure vibrations are kept to a minimum.

The levels of ground vibration expected from the proposed blasting ranges between 5.8 mm/s at 100 m and 0.3 mm/s at 600 m for the maximum charge. Typical vibration limits for infrastructure are as follows:

- National Roads/Tar Roads: 150 mm/s.
- Steel pipelines: 50 mm/s.
- Concrete aged less than 3 days: 5 mm/s.
- Concrete after 10 days: 200 mm/s
- Sensitive plant equipment: 12 mm/s or 25 mm/s depending on type.

The recommended limit for air blast currently applied in South Africa is 134 dBL[24] where the general public is of concern. In the case of schools and hospitals, a recommended limit of 128 dBL is applicable. The air blast levels calculated for this project range between 106.8 dBL for 100 m and 90.9 dBL for 600 m.

Surrounding structures are located from about 400 m to 1,726 m away from any of the blast areas. For these distances from the blast, the corresponding levels of ground vibration are calculated to range between 0.6 mm/s to 0.1 mm/s, whilst the air blast levels are calculated to range between 112.3 dBL to 97.1 dBL. Based on structural damage concerns and people's perceptions, the levels are well below levels normally associated for concern. Figure 25 depicts these vibration and air blast levels.

The nearest RCL laying house (L14) is located 532 m from where blasting will occur. Based on a concern for the wellbeing of chickens, a vibration limit of 6 mm/s was considered. This is significantly lower than for structures alone. No information or research was found on vibration limits for laying chickens. However, the 6 mm/s limit is expected to be low enough not to have any significant influence. The calculated ground vibration at L14 is significantly low at 0.4 mm/s and, thus, it can be assumed that possible ground vibration influence will be insignificant.

The air blast levels at L14 were calculated to be 90.9 dBL. These levels are again well within all norms for safe blasting under normal circumstances. No significant influence is expected.

The African Bird of Prey Sanctuary is located further away from the site than RCL farm L14 and levels expected will be significantly lower. No negative influence is expected at the Sanctuary.

Normally, the audible noise component is very difficult to measure or to predict. There are a significant number of factors that can influence the levels of noise. Noise evaluation considers similar aspects as for air blast evaluation with the main difference being that air blast is the inaudible part of the noise function. The audible noise signal duration is normally very short and difficult to be applied by noise specialists in any noise evaluation.

Air blast and noise make use of the decibel scale for reporting of values; however, for air blast, a pressure is associated with the decibel level. In order to manage the levels of noise or to get an understanding of noise levels from the actual blasting process, a conversion is applied to the predicted air blast.

Engineering conversion calculations not tested before by the specialist personally, indicated that for an air blast level of 90.9 as predicted at L14, audible noise could range from between 51.5 dBA to 92.1 dBA depending on the noise frequency and noise filter used in the calculation. Other research papers reviewed in this field indicated that there is

[24] dBL - decibels over a linear scale.

an approximate 25 dB difference between measured air blast (dBL) and audible noise measured on the dBA scale. Thus, this would put the audible noise at L14 in the region of 65.9 dBA per blast. The average expected for all installations around the project site is expected to range between 55 dBA and 69 dBA.

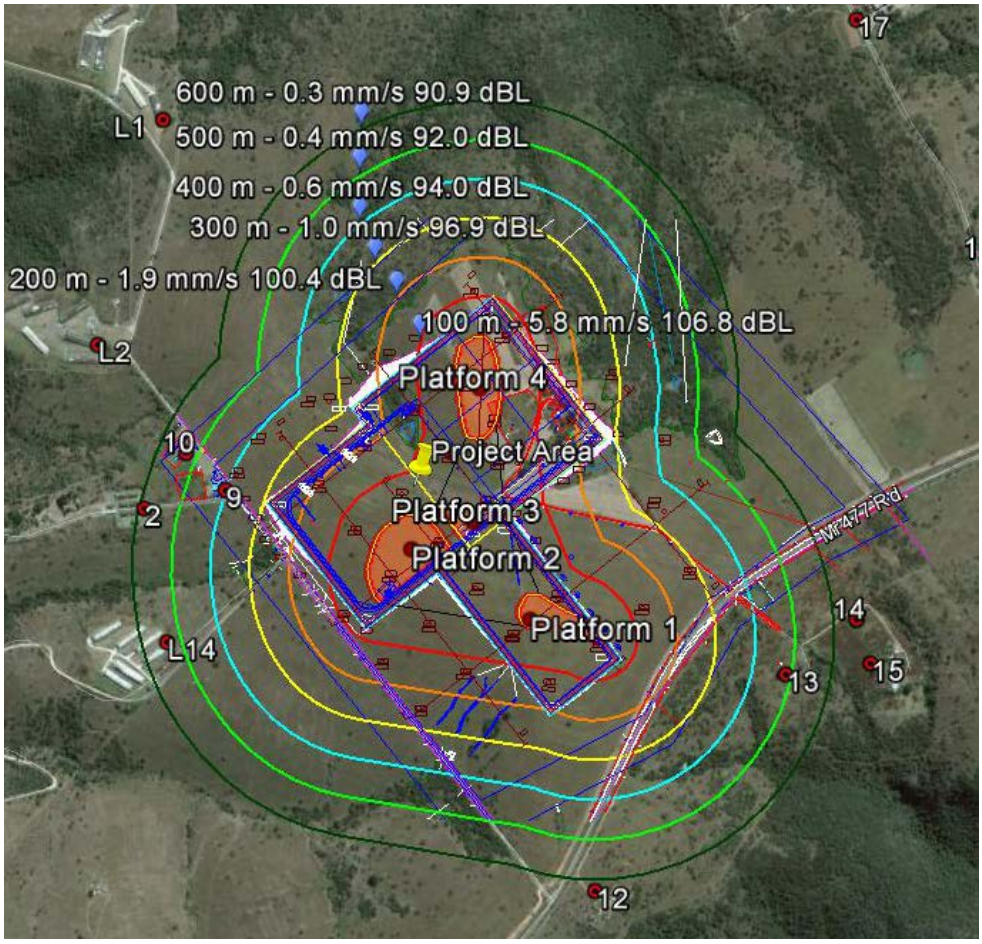

Figure 25 Aerial and surface plan with distance lines for ground vibration and air blast levels

Based on a standard blast process using the design proposed with stemming lengths of 2.9 m, an unsafe fly rock zone of 84 m is predicted. This distance forms the minimum exclusion zone where clearing of people, animals and equipment will be required. There are no privately owned installations or structures within this distance.

The proposed drilling and blasting designs are, however, not a standard process. Specifically in this case, the stemming lengths are significantly longer than normal. The normal ratio for stemming is between 20 and 25 times the blast hole diameter. In this case, the ratio is in the order of 37 times the blast hole diameter. This means that stemming lengths are actually excessively long and will add to additional control on air blast levels and fly rock. The blast designs proposed were also evaluated for scaled depth of burial (SD) value (Figure 26). The blast design proposed for this project has calculated SD values of between 2.33 and 2.49. These values are on the high end of the scale with little to no surface effects expected. This contributes to the situation that the possibility of fly rock is almost zero and air blast predicted will be significantly less. Restriction on rock movement during blasting will also restrict the creation of free dust particles, i.e. less dust will be observed.

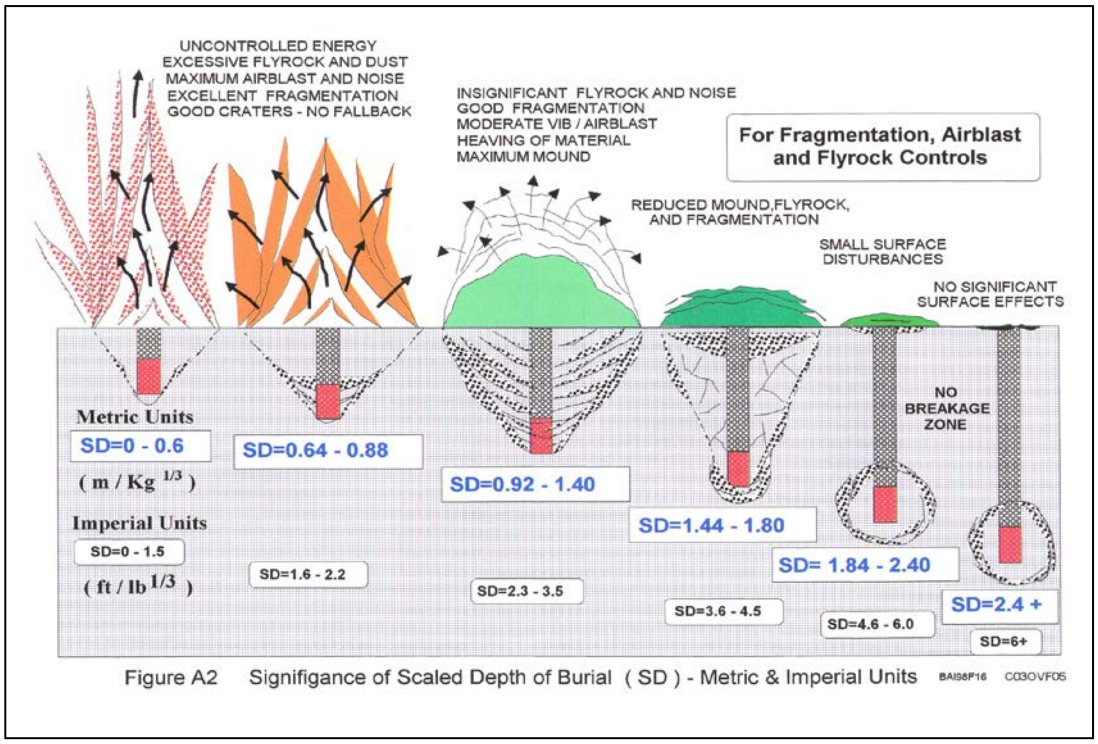

Figure A2 Signifigance of Scaled Depth of Burial (SD) - Metric & Imperial Units BAIS8F16 CO3OVF05

Figure 26 Significance of Scaled Depth of Burial

10.13.1 Mitigation measures

The current design and analysis indicate that additional mitigation will not be required for the management of ground vibration, air blast and fly rock. In order to ensure further reduction of any impacts, particularly noise, the following mitigation measures should be considered for the blast tender process and communicated to any blasters expressing interest:

- A detailed drilling and blasting methodology statement must be prepared for the project with a blast design revised for each blast to be done. This design must consider the normal legal requirements, with specific attention to the following as well: drilling procedures, charging, stemming and initiation procedures. For each blast, the monitoring positions must be indicated and the expected levels of ground vibration and air blast calculated.
- No blasting is to be done during inclement weather (i.e. during low cloud cover, rain or misty conditions). This is because the effects of blasting may be enhanced and result in excessive levels.
- Blasts must be carefully planned and laid out for each day's blasting so that there is no material left over that must be destroyed.
- Blasts must be done in blocks, i.e. no drilling and blasting of the whole area at once.
- Blast areas must be properly prepared. Excessive removal of softer material can create a poor drilling area. Drilling areas must be clean and level. Creating a level drilling area must be achieved rather than removing as much soft material as possible. This normally creates a "moon landscape" that adds to difficult drilling conditions and uneven surfaces with different drill depths. This could cause difficulty in drilling and the management of blast results.

- Cover blasting is not anticipated but if small diameter/jackhammer drilling is to be done, it must be covered with at least a 2 m cover. This will control air blast very effectively if done correctly to almost no air blast at all.
- Charges must be pre-calculated not to exceed the mass used in this blasting specialist report. The maximum allowable charges are defined in the designs. Any changes from this will require a complete re-evaluation.
- No detonating cord initiation system or shock tube initiating system should be used. Initiation systems must be electronic systems to facilitate a silent blast situation.
- The use of a drill diameter smaller than the 76 mm drill hole used in this report can be considered. Charging with cartridges instead of bulk products will help control the charge masses loaded in the blast holes.
- Adhere to proper stemming rules with the appropriate stemming lengths to be used. All blast holes should not have a stemming length of less than 2.6 m. In the event of jackhammer drilling and blasting, blasts must be covered with at least a 2 m cover. This will control air blast very effectively if done correctly to almost no air blast at all.
- Blast holes must be stemmed after charging with proper crushed aggregate of correct size (size +8-12) for the blast hole diameter used.
- The blaster must keep proper records of each blast hole, charging mass, length and stemming lengths.

Furthermore, it is recommended that third party consultation and monitoring should be considered. Monitoring should include setting up a seismograph/s and noise meters at point/s considered to be important to ensure compliance when a blast is done. The use of video cameras can be applied as well as video camera work during the blasting process. This will bring about an unbiased evaluation of levels and influence from an independent group.

10.14 Geohydrology and hydrology

To develop the proposed sub-station on the Isundu site, a water use licence[25] has to be obtained. The Department of Water and Sanitation (DWS) requested, as part of the submission, that hydrological and geohydrological assessments be undertaken. In their approval of the Final Scoping Report, DEA also specifically requested the inclusion of a hydrological assessment.

The aim of the geohydrological investigation is to quantify the pre-development geohydrological conditions. This baseline pre-development condition can then be used for monitoring and managing any groundwater related impacts during construction and operation. Potential risks to groundwater can be identified and their significance highlighted, with recommendations for mitigation both for normal operating times as well as for potential unexpected breakages or spills.

The main objective of the hydrological assessment is to investigate the surface hydrology of the Isundu site and its immediate surroundings to establish baseline conditions, to identify risks and to formulate mitigation measures. Included in the study are the site's general hydrology and climate; flood lines; conceptual water balance; a conceptual Storm

[25] Water uses 21 (c) (Impeding or diverting the flow of water in a watercourse) and 21(i) (Altering the bed, banks, course or characteristics of a watercourse). This water use application was prepared and the General Authorisation has been granted (Appendix 1).

Water Management Plan (SWMP) and baseline water quality assessments which include a surface water monitoring program following the completion of the construction of the sub-station.

The climate at the Isundu site is described as warm and temperate, with a humid and hot summer. Rainfall for the site is approximately 840 mm per annum.

Flood lines were calculated for the seven sub-catchments surrounding the Isundu site, for a 1:50-year and 1:100-year recurrence interval. A 100 m buffer surrounding the streams was also defined. For the small catchments, the delineated exclusion zone largely follows the 100 m buffer. The sub-station does not fall within any of the plotted flood lines (Figure 27). However, some parts of the sub-station site are located within the exclusion zone.

The water samples taken from the dams located on the site, recorded high counts of *E. coli*, total coliforms, standard plate count, colour and turbidity as well as unacceptable concentrations of iron and lead.

The pre-development period's rainfall-runoff generation ratio from the catchments is 9 % (9% of rainfall failing turns into runoff). However, due to the lay-out of the proposed site, it is anticipated that this ratio will increase to 30% during the post-development period. This runoff will be discharged from the development as per the Storm Water Management Plan (Figure 28). The Storm Water Management Plan recommends that an energy dissipating structure be installed at each discharge point to minimise erosion of the receiving streams' channel. These energy dissipating structures should be comprised of a discharge chute and stone pitching at the discharge points.

The site soils and geology comprise a thin layer of transported and residual soils derived from the in-situ decomposition of yellowish-grey Dwyka Tillite. These superficial clayey soils were unsaturated at the time of the investigation and have a low hydraulic conductivity. A seasonal aquifer perched on the bedrock probably forms within this horizon, especially after high rainfall events. Base flow would be expected to follow the surface contours closely and would generally be in a northerly to north-easterly direction.

The underlying slightly weathered, fractured, massive Tillite is typically a low-permeable bedrock with an expected low hydraulic conductivity. The permanent groundwater level within the Dwyka Tillite is expected to fluctuate between 10 and 30 metres below ground level. The local groundwater level is to some extent influenced by the regional topography and, as such, the groundwater flow directions are generally expected to be towards the lower-lying, north-eastern and western areas of the surrounding country side.

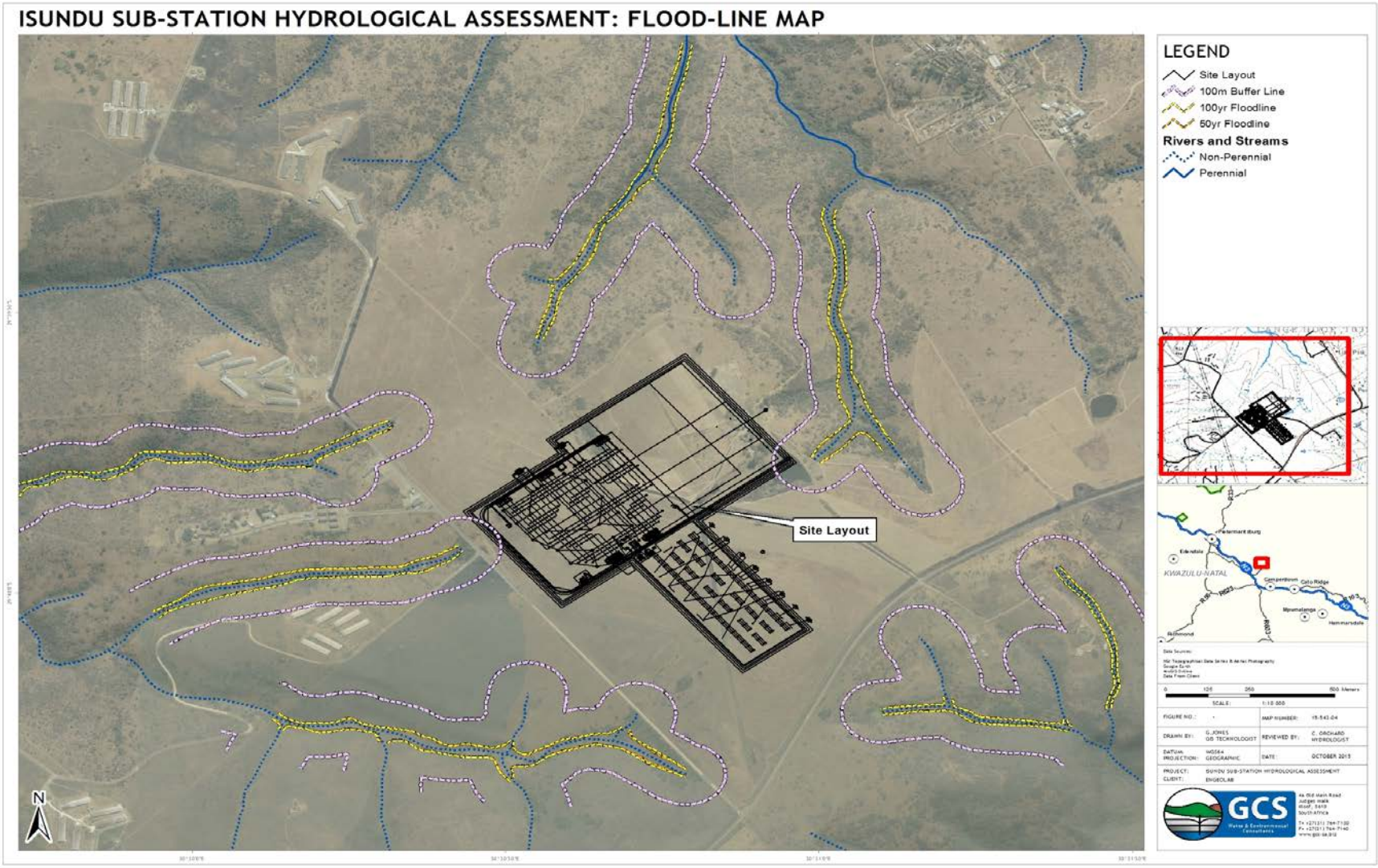

Figure 27 Flood line and 100 m buffer extents for the Isundu sub-station

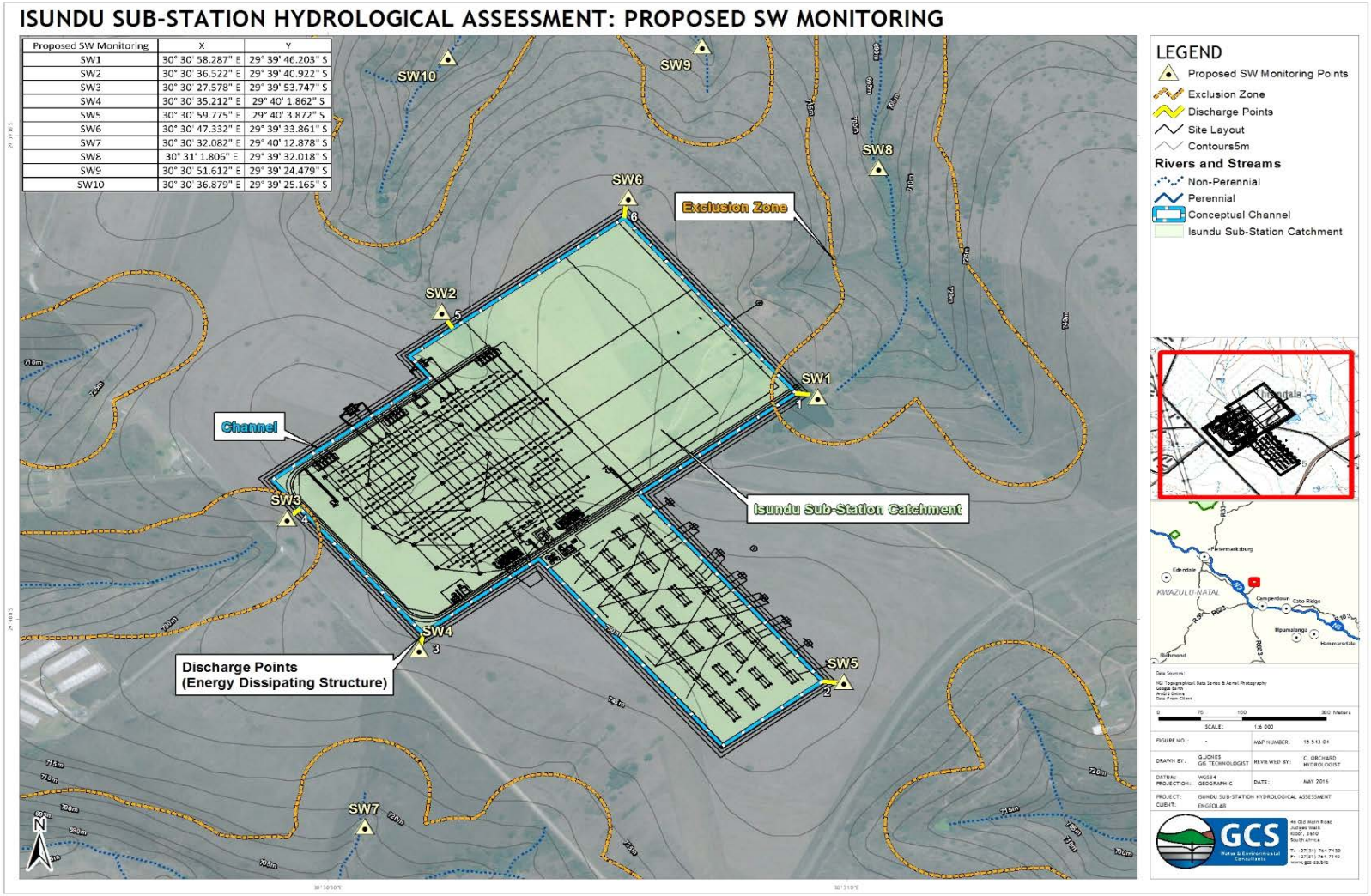

Figure 28 Stormwater discharge and monitoring points

Low recharge rates, low permeable residuum combined with the low groundwater potential aquifer decrease the aquifer significance as well as risk of groundwater pollution. No boreholes are recorded on the National Groundwater Archive database within a 5 km radius of the Isundu site. However, during fieldwork, three boreholes were recorded within a 1,000 m radius both up- and down-gradient of the site. Of the three boreholes, only one was equipped with a submersible pump providing water for domestic purposes to a local homestead located 1 km east of the Isundu site. Based on this information, it was concluded that groundwater use in the immediate catchment area is expected to be insignificant and can, therefore, be viewed as a non-strategic resource in this area.

The pollution risk to the groundwater environment associated with the construction and operation of the proposed facility was determined by collating the existing information into a conceptual site model.

The evaluation of the potential impacts on groundwater during construction concluded that the release of hydrocarbon fuel products to the soil and perched aquifer could result in pollution of groundwater. Without mitigation measures, the significance of this impact is medium. However, implementation of appropriate mitigation measures will reduce the significance of the impact to insignificant during construction.

During the operational phase, the following potential impacts were identified:

- Incorrect storage and handling of dry input materials and products could result in leachate being generated, negatively impacting on the perched groundwater table. The impacts were assessed to be of low significance and can be reduced to insignificant should mitigation measures be implemented.
- The failure of any underground sewage or other tanks or pipelines within the proposed site poses a risk to the soils and perched groundwater aquifer underlying the site. These impacts were assessed to be of low significance and possible to occur, but can be reduced to very low significance should mitigation measures be implemented (and the presence of a satisfactory clay layer under the proposed facility be confirmed).
- The cumulative impact of continuous polluted residues infiltrating the perched and shallow groundwater aquifers and the potential interconnectivity of the groundwater to the surface water pans located to the south-east of the site was found to have a medium significance but could be reduced to very low significance if the recommended mitigation measures are implemented.

Overall, the impact of the proposed development on groundwater and hydrology was found to be of low significance, provided that mitigation measures are implemented.

10.14.1 Mitigation measures

The mitigation measures suggested for the construction phase include:

- Should fuel products be kept on site for refuelling, these products should be contained within a bunded area that can contain a spillage should the tank fail.
- Machinery and vehicles must be serviced/repaired off-site and be kept in good working condition.
- In instances where hydrocarbon leaks associated with trucks and equipment are identified, drip trays should be placed to contain these leaks.

- A spill kit such as Spillsorb or hydrocarbon sorbent materials should be kept on site and be readily available to address any hydrocarbon releases if they occur.
- Should a solvent based product be used as a degreaser, it should be a biodegradable, environmentally safe product (and the Material Safety Data Sheet (MSDS) for the products should be kept on site).
- Construction of the new facilities should not change the nature of the "protective" clayey overburden to such a degree (more permeable) that fast infiltration becomes possible resulting in increased pollutant transport times.

Mitigation measures during the operational phase include:

- For the storage and handling of dry input materials and products, good housekeeping practices should be maintained at all times. Surfaces should be kept clear of dry material residues, which could be blown by the wind or transported on truck/vehicle tyres to areas where surfaces are not covered with concrete or tar. This will prevent them from entering the soil and groundwater should surface water run-off or a rainfall event occur.
- All surfaces that are concreted should be maintained so that water cannot filter into the soil and groundwater through cracks in the cement/concrete.
- To lower the potential for leachate formation, domestic waste should be placed in a water tight container and disposed on a regular basis.
- For the storage and handling of hazardous materials, above surface tanks should be contained in a lined (concreted) and bunded area.
- The drainage system from the facility to the stormwater retention pond should be lined and sealed so that no pollutant can enter the perched groundwater environment.
- All pipes and tanks should be regularly inspected and maintained to ensure that no leaks or failures occur.
- Determining the integrity of the clay layer underlying the site specifically the area where tanks will be located should be done during detailed design.
- In terms of impacts on wetlands, streams and surface dams, subsoil collector drains and a hydraulic containment system should be installed. The water collected from the subsoil collector drains and hydraulic containment could be pumped to a stormwater retention pond and then be re-used.
- Any spills require sampling to be done within 24 hours. This is to ensure that any impacts on surface water quality are identified as soon as possible.
- It is recommended that an energy dissipating structure be installed at each discharge point (Figure 28) so as to minimise erosion of the receiving streams' channel. These energy dissipating structures should comprise a discharge chute and stone pitching at the discharge points. This should minimise the risk of streambank erosion caused by the stormwater discharged from the sub-station platform into the receiving streams.
- Water quality must comply with either water quality objectives or water quality conditions as contained in the WUL before release into the neighbouring water course, as no re-use purpose for this water can be recommended at this stage.

The following monitoring requirements are recommended:

- Water level monitoring.
  - The groundwater levels recorded during this investigation are proposed as pre-development values for future gauging.

- In the specialist's opinion, no additional boreholes are currently required, provided that no significant changes to the sub-surface are made (e.g. removal of protective clayey layers).

- Water quality monitoring.
  - During construction and operations, monitoring is to be conducted bi-annually.
  - It is important that both the water stored on the site as well as any water that leaves the site is of acceptable quality according to DWS general limit values.
  - Any spills require sampling to be done within 24 hours. This is to ensure that any impacts on the surface water quality are identified as soon as possible.
  - The nearest existing borehole sources should be sampled bi-annually in terms of water quality (SANS 241) guidelines for domestic use.
  - The groundwater and surface water monitoring protocol and plans should adopt the monitoring points proposed.
  - Groundwater monitoring will be undertaken according to SABS and DWS requirements according to the schedule outlined in the WUL.
  - Precautions should be taken to ensure that surface run-off, potential leaks or spills do not flow into any new boreholes and, for this purpose, the specialist proposes a concrete apron around each borehole casing and inside the pump house structure.
  - Wellheads on boreholes down gradient of the proposed facility must be constructed to prevent any ingress of surface water either from a spill or flooding.
  - A berm needs to be built around the site to separate the clean and dirty water areas.

10.15 Aquatic and Riparian Ecosystems

In addition to wetlands and dams, the study area also contains freshwater ecosystems that are characterised by river channels (or watercourses) with associated riparian vegetation. All riparian systems were not flowing at the time of the assessment, and it is expected that they only flow intermittently, and primarily in response to rainfall events.

In terms of the National Water Act (Act 36 of 1998), the drainage line is not classified as a freshwater ecosystem. However, it would be preferable to retain these features as far as possible given the role that they play for stormwater control, as well as for providing ecological corridors across the broader landscape. South Africa is a semi-arid country and, thus, aquatic ecosystems are important features within the landscape as they provide ecosystem services directly related to water quantity and quality.

River systems are generally classified according to their position in the landscape in relation to zones of saturation. The river systems associated with the study area are classified in the following manner according to the river classifications of DWAF (2005):

- "B Section" channels, i.e. "channels that are in the zone of the fluctuating water table and only have baseflow at any point in the channel when the saturated zone is in contact with the channel bed… The gradient of the channel bed is flat enough in these sections for deposition of material to take place and initial signs of flood plain development may be observed". These include sections of RZ01, RZ02 and RZ05 as illustrated in Figure 29.

- "A Section" channels, i.e. drainage lines that appear to be well above the zone of saturation, and as a result do not receive any baseflow. However, these systems merely function as conduits for stormwater runoff during rainfall events.

At present the riparian areas are being affected by the following:

- ***Invasive alien plants –*** some of the riparian areas (particularly in the vicinity of roads, buildings, and other disturbed areas) contain invasive alien plants. *Lantana camara* (Tick-berry) is the dominant alien plant within the riparian areas, forming dense stands in some areas. Other problematic species include *Opuntia* spp. (Prickly Pear), *Schinus terebinthifolius* (Brazilian Pepper) and *Solanum mauritianum* (Bugweed). Invasive alien plants are recognised globally for transforming ecosystems through resource use and change in ecosystem cycles. Consequently, the ecological functionality and integrity of the riparian areas have been reduced leading to a relatively poor (or lack of) supply in particular ecosystem services.
- ***Illegal dumping of solid waste –*** particular areas of the study area are used as illegal dumping sites, which extend into the riparian habitat. These areas of disturbance remove any vegetation cover and exacerbate erosion as well as posing as health risks. Dumping is largely restricted to the riparian areas on the RCL Food's property, namely RZ03 and RZ04 (Figure 29).
- ***Removal of riparian vegetation –*** localised portions of riparian vegetation have been cleared, notably as a result of Rainbow Chickens' main access road from the MR477.
- ***Erosion –*** some areas display unnatural bank erosion and channel incision. This is largely a result of invasion by invasive alien plants, clearing of vegetation, increased surface water runoff and nick points developing in relation to the construction of roads and road crossings. Erosion leads to increased sedimentation of instream habitats, reducing habitat diversity and ecosystem functionality.
- ***Hydrological modification –*** the hydrology of riparian/instream habitats has been altered through anthropogenic activities/land cover changes (e.g. construction of roads, road crossings, drains and channel modifications), as well as by the presence of several small farm dams. Hydrological alterations, to some extent, have negatively transformed the freshwater ecosystems within the site leading to a decrease in ecosystem health and functionality.

The riparian habitats that occur along the rivers and drainage lines within the study area are generally in good condition (i.e. systems with a PES category of at least a "B"), particularly the riparian systems that drain in a northerly direction (i.e. RZ01 and RZ02). This indicates that the riparian habitats are 'largely natural' denoting that only a small change from natural habitats and loss of biota may have taken place with ecosystem functioning essentially unchanged. In contrast, the riparian systems that drain in a westerly direction are currently in a more "moderately modified" condition, in particular, RZ03 and RZ04. Thus, there has been a change from natural habitats with a loss of biota; however, basic ecosystem functions are still predominantly unchanged. Only approximately 0.25 ha of riparian habitat with an A Channel will be directly affected by the project.

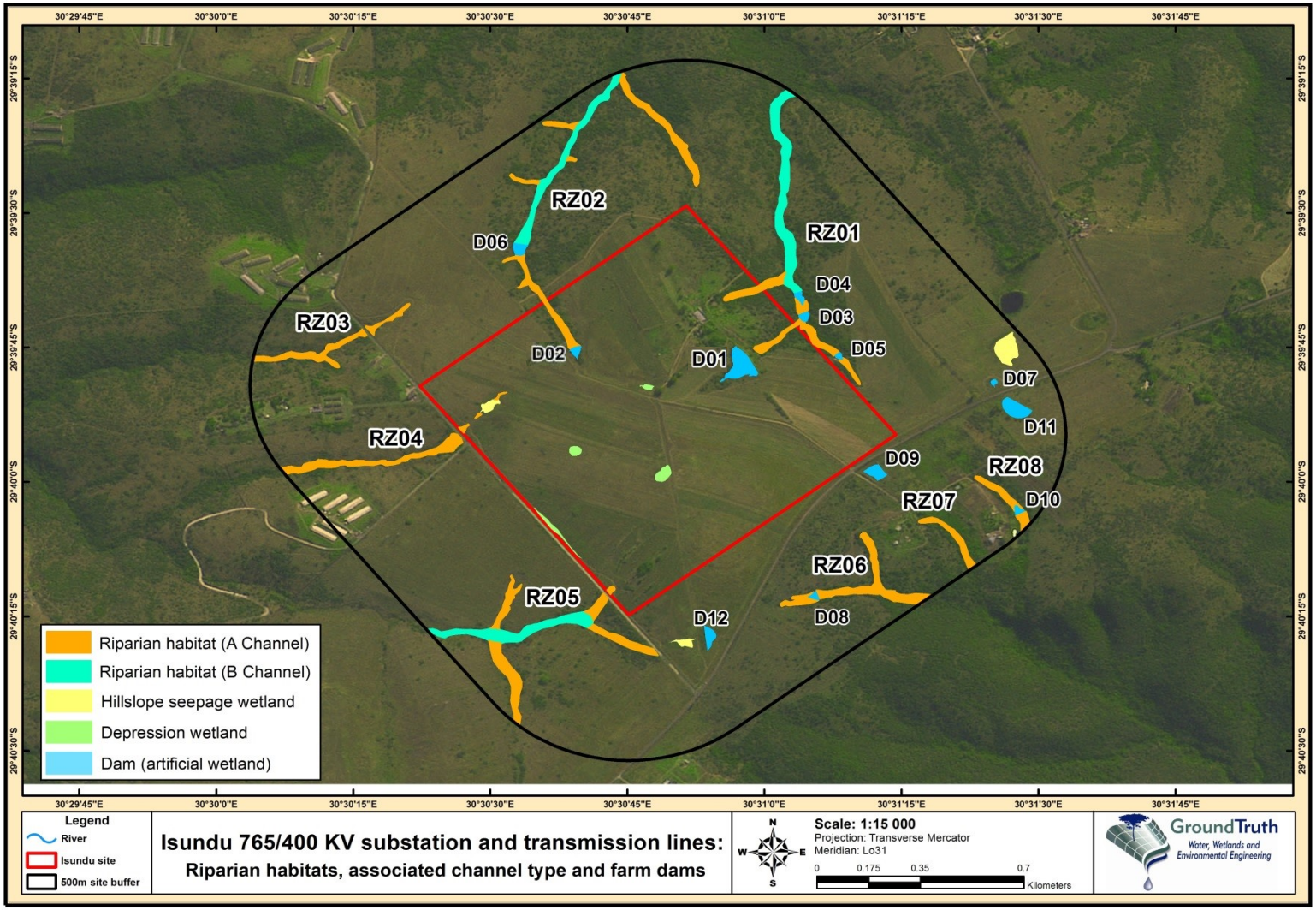

Figure 29 Extent and distribution of riparian habitat (according to channel type) and farm dams within the Isundu study area

There are 12 small farm dams located within the study area that range in size from 0.03 ha to 0.60 ha, averaging around 0.16 ha. Most of the dams occur within and/or are connected to the riparian systems draining the study area. The largest dam (Dam 1) is located roughly in the centre of the property, and appears to hold water throughout the year. The other dams were found to be either completely dry or holding only a small amount of surface water at the time of the site visit.

The main farm dam has well-defined marginal wetland habitat and comprises a mix of aquatic herbs, sedges and grasses, dominated by *Cyperus dives* and *Typha capensis*. This dam has potential to support aquatic fauna. Fish such as *Clarius gariepinus*, *Micropterus salmoides* (exotic), *Tilapia sparrmanii* and *Pseudocrenilabrus philander* are likely to occur within this dam. The other dams will also support various aquatic fauna and flora, but in lower abundances. All the dams are an important source of drinking water for larger mammals, especially during the dry periods when surface water becomes confined to several of the dams.

Two of the farm dams will need to be removed to allow for the construction of the sub-station, viz. the main farm dam[26] (Dam 1) and one other smaller dam (Dam 2). This will result in a 35% reduction in surface water, which will be more significant during dry periods when a number of the smaller dams dry up.

The following impacts on the riparian systems may occur as a consequence of developing the Isundu Sub-station:

- Habitat loss and transformation.
- Increased stormwater runoff.
- Erosion.
- Loss of surface water.

10.15.1 Mitigation measures

Considering the loss of freshwater ecosystems within KZN, it is generally recommended that the planning and implementation of any development should adopt a 'no-net-loss' approach. In the case of the Isundu Sub-station, this should include the following options:

- Mitigating impacts of the project's development by rehabilitating freshwater habitat on-site (within the same system) so as to balance the loss of riparian/instream habitat; and/or
- Where the impacts of the proposed development cannot be mitigated on-site, offsite rehabilitation and/or offsetting of the habitat loss may be required.

In view of the above, the following recommendations need to be considered to avoid and/or mitigate impacts that may arise from the development of the Isundu Sub-station:

- Beyond the extent of the finalised layout plan, ensure that the development avoids further loss/disturbance of riparian habitat and associated buffers zones.

[26] It is not certain that the larger dam will be lost. This dam will only be directly affected in future expansion phases. Future expansion may nor may not occur and if it does, the design of the layout may be able to avoid affecting the dam.

- Incorporate buffer zones to preserve and protect ecosystem functioning. Generally, buffers are adopted to protect ecosystems from physical disturbance and to protect the water resource from diffuse pollution sources within an altered landscape. The following buffers are recommended in the context of the Isundu project:
  - A buffer zone of 20 m from the riparian boundary of B Channel systems – to reduce impacts on the riparian systems within and adjacent to the site.
  - A buffer zone of 10 m for the riparian boundary of A Channel systems – to maintain stormwater runoff functions, and to reduce impacts on freshwater ecosystems further downstream.
- Manage and maintain riparian habitats and surrounding buffers as far as practical within the study area. Management actions should consider, but not be limited to, the following:
  - Develop and implement a programme to eradicate and control problematic invasive alien plant species and prevent further spread.
  - All invasive alien plant control work should only be undertaken by a competent contractor.
  - Active planting and revegetation using indigenous riparian plant species, ensuring a multi-layered, undisturbed vegetative community develops.
- Erosion control methods should be implemented to minimise the loss and degradation of soils. This should take the following into consideration:
  - Vegetation should be established as soon as possible after construction activities.
  - Where necessary, an approved local indigenous grass seed mixture should be applied in conjunction with the sods removed during clearing activities.
- Ensure that the stormwater management plan for the development minimises flow-related impacts to the aquatic environment by incorporating:
  - Detention/attenuation structures where appropriate.
  - Permeable pavers for hardened areas (e.g. parking areas) to reduce stormwater runoff, to encourage infiltration of surface water and to reduce the concomitant transport of pollutants.
  - Multiple discharge points from the sub-station site to allow a diffuse spread of surface runoff from the site.
  - Suitable baffle structures (e.g. gabion mattresses) at discharge points to dissipate the energy of stormwater runoff.
- Ensure minimal or no disturbance outside of the development footprint during construction i.e. dumping in or disturbance to the riparian areas and associated buffer zones outside the footprint must be prohibited.
- No hazardous chemicals used and/or spilled during construction must be allowed to enter the riparian areas. If such a spill occurs during and/or on completion of construction, a hazardous spills protocol must be implemented and the affected area cleaned and rehabilitated immediately.
- Provide alternative sources of drinking water for larger mammals that typically utilise farm dams with a more permanent surface water. This may be in the form of livestock drinking troughs, and assumes that large game animals will remain in the property.
- Incorporate the aforementioned recommendations into the Environmental Management Programme and include monitoring of riparian habitats, natural corridors and other open spaces to be implemented during both construction and operations.

10.16 Species Survey

In order to address comments received during the review of the DEIAR, ACER appointed Brousse-James & Associates to undertake a survey in January 2017 of the site for the following specific species:

- Frog species.
  - Spotted Shovel-nosed frog, *Hemisus guttatus.*
  - The Natal Leaf-folding Frog, *Afrixalus spinifrons.*
- Giant Green-earthworm, *Microchaetus papilatus.*
- Millipede species.
  - Flat-toothed shagreened millipede, *Camaricoprotus planidens*.
  - Visible keeled millipede, Gnomeskelus spectabilis.
  - Urban lumpy keeled millipede, *Gnomeskelus tuberosus urbanus.*
  - Resembling two-toothed slender spindled millipede, *Patinatius bidentatus simulator.*
  - Destroyed slender spined millipede, *Spinotarsus destructus.*
  - Glomerate slender spined millipede, *Spinotarsus glomeratus.*
  - Maritzburg slender spined millipede, *Spinotarsus maritzburgensis.*
- Snail species.
  - Warty hunter snail, *Gulella euthymia.*
  - Jigsaw-piece hunter snail, *Gulella separate.*
- The Rough-haired Golden Mole (*Chrysospalax villosus*).

The purpose of the survey was simply to confirm whether or not the specific species occurred on the site in the areas where they are likely to occur. The survey focussed on seven sites where snails and millipedes species were most likely to be found, and an area of approximately 20 x 20 m was searched for one man-hour at each site. At dark, the survey team moved to the two dams holding water to confirm frog species present.

No threatened frog species requiring conservation were identified. No Spotted Shovel-nosed Frogs were heard at either of the dams, although this does not guarantee that they do not occur on the property. However, the habitat is definitely not ideal for them. No Natal Leaf-folding Frogs were either seen or heard during the survey and no leaf-folding frogs of any species were heard. In addition, there were no plant species around the dam that lent themselves to the habit of the species folding leaves in which they deposit eggs. Thus, it was concluded that the Natal Leaf-folding Frog does not occur on the property.

There was much evidence of the Giant Green-earthworm (*Microchaetus papilatus*) occurring on the site and rain during the survey caused many to emerge from their burrows. There are no specific mitigation measures that can be taken to safeguard earthworms, other than maintaining the integrity of surrounding habitat, as they are locally abundant.

The dry conditions prevailing on the property, prior to the rainfall during the site visit, would not have been favourable to millipedes. However, none of the targeted millipede species were found and few millipedes were encountered. Based on discussions with Dr Michelle Hamer, Millipede Specialist with the South African National Biodiversity Institute, the site does not have any conservation significance for millipedes.

There was a general paucity of snails within the site and some sample sites yielded no snails at all. The dry soil conditions could have been a contributing factor. However, neither the Warty Hunter Snail (*Gulella euthymia*) or the Jigsaw-piece Hunter Snail (*Gulella separate*) were found on the property.

No Rough-haired Golden Moles (*Chrysospalax villosus*) were seen during the site visit and, in fact, the only way to tell whether or not they are there would be to trap them either by means of a live trap placed near mole burrows or by means of drift fences and pitfall traps. However, given the disturbed nature of the area and the fact that they require sandy soils and dense vegetation close to water sources, it is unlikely that they are present on the site.

Overall, the property gave the impression of being badly managed and neglected. However, given that most of the snails were found in the leaf litter under trees adjacent to the wetlands below the largest dam (Dam 1) and given that the dams do support a variety of frog species, every effort should be made to rehabilitate and maintain the integrity of wetlands and keep the proposed infrastructure away from wetlands. There are no specific mitigation measures that can be taken to safeguard earthworms, other than maintaining the integrity of the surrounding habitat, as they are locally abundant.

11. INTEGRATED DESCRIPTION OF ENVIRONMENTAL ISSUES AND POTENTIAL IMPACTS

An issue is a point of concern around which debate can be held, whilst an impact is how the natural, social or economic environment will be affected by a specific intervention.

The key issues identified during Scoping and carried through to the Impact Assessment were formulated as eight questions:

- What are the potential economic and socio-economic impacts associated with the construction and operation of the proposed sub-station?
- What impacts will the construction and operation of Isundu Sub-station have on the natural environment (flora and fauna) of the site?
- How will the development of the Isundu Sub-station impact on existing and developing tourism land use plans and other town planning initiatives?
- How will the construction and operation of the Isundu Sub-station impact upon surrounding enterprises dealing with sensitive animals and birds?
- Can the construction and operation of the Isundu Sub-station be detrimental to the health and safety of local communities?
- What effects will the construction of Isundu Sub-station have on cultural and heritage resources?
- How will earthworks during construction and stormwater during and after construction, affect the surrounding water courses and environment?
- What cumulative effects will the proposed Isundu Sub-station contribute, considered in association with impacts arising from other activities in the region?

This section synthesises the impact assessment phase findings and discusses the issues identified during scoping. The significant impacts associated with each of the above issues are discussed and the significance of each impact is rated in Chapter 12, according to the assessment conventions outlined in Section 9.1 (Table 9).

11.1 What are the potential economic and socio-economic impacts associated with the construction and operation of the proposed sub-station?

11.1.1 Positive national and regional economic benefits

The positive economic benefits of the proposed project fall under three categories:

- During construction there will be a significant injection of investment into the local, regional and national economies.
- During construction there will be local employment benefits.
- During operations there will be significant economic benefits from the increased reliability of electricity.

Based on the data provided by Eskom, construction of the sub-station will take approximately three years and will cost in the region of R 2,904 million (this figure will increase with escalation), which equates to 0.1% of South Africa's GDP, and 2.5% of the GDP generated by the national construction activities.

During the VSHA EIA, Imani Development, the economic specialist, using a construction cost of R 1,700 million in 2010, estimated that during the construction period alone, there would be a direct total GDP impact of R 301 million. In terms of employment, the Imani Development study estimated that the transmission will create 550 direct jobs during the construction period, of which 24 will be skilled, 75 semi-skilled and 451 unskilled. If the

indirect and induced effects are added, a total of 2,594 jobs will be created. Of these, 202 will be skilled, 416 semi-skilled and 1,976 unskilled. Households will receive R 211 million over the period, with R 35 million accruing to low-income families. The different levels of government will receive R 92 million in taxes, with R 6 million for local government, R 1 million for the province and R 85 million for the national treasury (Imani Development, 2010).

Whilst it is estimated that only approximately 80 people will be working at any one time at the Isundu site during construction, this does not take into account the total number of people who will be directly or indirectly employed during the entire construction period, inclusive of the transmission lines.

However, although the economic benefits of construction may be valuable, it is the long-term economic benefits of a reliable electricity supply that provide the most significant positive impacts. Due to historical load-shedding resulting from the lack of generation capacity, the South African economy has suffered over the immediate past, with unreliable electricity supply being regularly cited by economists as a factor hindering economic growth.

As outlined in Section 4.6, the new Medupi and Kusile coal fired power stations, the first to be built for 20 years, will address this lack of generation capacity. However, if significant delays occur in increasing and strengthening the electricity transmission network across the country, the additional available power will not be able to benefit the country.

The economic multipliers associated with electricity can vary depending on where the electricity is to be used.

A modern economy cannot grow without the availability of a reliable electricity supply. During 2004/2005, Conningarth Economists calculated a detailed set of electricity multipliers based on the activity split and structure in the National Social Accounting Matrix (SAM). Based on these and 2010 figures, Imani Development calculated the following macroeconomic indicators from the multiplier model at full use of the available electricity (Imani Development, 2010)[27]:

- Gross Domestic Product contribution = R 29,081 million.
- Employment sustained = 216,000 jobs.
- Payment to households = R 13,920 million.

The key purpose of this sub-station and associated transmission lines is to strengthen the supply to the Pietermaritzburg, Ethekwini, the KZN south coast and north coast regions, and, hence, help to realise the economic benefits in terms of Gross Domestic Product. Production increase and employment sustained or created for these regions of KZN will be significant.

11.1.2 Economic impacts on local enterprises

The economic impact upon local enterprises situated in Mkhambathini Municipality will vary. There will be a number of positive economic benefits, accruing to both the Mkhambathini and Msunduzi Municipalities in terms of demand for local service provision, such as accommodation, food, etc. as well as local employment, amongst others.

27 These are once-off contributions.

However, it is also envisaged that some of the surrounding existing enterprises, such as RCL, as well as the existing and planned tourism enterprises may experience some negative economic impacts. Negative economic impacts upon RCL are now unlikely given their intention to sell these surrounding farms and relocate their operations out of KZN.

Similarly, the potential of various proposed estates still to be developed may conceivably have their planned economic potential curtailed by negative impressions or views of electrical infrastructure. However, this will not necessarily prevent alternative development opportunities not necessarily negatively affected by being located within the vicinity of a sub-station and associated transmission lines that could provide similar economic benefits for the local region.

Whilst these localised economic impacts will be relatively small in comparison to the local, regional and national benefits accruing from the project, they cannot be ignored and need to be minimised as far as possible, with suitable mitigation measures devised.

Potential negative economic impacts on surrounding local enterprises are discussed under the various sections dealing with the key issues and concerns related to each enterprise.

11.1.3 Negative impacts on National Food Security

Eversheds, on behalf of RCL Foods, has continually raised the point that any impact upon their client, RCL Foods, would result in significant negative impacts upon national food security. The line of argument is generally as follows: RCL Foods is one of the large national producers of chicken; chicken is the preferred and most consumed protein source in South Africa, and is also one of the cheapest sources of protein for the poorer segment of the population; thus, any impact upon RCL Food's production chain would be an indirect impact upon the food security of South Africa and especially the millions of poorer citizens relying on this food source.

RCL Foods stated in their comments on the draft EIAR that 'The disruption to the RCL operation will be a significant threat to food security, a strategic imperative in the National Development Plan and Phakiso project ...the impacts that will result for RCL Foods and the nation at large are not justifiable and the result must be the "no-go" option, or the application must consider alternative sites'.

This section examines these claims.

The definition of food security adopted by the 1996 World Food Summit is as follows:

"Food security exists when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life".

Food security and vulnerability to food insecurity are assessed using the four dimensions of food security arising from this definition, namely:

- **Food Availability: i**s there food physically available to consume?
- **Food Access:** can people physically and economically access this food?

- **Food Utilization:** how do people use this food, i.e. food can be consumed in the incorrect quantities such as too many processed foods, or an over reliance on only specific food types?
- **Food Stability:** examines how food availability, access and utilization may vary over time, i.e. large yields in one year and crop failure the next can affect food security.

Depending on the food insecurity focus and scale being considered, these four dimensions can be considered and investigated at a national level for a country, at a regional level for certain areas or for segments of the population, or at an individual household level. Using the four dimensions of food security enables any intervention to understand where and how people may be food insecure and to design appropriate interventions, i.e. food stamps will be ineffective if there is no food available to purchase.

In order to examine briefly whether or not the sub-station near RCL Food's property is likely to affect national food security as claimed, the possible impacts upon the four dimensions of food security are discussed below.

- **Food Availability.**

  Whilst it is accepted that chicken is indeed the most popular meat source in South Africa and is also cheaper than other meat such as beef, pork and fish, it is not the only source of food. According to the Food Price Monitor, the five food items most widely consumed by very poor consumers in South Africa are: maize porridge, brown bread, full cream milk, tea and sugar (NAMC, 2015). In addition, there are numerous other sources of food including grains, vegetables and fruit.

  Thus, even if not a single chicken was produced in South Africa, and no poultry could be imported, the country would still be regarded as food secure and people would have enough food to eat. If the key issue was further narrowed down to the availability of protein sources, then there would still be sources of protein via other meats, milk products, beans, etc. A few of these protein sources are in fact cheaper than chicken and so would be available as substitute protein sources, although they may not be the preferred sources of protein.

  However, even with no local production, poultry could still be imported into the country and, currently, this is occurring at a price cheaper than local poultry can be produced. Thus, there is no risk that there may be a complete lack of food or chicken physically available for South African citizens to consume as a result of this project.

- **Food Access.**

  If local production suddenly dropped, poultry prices would increase and this could affect the ability of poorer consumers to purchase chicken. The issue to consider is what percentage of local production could possibly be affected by the proposed sub-station and if this would have a significant enough impact on supplies and prices.

  Based on the findings of the Tourism and Economic Development Specialist Study, the following statistics are relevant:

  - RCL Foods' total market share of the South African Poultry Industry was only 24%, with other producers supplying the other 76%.

- RCL Foods have facilities based primarily in Limpopo, the Western Cape and KwaZulu-Natal, with the production in KZN being approximately 28-32% of RCL's production for the country.
- Furthermore, RCL has 14 layer farms in KZN, supporting the value chain, and only seven of these occur on the farms adjacent to the proposed sub-station.
- Of these seven layer farms, this investigation has found that three may be possibly impacted upon, and the extent of this impact is uncertain and temporary for reasons discussed in Section 11.4.2.

An impact, even if relatively significant, upon one or all three of RCL's adjacent layer farms, is not likely to significantly change poultry prices across the whole country as they do not constitute a large enough proportion of the National Poultry Industry.

Furthermore, the issue of price is far more complex than only the supply and demand of local production as indicated above. In 2013, the Government signed into law new brining limits for local producers. This basically limited the amount of salt water that can be injected into frozen poultry. This has raised the price of chicken. Supporters claim consumers now pay for chicken rather than salt water. The technical merits of brining and what percentages should be permitted are not relevant here, yet this change will have affected the profits of local poultry producers.

In addition, recently there have been numerous articles about the cheap imported chicken products being 'dumped' in South Africa by the USA, Europe and other countries. The price of imported poultry is currently cheaper than poultry produced in South Africa. However, the Government implements tariffs on imports to maintain the competitiveness of the South African poultry industry and to protect jobs.

Yet, there are groups, such as the Association of Meat Importers and Exporters of SA, which claim that these tariffs increase food prices, limit access and threaten food security (Parliamentary Monitoring Group, 2013).

In order to remain competitive against these global imports and other market changes, RCL Foods in KZN is reported to be retrenching staff and considering the sale of 15 of their 25 farms. RCL Foods has confirmed that the sale of the properties adjacent to the proposed sub-station are part of this consideration.

Across the country, local poultry producers, not only RCL Foods, are cutting costs, scaling down production and/or going out of business, due to the various recent changes in Government policies.

Thus, the price and ability of poor consumers across the country to purchase chicken will not be affected by this proposed project.

- **Food Utilization and Stability.**

The utilization of poultry and how it affects diet and health are not relevant here.

To ensure stability in chicken availability and price, governments need to enforce policies. A policy that favours imports over local production may result in cheaper prices, but also makes consumers more vulnerable to exchange rates and international price fluctuations, with no local production to act as a buffer. A policy

favouring local producers over imports, can result in increased food prices for millions of consumers whilst protecting jobs in an industry which has less incentive to remain competitive. Yet, local producers can also be disadvantaged if international producers are able to sell excess production in South Africa at a lower cost than they themselves can produce it only because their governments are subsidizing these international producers unfairly, i.e. leading to the 'dumping' of excess produce on the markets of developing countries.

This is a brief and simplified explanation of how government policy and international trade rules can play a role in national food security, food availability and price. These are national and international trade and policy debates which are not relevant to this project.

Thus, this brief explanation and assessment of food security demonstrates the following: (a) the fact that the proposed sub-station site is adjacent to RCL Food's property is not going to affect national food security in any way; (b) any impact upon RCL Foods as a company does not equate to an indirect impact upon national food security. As discussed further in Section 11.4.2, impacts are difficult to predict with certainty and, if any occur, they would only be over the short duration of the initial construction phase and suitable mitigation measures have been proposed; and (c) it appears quite likely that RCL Foods may not even own the adjacent property when Eskom wishes to start construction. If RCL Foods do still own the property when construction needs to commence, production across all KZN farms may have been so significantly cut by RCL to reduce losses, that there will be sufficient opportunities to minimise any possible losses during the construction phase by simple management decisions.

11.1.4 No-development option

The no-development option would be to not construct the sub-station and associated transmission lines, thereby not strengthening the KZN transmission network, i.e. the status quo would remain.

The impacts of the no-development option are closely linked to the potential economic and socio-economic impacts outlined above.

Firstly, there is a widespread recognition amongst all economists and even amongst the directly affected stakeholders, that a reliable electrical supply is essential for continued economic and socio-economic growth. As outlined in Sections 3 and 4, there is a need to increase the reliability of the electricity supply to the KZN Midlands, southern regions and Zululand, and there are various technical reasons which limit the regional location of sub-stations within the overall grid.

Since 2008, Eskom has undertaken extensive searches within this grid in the area of the KZN Midlands to identify a suitable sub-station site. Of the order of 25 sub-station sites were identified and investigated; however, each has challenges and flaws, leaving the proposed Isundu site as the only viable alternative. The no-development option will result in further significant delays in increasing and strengthening the KZN electricity transmission network, with negative economic consequences for KZN.

The main advantages of the no-development option are to avoid any potential negative impacts upon surrounding developments and the irreplaceable loss of biodiversity on the site. However, when it comes to service infrastructure such as electricity, the no-development option is really the option of just relocating the impacts elsewhere as KZN's electricity supply needs to be strengthened and, thus, new sub-station infrastructure and transmissions lines are necessary somewhere in order to achieve this.

As raised in Chapter 7, there are no locations for a sub-station in the KZN Midlands where it would have no potential negative impacts and, thus, raise no objections.

As highlighted above, selecting the no-development option for this Isundu application, will only result in infrastructure being located in other areas with potential negative impacts being shifted back to other sectors operating in the KZN Midlands, like the cane, forestry or established high-income tourism areas, whilst also delaying the economic benefits for the rest of KZN.

The potential socio-economic impacts, issues and concerns of these other sectors were assessed during the VSHA investigations and in many cases are as difficult or more difficult to mitigate than the concerns raised for the current Isundu site.

11.1.5 Recommendations for mitigation/enhancement

There are no recommended mitigation measures required for the positive impacts. The mitigation of possible negative economic impacts on surrounding enterprises is addressed in sections that follow, under the key issues and concerns related to each enterprise.

The no-development option is not recommended for this application.

11.2 What impacts will the construction and operation of Isundu Sub-station have on the natural environment (flora and fauna) of the site?

11.2.1 Isundu Sub-station

Whilst the sub-station will not transform the entire property upon which the sub-station is to be located, nor even the entire 100 ha area to which this application applies for, it will completely clear the vegetation and transform an area of approximately 40-45 ha.

The predominant vegetation type on site is natural grasslands, which are mowed regularly for hay production. The vegetation type on site under natural conditions is KwaZulu-Natal Hinterland Thornveld, which has a provincial conservation status of least threatened. Although a large portion of the area comprises disturbed grasslands, there are various plant communities associated with the terrestrial, riparian and wetland habitats.

Although the various shallow farm dams have resulted from excavations within the riparian areas, they currently support hydrophilic vegetation ranging from reedbeds to hydrophilic and terrestrial grasses, forbs and sedges.

Four wetland pans and three hillslope seepage wetlands were also identified on site and rated largely natural and unmodified. Regardless of the degraded nature of the surrounding grassland, the wetlands were considered valuable because of their unmodified hydrological and geomorphological condition, and because they are well covered with hydrophilic vegetation.

In terms of fauna, the site is expected to support a low to moderate diversity of fauna with few conservation important species expected, primarily due to the lack of suitable habitat and high levels of habitat disturbance, particularly within the grassland areas. Consequently, the potential for conservation important species occurring on-site is likely to be low, although the small population of Oribi (*Ourebia ourebi)* which may occur in the broader study area, including this site, is listed as Endangered.

The terrestrial fauna specialist indicated that the aquatic habitats (including the several small farm dams) may provide suitable habitat for faunal diversity and, particularly two frog species, viz. the Natal Leaf-folding Frog (*Afrixalus spinifrons)* and Spotted Shovel-nosed Frog (*Hemisus guttatus)* currently listed as Near Threatened and Vulnerable, respectively. The vegetation specialist also rated the wetland habitats for potential biodiversity based on these fauna recommendations. However, a survey for these frogs did not find either of these species and stated that the habitat and plant species on site were not ideal for these species.

Yet, the sub-station will still impact upon some of the seasonal pans and seepage wetlands and, thus, these areas will be transformed and lost. The vegetation and wetland specialist recommended that off-set mitigation was necessary to mitigate for this loss.

11.2.1.1 Off-set mitigation

The need for and definition of off-set mitigation was discussed during the joint EAP, Eskom and Authorities site visit held on 14 March 2017. The Authorities confirmed that only if the ecosystem services provided by the habitat or wetland in question could not be recreated elsewhere on the site, thereby, mitigating any net loss of services on the site, would 'off-set' mitigation on another property be necessary[28].

As illustrated in Table 23, the ecosystem functions of the pan and hillslope seepage wetlands that will be impacted upon by the sub-station footprint can be recreated in the grassland areas surrounding the proposed sub-station (Figure 30). The stormwater management plan will also support these areas.

These recreated areas will be in the same drainage catchments as the original wetlands, and could be recreated no more than approximately 100 – 400 m away from the original wetlands. These areas as proposed in Figure 30 are also still within the same erf/property boundary which Eskom will need to purchase prior to construction commencing.

In addition, there have also been requests from a neighbouring landowner to possibly lease the unused grassland areas surrounding the sub-station for game ranching purposes. Thus, the grasslands surrounding the sub-station will continue to receive minimal human traffic and the biodiversity may even be improved with good grazing management and if the regular cutting of grass for hay no longer occurs. Both dams are man-made dams. Dam 2 will be lost, whilst only a portion of Dam 1 may be affected if the sub-station is expanded into the future. However, depending what is required in the future, it may even be possible that Dam 1 is never directly impacted at all.

28 This definition is slightly different to that used by the vegetation and wetland specialist, where off-set mitigation refers to the need to physically recreate the wetland elsewhere, regardless of distance or erf boundaries.

Table 23 Summary of ecosystem services on the site and proposed mitigation

	Affected pan/wetland			
	Pan 1	**Pan 2**	**Pan 3**	**Seep 1**
Size (m²)	1818	524	1033	1525
Ecosystem services provided as per the specialist findings	Biodiversity maintenance and erosion control, enhanced by restricted human access to the site	Biodiversity maintenance and erosion control, enhanced by restricted human access to the site	Biodiversity maintenance and erosion control, enhanced by restricted human access to the site	Biodiversity maintenance and erosion control, enhanced by restricted human access to the site and also intermediate nitrate removal.
Present Ecological State Category	**Pan 1**	**Pan 2**	**Pan 3**	**Seep 1**
Hydrology	A	A	A	A
Geomorphology	A	A	A	A
Vegetation	B	B	B	B
Overall	A	A	A	A
Recommended mitigation	**Pan 1**	**Pan 2**	**Pan 3**	**Seep 1**
Findings	No frogs of conservation importance were identified on this pan. Furthermore, the site is on top of the hill on level ground, thus, the contribution to erosion control will be minimal.	No frogs of conservation importance were identified on this pan. Furthermore, the site is on top of the hill on level ground, thus, the contribution to erosion control will be minimal.	No frogs of conservation importance were identified on this pan. Furthermore, the site is on top of the hill on level ground, thus, the contribution to erosion control will be minimal.	No frogs of conservation importance were identified. Site is at the top of the drainage line. The storm water management plan includes erosion control mitigation in this area.

	Affected pan/wetland			
	Pan 1	**Pan 2**	**Pan 3**	**Seep 1**
Proposed mitigation	Recreate similar sized pan on a portion of unaffected grassland adjacent to the sub-station and re-establish wetland vegetation. Due to the site being owned by Eskom, restricted human access will still occur.	Recreate similar sized pan on a portion of unaffected grassland adjacent to the sub-station and re-establish wetland vegetation. Due to the site being owned by Eskom, restricted human access will still occur.	Recreate similar sized pan on a portion of unaffected grassland adjacent to the sub-station and re-establish wetland vegetation. Due to the site being owned by Eskom, restricted human access will still occur.	Recreate similar sized seepage area in conjunction with the storm water management plan. Due to the site being owned by Eskom, restricted human access will still occur.

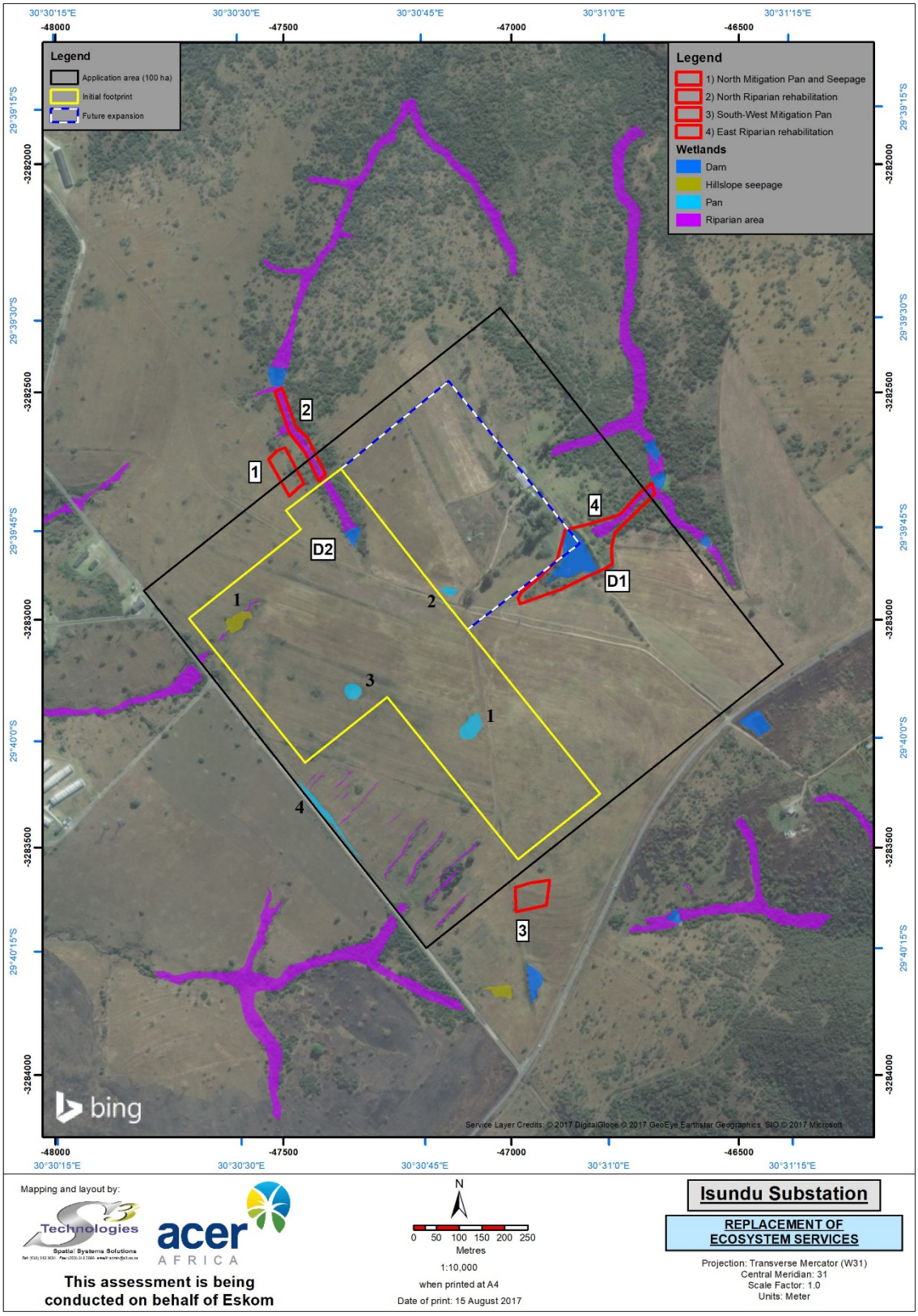

Figure 30 Proposed mitigation areas on-site for existing ecosystem services

The ecosystem services of these man-made dams can be recreated in the same drainage lines just out-side the sub-station footprint. Indeed, it may be an improvement in terms of biodiversity to simply restore the natural riparian area and clear the alien vegetation within these watercourses.

Table 24 provides the sizes of the areas to be lost and the proposed replacement areas as depicted in Figure 30.

Table 24 Size of ecosystem habitats impacted and proposed replacement

Habitat impacted	Size (ha)	Proposed replacement areas	Size (ha)
North catchment			
Pan 2	0.05	North Mitigation Pan and Seepage	0.40
Seep 1	0.15		
Riparian habitat	0.25	Riparian rehabilitation	0.42
TOTAL	**0.45**	**TOTAL**	**0.82**
South-West Catchment			
Pan 1	0.18	South-West Mitigation Pan	0.40
Pan 3	0.10		
TOTAL	**0.28**	**TOTAL**	**0.40**
East Catchment			
Riparian habitat	0.00*	Riparian habitat	2.00
TOTAL	**0.00**	**TOTAL**	**2.00**

* This riparian area and Dam 1 may only be affected if the sub-station is expanded into the future, yet depending on the platform and layout needed at the time, it may even be possible that this riparian area and dam is never impacted.

Thus, formal off-set mitigation is not deemed necessary, rather the mitigation of existing ecosystem services must be achieved by recreating and protecting similar habitats just out-side the sub-station footprint. As illustrated in Table 24, the proposed mitigation areas surrounding the footprint area will exceed the ecosystem areas that will be impacted by the proposed sub-station, with no overall loss of ecosystem services.

11.2.2 Transmission lines

The main impact upon the natural environment resulting from transmission lines relates to the removal of vegetation. This, in turn, fragments habitats, creating edge effects, along with increasing the potential of alien plant infestation, soil erosion and further degradation.

The loss of habitat and disturbance also affects fauna in a similar manner through habitat fragmentation.

Two 400 kV double-circuit lines will need to run from the sub-station to the existing Hector-Ariadne 400 kV double-circuit transmission line. The proposed alignment for these as previously agreed with the affected stakeholders (Figure 32) is to follow the existing 275 kV Georgedale-Mersey transmission lines.

The initial portion of this route will run over grassland habitat, which is just north and south of the P477. In this section, little habitat disturbance and clearing will be required. Thereafter, these lines will run parallel to the existing transmission line through the

Mayibuye Game Reserve. Although this area consists of bushveld, the trees are generally sufficiently low that, along with the topography, a large cleared servitude is not currently visible under the 275 kV lines. As the double-circuit 400 kV lines will be higher, it is predicted that significant clearance of the woody vegetation will not be necessary for the servitude, at least during operation.

However, during construction, more clearance will be required and as far as possible, vegetation clearance must be minimised by using existing tracks and access routes. Ideally, any access routes should be created along the planned access routes for the Mayibuye Game Reserve, if they have not yet been created, in order to reduce the overall impact.

An important element of the current proposed design is that these lines will be constructed as double-circuit lines. Thus, it will be possible to operate four transmission lines through this area while only disturbing the area required for two transmission line servitudes.

11.2.3 Recommendations for mitigation

Key mitigations measures recommended to limit the negative impacts on vegetation, wetlands and fauna are provided hereunder.

Pre-construction

- Undertake a survey prior to construction (referred to as the 'walk down survey') to identify any protected or rare/threatened vegetation species. This needs to be done at the right time of the year for flowering and will also need to identify any protected plants or trees to be impacted, once the final site has been demarcated.
- Once the final site has been demarcated, a plan to mitigate the existing ecosystem services by recreating and protecting similar habitats just outside the sub-station footprint needs to be implemented as per Section 11.2.1.1. and Figure 30. For the riparian zones, this will include clearing alien vegetation from the riparian areas and confirming that no erosion points have been created. For the pans/seepage areas this will involve creating slight depression areas and re-establishing cover using similar hydrophilic vegetation.
- Once a preferred transmission line route has been selected, and prior to the construction of towers, input from the vegetation/wetland specialist and the fauna specialist is required on the final location of towers, and sensitive areas of vegetation and habitat to avoid.

During construction

- A range of mitigation measures to protect fauna and flora during construction, such as effective site demarcation during construction, pollution control and suitable rehabilitation are recommended. These have been incorporated into the EMPR.

During operation

- During operation, the ongoing maintenance of servitudes and removal of alien plants are important. These have been incorporated into the EMPR.
- The project area must be kept free of alien vegetation as required in terms of the Conservation of Agricultural Resources Act 1983 (Act 43 of 1983).

11.3 How will the development of the Isundu Sub-station impact on existing and developing tourism land-use plans and other town planning initiatives?

The proposed sub-station site falls within an area zoned by the LM for agriculture and eco-tourism. The existing surrounding enterprises are either agricultural or tourism related activities whilst the planned future developments in the area are also based around eco-tourism initiatives. The adjoining Msunduzi LM SDF also has the area bordering on Mkhambathini zoned for agriculture, conservation use, and open spaces.

Thus, the construction of a large sub-station within this area, along with at least the five currently planned transmission lines and the possibility of additional lines in the future, is likely to have direct and indirect impacts upon existing and future plans. Possible cumulative impacts in this regard are addressed in Section 11.8.

From both a visual and noise perspective, this area falls within two landscape characters, one being the urban fringe corridor that runs beside the N3 and the other the more rural settlement that occurs in the valleys further from the N3. In terms of agricultural potential, the Department of Agriculture and Rural Development has confirmed that the site has moderate agricultural potential and is not regarded as high value agricultural land that must be retained for agricultural use.

The main agricultural activities in the area are those associated with poultry, which creates an agri-industrial feel to the area. The dominant views along parts of the P477 are already visually degraded due to the existing RCL chicken houses, whilst across the valley, a quarry and industry of Camperdown are clearly visible during the day and also at night.

The future development of this area is currently poised between developing around tourism and low density residential activities, or possibly developing along a higher density residential and light industrial trajectory. Despite municipal zonation of agricultural and ecotourism, the area is under pressure from the following:

- There appears to be significant pressure for housing development, with apparently unplanned development occurring rapidly along the M556 road to the east of the site running down into the larger settlement areas of the Valley of Thousand Hills.
- Although both have a tourism focus, the still to be developed Mayibuye Estate and proposed Aloe Wildlife Estate plans also have their infrastructure situated alongside the P477.
- There have been plans proposed, which continue to be raised by stakeholders, of developing an international airport, instead of the proposed Aloe Wildlife Estate, with plans for light industry along the N3 and to the east of the airport, up to the proposed sub-station site. Whether or not these plans will ever materialise is unknown but there are anecdotal claims that the concept has high-level political support.

Importantly, the proposed development plans focussing on tourism are predominantly based around the following:

- The existing Natal Lion Park and Zoological Gardens and the Africa Bird of Prey Sanctuary.

- The Mayibuye Game Reserve. This reserve also has political support and has commenced with the development phase. However, this entire development has a number of potential pitfalls and there is no certainty that it will develop as fully envisaged. The reasons for this are:
  - As outlined in Chapter 7, there are numerous planned developments that never materialise as proposed or at least never develop as fully as envisaged. The Mayibuye Game Reserve as proposed will require substantial private investment over numerous phases in order to develop as per the approved layout plans. A large proportion of this investment is also reliant on the area attracting high-income individuals wishing to develop within an eco-estate/game reserve. This area needs to compete with other high-income areas such as Hilton and the Midlands. Further, a key disadvantage is the already industrialised feel of the area.
  - This game reserve is being developed in partnership with the local community. This presents a risk, especially as the income and employment claims made in the business plan appear to be overestimated. It is possible that dissatisfaction over benefits accruing and/or the need for land for housing may reduce or curtail development plans into the future.

Nevertheless, the presence of the sub-station and numerous transmission lines as proposed may stifle tourism investment into this area and push the balance of development, at least along the ridge part of the P477, possibly more towards light industrial and/or higher density residential than is currently planned.

However, even the planned tourism developments will themselves visually change the views along the P477, both during the day and night. These, along with the existing poultry farms, will create a distinct built up urbanised feel when travelling along this road. Thus, regardless of the proposed sub-station, the whole area from the N3 along the P477 to the Lion Park is likely to develop and will have a more built up feel in the future, rather than the more rural open area experienced once past the existing 275 kV transmission lines.

The impact of the proposed sub-station on the Africa Bird of Prey Sanctuary, including the tourism impact, is discussed in Section 11.4.

The significance of impacts for the Natal Lion Park and Zoological Gardens is considered low. This is because, although the drive towards the Lion Park will have a more industrial feel, the primary reason for tourists visiting the Lion Park and the Zoo is to see the animals. These animals are captive animals and around the world, zoos exist and function in the midst of large cities. The sub-station infrastructure and transmission lines will be visible from some angles within the Zoological Gardens but the primary views will still be the animals and cages. The Lion Park enclosure faces away from the sub-station site and will not be affected by the proposed sub-station.

The cumulative impact of future lines on the Lion Park is discussed in Section 11.8.

The impact of the proposed sub-station upon the Mayibuye Game Reserve is rated as one of medium-high significance without mitigation. The presence of a sub-station of this size directly opposite the main entrance is likely to make some investors or tourists reconsider their investment plans. However, investors in this area commenced their development plans alongside the existing transmission lines, the numerous chicken farms visible along the P477, with the Camperdown industry, and quarry clearly visible across the valley.

From a visual perspective, it will be possible to largely screen the sub-station from the P477 to reduce the visual impact when approaching the Reserve. Thereafter, once entering the game reserve, the main views are across the valley in the opposite direction.

In terms of the Mayibuye Game Reserve plan, as outlined in Figure 19, the sub-station will not significantly change or alter in any way the attractiveness of the majority of the plots or stands located within the valley. This is one of the important characteristics of the reserve, viz. that adjacent to the N3 and a large KZN urban area, one can drive down into the valley and have a unique bush and game experience.

However, the development of the sub-station may potentially stop any further expansion of eco-tourism development north of the P477 in order to join the Lower Mphusini Valley Conservancy (in Msunduzi LM). From a natural fauna and flora conservation perspective, this is not deemed to be significant due to the non-threatened conservation status of the area but it may be in terms of developing a larger more consolidated eco-tourism area. However, encroaching housing developments may also reduce the possibility of eco-tourism corridor development options.

In terms of lost economic investment and employment creation, it is possible that there would be little or no overall economic loss to the area as a focus on light industry or high density residential in this area, with the existing infrastructure available, could possibly deliver equivalent economic benefits to tourism, whilst some tourism opportunities can still be pursued within the valley.

Upon review of the DEIAR, the developers of the Aloe Wildlife Estate raised the need to be considered for visual screening from the proposed sub-station. The need and location for screening is difficult to determine at this stage as whether or not the Aloe Wildlife Estate will materialise as planned is uncertain. KZN EDTEA initially refused authorisation for the Estate, but this is currently on appeal by the applicant. If authorisation is granted, the applicant will need to source investors and prepare final architectural designs for authorisation, etc. prior to construction. Thus, the need for visual screening and where it would need to be can only be determined if the Estate is authorised and their infrastructure placement and planning are further refined.

11.3.1 Recommendations for mitigation

The following mitigation measures are recommended:

- The implementation of the measures recommended by the visual impact specialist including:
  - Planting and maintaining screening vegetation along sections of the P477.
  - Implementing lighting recommendations to reduce the visual impact on night-time light.
- To align and minimise the impact of the proposed double-circuit 400 kV line through the Mayibuye Game Reserve as per the vegetation specialist's recommendations in order to minimise the visual impact of servitudes and the need for new access roads.
- If the Aloe Wildlife Estate is authorised, then once the final layout designs have been approved, Eskom needs to negotiate with the developer on the need for and the location of screening trees to minimise visual impacts.
- Eskom needs to involve an independent acoustic engineer during the design phase to provide input and guide the design and insulation of noisy plant and equipment in accordance with the recommendations provided in Section 10.8.4.

11.4 How will the construction and operation of the Isundu Sub-station impact upon surrounding enterprises dealing with sensitive animals and birds?

There are three existing enterprises surrounding the proposed sub-station that have raised concerns regarding the impact of the proposed project upon their animals and birds. These species range from vulnerable raptors of conservation significance, zoo animals and breeding parrots, to commercial poultry species.

11.4.1 African Bird of Prey Sanctuary and Raptor Rescue

The African Bird of Prey Sanctuary and Raptor Rescue have a range of different activities and species. There will be few direct impacts upon the Sanctuary.

The main direct impact identified is noise disturbance, particularly from traffic during sub-station construction, especially during the most active construction period. The impact of this noise is that it will create nuisance disturbance and may make speech difficult to hear if a truck passes during the flying demonstrations. However, this will only be an impact if a truck passes during the flying show and the noise level itself would be relatively short-lived as the truck passes. Nevertheless, with modelled 300 trucks per day, this noise and disturbance could ruin the ambience of the flying show. This could affect the feasibility of the flying shows (a key source of income to the Sanctuary) with similar impacts and consequences as discussed in the following sub-section.

The EMF levels calculated are not significant and will not present any harm to birds or humans, whilst the impact of noise during construction and possible light impacts during operation will not affect the majority of birds at the Sanctuary. These are captive, injured animals that are accustomed to school groups and activities.

However, there are three significant indirect impacts identified that will affect the Sanctuary as outlined below.

11.4.1.1 Feasibility of flying demonstrations

One of the key income generating activities of the Sanctuary is the flying demonstration. This is also a time when the public get to interact with and experience the raptors in a more natural context, which forms an important part of the educational and awareness mandate of the Sanctuary.

The Sanctuary established itself and operates approximately 750 m from the existing 2 x 275 kV Georgedale-Mersey transmission line. The potential risk to the free-flying raptors appears to have been accepted at the time and managed by the owners, in order to maintain the advantage of a location near the N3 and both main urban centres of KZN, whilst still having a natural vista as a backdrop for the flying demonstrations. This existing transmission line risk is also only on one side of the Sanctuary.

During the flying demonstrations, the raptors are kept relatively close to the trainer. This may be due to a generally risk adverse approach based on previous experience of raptors being lost or attacked whilst flying and/or the experience and age of the particular birds being flown. In comparison, the raptor centre located in the central Drakensburg allows its raptors to fly out of sight and significantly further away from the centre, i.e. 1 km or more. This is also probably a reflection of the additional open space available in the Drakensburg. Although raptors are currently flown in a narrow range, the proposed sub-station and associated transmission lines would curtail possible future wider range flying opportunities.

Regardless of the fact that the Sanctuary has operated near the existing 275 kV line since it was established, the proposed project will significantly increase the risk to their raptors during free flying demonstrations. The current development proposal will result in two additional larger transmission lines approximately 600 m to the east and south-east, a 40 ha sub-station and 765 kV transmission line across the road to the north-west, and depending on the alignment, the two Isundu-Mbewu 400 kV lines also just north of the road and the Sanctuary, and/or to the north-east and south-east (Figure 32). This excludes any additional future transmission lines that may be planned.

The result is that within the range of 600 m to 1 km, the Sanctuary will be almost surrounded by electrical infrastructure, all larger than the existing 275 kV transmission lines.

This increases the risk of holding flying demonstrations as follows:

- Increased risk of collisions.
  It is well established that electrical transmission lines present significant risks to raptors. A fair proportion of the injured animals coming to the Sanctuary are there because they have collided with transmission lines. With the increased number and size of lines, as well as possible future lines, the risk of flying trained raptors increases.

  Importantly, as these are wild animals there is no way to sufficiently train, manage or mitigate all the possible factors to ensure risks are minimised. For example, a wild raptor can appear suddenly during a show and attack the trained raptor, with there being no way to mitigate or control in what direction or how far the trained raptor will then fly.

- Increased risk of losing birds.
  These raptors are flown with a tracking device in order to be able to track them should they fly away. Electromagnetic interference occurs when the tracking device is pointed towards a transmission line. Alternative better sophisticated receivers will cost more and would need to be suitable for small raptors, but as confirmed by the EMF specialist, would still not guarantee no tracking interference as the physical location of the bird and handler, relative to the power lines will also play a role. Thus, should a trained raptor fly away, it will be more difficult to locate and find it with electrical interference in all directions.

- Risk to permit renewal and/or show birds.
  All of these raptors are protected species. The show birds are those that have been bred in captivity and new birds cannot be harvested from the wild. These birds require annual conservation permits to own and to fly. Should a bird be lost, either due to a collision or being unable to track it, or should the conservation authorities

perceive the risk of flying has increased sufficiently, there is the possibility that the Sanctuary will not be granted the necessary permits to continue to fly their birds. This could end the Sanctuary's flying shows and reduce one of their main sources of revenue.

In addition, breeding, rearing and training a protected raptor for the flying demonstrations takes time and, thus, if a bird is lost it cannot be replaced easily or quickly.

11.4.1.2 Bearded Vulture Breeding Programme

The Bearded Vulture (*Gypaetus barbatus*) is a large raptor that nests on high mountain cliffs in Africa, Europe and Asia. There have been significant declines in the species over their range and the Southern African species is restricted to the Maloti-Drakensberg Mountains of Lesotho and South Africa. Due to its declining numbers it is listed as critically endangered and is the subject of a Government Gazetted Biodiversity Plan.

A component of this Biodiversity Plan is to establish a captive breeding population with sufficient genetic diversity in order to be able to breed and re-establish the birds into the wild. It is vital that this captive breeding population is established prior to the genetic diversity of the pairs in the wild dwindling further. Similar programmes have apparently been successfully undertaken in Europe and DEA has committed to establishing a similar programme for the Southern African species.

The African Bird of Prey Sanctuary and Raptor Rescue were nominated as the centre at which to establish this captive breeding programme. This is a testament to skills and experience at the Sanctuary and its status in terms of raptor conservation initiatives in South Africa.

The first wild Bearded Vultures were captured and reared in mid-2015 and this programme will continue to expand as more birds are harvested from the wild and reared.

These birds are regarded as highly sensitive to disturbance and take seven years to reach sexual maturity.

The additional cages for these birds will be constructed approximately 150-180 m from the P477 road due to the current layout and location of facilities at the Sanctuary.

The noise specialist has measured and calculated the general noise climate at this distance from the P477, which is currently approximately between 47- 49 dBA. This specialist also stated that based on Eskom's estimates and data from similar construction sites, construction activities could generate 36-80 vehicle trips (two way trips) daily. At the most intense stage of construction, the additional daily construction traffic could peak at 300 vehicle trips per day, mainly concentrated in the morning and evening peak periods. The noise specialist stated that this construction traffic would have a significant effect on the noise climate alongside the P477 and calculated the sound of a loaded truck at these distances at around 67 dBA.

Other construction impacts, whilst also likely to create noise, are deemed to be less of an impact to the African Bird of Prey Sanctuary and Raptor Rescue due to distance from the sub-station site to the Sanctuary.

The noise increase from construction traffic is considered significant in that whilst this temporary noise may not significantly impact other injured caged birds, it introduces a significant variable into the captive breeding of a vulnerable species that resides in quiet mountain areas.

Research shows that the reaction of birds to noise is species dependent and also dependent on the individual birds. Thus, it is not possible to say with certainty what the effects of construction or operational noise will be on the individual Bearded Vultures in captivity, their ability to breed successfully or if any other stress or physiological changes may occur.

Importantly, this is a long-term breeding programme, with the birds taking seven years to reach sexual maturity. The proposed timing of the sub-station construction is also likely to coincide with the critical initial start-up years and breeding period for the first birds. Thus, should there be any negative consequences as a result of the construction activities or disturbance, these may only become known after about 7-10 years of the programme. This could result in wasted financial resources and time. However, more importantly, it may then be too late for these individual birds to start a new breeding programme elsewhere.

As mentioned by the avi-fauna specialist, the owners of the African Bird of Prey Sanctuary are driven by conservation imperatives and concern for the wellbeing of their birds. Thus, approval of the sub-station site at this location will almost certainly result in a decision to abandon the Bearded Vulture captive breeding at this site or delay the programme whilst a search for a new location is made. This has also been communicated in the Sanctuary's comments during the public participation process. Without mitigation, this is likely to have significant negative conservation implications for the critically endangered Bearded Vulture and the success of the Government Gazetted Biodiversity Plan.

11.4.1.3 General tourism and donor support

Closely associated with the two issues above, is the negative impact of the sub-station and transmission lines upon tourist numbers and donor support, which is required to keep the Sanctuary operating. Tourist numbers and donor support are fundamental to the ongoing success of the Sanctuary.

The uncertainty created as a result of the proposed sub-station and transmission line infrastructure may have a negative impact on the motivation of the owners of ABOPS to promote and raise funds for their various programmes. Similarly, any potential donor supporting raptor conservation will know that electrical transmission lines are a significant cause of raptor fatalities. Donors may question the value of their donations if the Sanctuary owners appear to be raising and/or flying endangered raptors in the midst of what will be one of KZN's largest sub-stations and transmission line hubs.

11.4.2 RCL Foods

RCL has raised a large number of issues, concerns and objections to the proposed project. A summary of each issue and a response is contained in Appendix 3. The issues raised and the result of the specialist findings were workshopped with RCL representatives at a Key Stakeholder Meeting and the minutes of the meeting are provided in Appendix 2.

Through these discussions and the poultry specialist input, the key issues and concerns related to this sub-station application have been focussed down to the following three areas of potential impact: light, dust and noise (including vibrations).

Importantly, these discussions all assume that RCL Foods is operating at full production on the layer farms adjacent to the sub-station. However, since the publication of the DEIAR, these farms have been put up for sale, along with a large number of other KZN farms owned by RCL Foods. Thus, it is quite likely that RCL Foods will not even own the adjacent properties when Eskom wishes to start construction.

11.4.2.1 Light

Light intensity, duration and timing play an important role in terms of optimising the birds' active and resting periods which, in turn, affects their laying productivity. Thus, RCL carefully controls all lighting within the houses.

Due to the nature and strategic importance of the sub-station, it will have security fencing that will be lit with security lights mounted on 4 m poles at approximately 20 m intervals. There will also be floodlighting in the HV Yard mounted on 36 m high masts. These lights will turn on when staff enter in the HV yard at night. The perimeter fencing will turn on during security patrols of the fence.

The frequency of lighting being on at night is difficult to predict but it is likely that small maintenance tasks could be carried out at night-time when the electricity demands are lower.

There is a risk that if lighting is poorly designed, glare from the tall mast lighting or light spill from the security fencing could enter the nearest RCL laying houses and disrupt their controlled lighting programme.

However, it also needs to be noted that RCL have an outside light on the closed side of their L14 houses (their 'open-houses') and a light on a pole above the houses of L2 ('light-tight houses') as well as an outside floodlight attached to the wall. Indeed, during the night time visit to the area, it was the RCL chicken houses which were the main source of light in the immediate surrounds of the P477.

Both L1 and L2 farms are further from the sub-station and are closed houses. L14 is the nearest farm but the four nearest chicken houses of L14 are orientated so that the closed side is facing the sub-station.

This assessment found that no lighting impacts or disturbance are anticipated provided Eskom follows the lighting designs recommended by the visual impact specialist. Eskom has also done a preliminary lighting design and light dispersion simulation. This has confirmed that there is little or no risk of impact (Figure 31). However, it is important that monitoring be undertaken and if any negative impacts or light is found to be entering the laying houses, the lights need to be disconnected until suitable mitigation screening measures are devised.

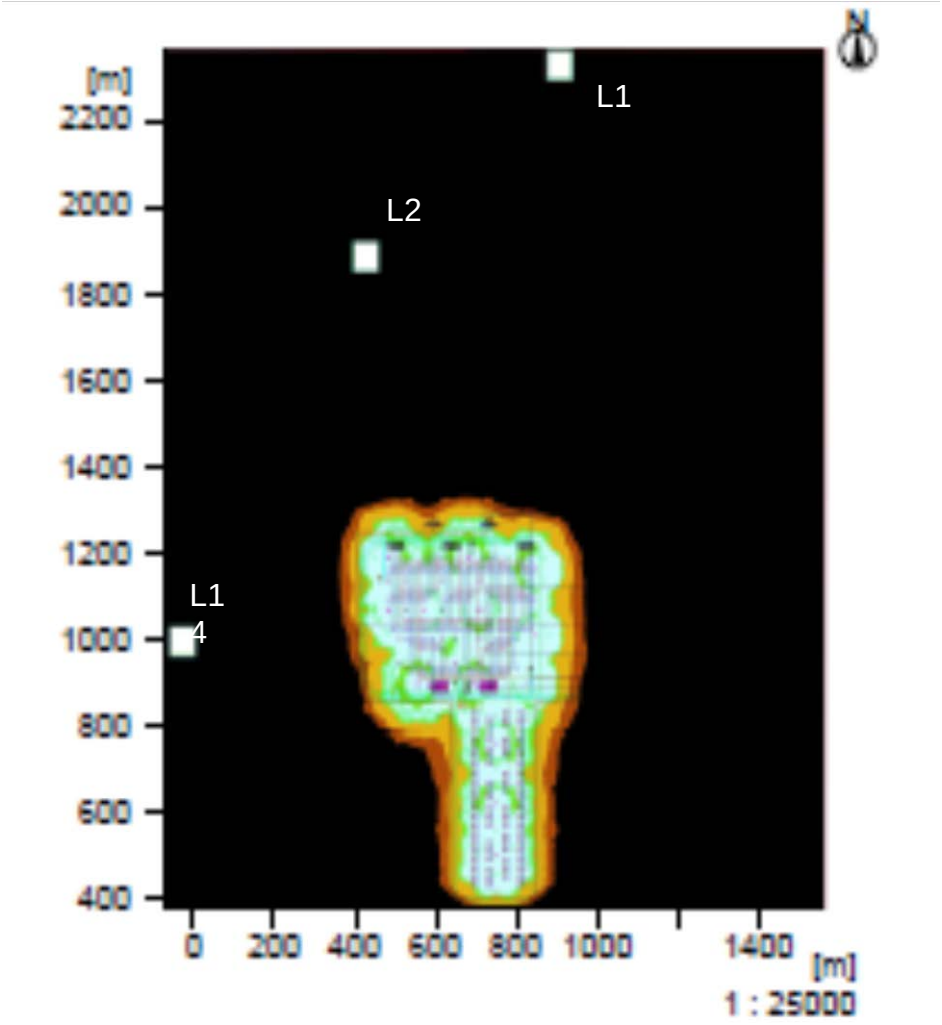

Figure 31 Preliminary sub-station lighting design and light simulation

11.4.2.2 Dust

Dust and noise are similar in some respects, because unlike light which affects the active and resting times of the birds, dust and noise affect stress levels of the birds and increase susceptibility to infections. Yet, because these birds are biological entities, there is a wide range of tolerance. Birds of different breeds, flocks and age groups may respond differently, some more tolerant than others, to either dust or noise stress factors. Tolerance to one aspect, for example, dust, can change for individual birds if they have been stressed by ammonia, heat, noise or other disease agents.

Dust levels within the houses also naturally change over the course of the production cycle and can be affected by management practices. Also, not all dust on the outside of a house will necessarily enter the house.

Thus, it is a challenge to predict with precision the significance of dust (and noise) impacts on a particular farm and flock at RCL within a particular year or part of the laying cycle.

Increased dust levels can result in physical damage to the bird's respiratory tract and/or the entry of infectious agents. These aspects again increase susceptibility to disease and stress within the birds. The creation of dust is a common occurrence on construction sites and, in this instance, the prevailing wind direction is towards the RCL farms.

In the absence of RCL data, the air quality specialist estimated a maximum limit and short-term target dust concentration. These estimates were based on levels indicated in the literature review. The air quality model and mitigation measures test the scenarios to keep dust levels around the three nearest chicken houses (L14, L1 and L2) below these limits. These calculations are based on various assumptions, one being that all dust on the outside of the building has the ability to enter the houses.

The model was run for 21 ha and 5 ha active construction areas (cleared of all vegetation). A size of 21 ha is deemed to be more accurate if the blasting is done all at once as the areas to be blasted constitute 6.8 ha and the portion of the sub-station to be initially constructed measures approximately 30 ha. However, it may also be possible to work on smaller areas if necessary.

The model results indicate that with no mitigation on a 21 ha area, the target short-term dust limit will be exceeded at L14, L2 and L1 in weather conditions occurring 71% of the time, whilst the maximum dust level limit will be exceeded at all three farms 47% of the time. However, this takes into account both day and night time conditions.

Since all construction will occur only in the day, it is mainly the day-time weather conditions which are relevant[29]. During the day, with no mitigation on a 21 ha area, the maximum dust limit may be exceeded at L14 and L2 for 6% of the day-time conditions. Without mitigation, target concentration limits will be exceeded at L1 for 43% of the day-time conditions, and at L14 and L2 for 74% of the day-time conditions.

[29] Wind erosion off bare surfaces only constitutes a very small fraction of dust pollution dispersed into the atmosphere. Dust is predominately caused by vehicles and other construction activities. Hence, it is more important to consider potential exceedances in day-time conditions, particularly for this area which has a relatively low average wind speed and high percentage of very stable night time conditions, reducing the risk of wind erosion.

However, with 75% mitigation of dust on a 21 ha construction site, the maximum dust level limit will not be exceeded at any of the three farms during either day time or night time conditions. The short-term target limit will be exceeded at L14 and L2 for weather conditions occurring for 6% of day time conditions.

With mitigation, neither the maximum dust level limit nor the short-term target limit, will be exceeded for a 5 ha construction area, during day time conditions.

There are, however, a number of challenges and cautions associated with interpreting the model's results.

The proposed limits were calculated using an average inhalable PM (PM10) air concentration of 3,600 µg/m³ (taken from a broad European Union-wide study). Yet this study also found that the highest concentrations regularly occurred in houses for laying chickens. Another researcher observed PM concentration limits in laying hen houses ranging from 700 µg/m³ to 8,780 µg/m³, whilst other research found that total dust concentrations for poultry operations ranged between 120 µg/m³ and 26,000 µg/m³.

A safety factor of two (or 50%) was added into the model calculations to ensure that the average of 3,600 µg/m³ would stay below the recommended level of 5,000 µg/m³ found in some guidelines. However, if the current PM concentration limits within the RCL houses are as low as 120 ug/m³ or 700 ug/m³ then the dust from construction is probably comfortably within acceptable limits and will not have any influence on the chickens, with or without mitigation. Similarly, if the tolerance levels of laying chickens are as high as 8,780 µg/m³ or right up to 26,000 µg/m³, then any temporary increase in dust from earthworks will not be significant.

However, if the average PM levels in RCL's houses are already at levels such as 8,780 µg/m³, and the tolerance levels are similar, then the acceptable limits may have already been exceeded and any dust increase could have a detrimental impact.

The poultry specialist consulted could find no guidelines on recommended dust levels in the Cobb Breeder Manual and rated air quality and dust as a less certain risk. Thus, it is difficult to conclude, based on air concentrations alone, if the potential risks are being overstated or understated, i.e. it is difficult to impossible to project the significance of this impact.

The poultry specialist deemed that any risk would be more likely due to inorganic dust potentially being abrasive to fans and increasing airborne dust within houses. This increase could irritate the bird's respiratory tracts leading to secondary infections. The impacts were deemed most likely on the closest houses in the direct path of "dust storms".

The air quality model also assumed that all of the dust outside the house would be able to enter the house, which may be conservative, particularly in closed light-tight houses. The modelled results would be very different if only 20 to 50% of dust around the building was assumed to enter the houses. However, these closed houses do have large fan banks on the ends of them which are used to ventilate the houses. Thus, it is quite feasible to assume that any increase in dust in the surrounding air will at some point be drawn into the houses.

Whilst this may not result in sudden immediate increases in dust within the houses, it may slowly increase the overall dust level within the house over the duration of the laying cycle (approximately 9-10 months). Thus, it may be possible that even with no dust limits exceeded, the incremental increase in dust over the season could still have a negative impact.

The dust from construction will be inorganic dust, as opposed to dust from feathers. This may be an abrasive irritant to the respiratory tracts of the chickens, leading to increased secondary infections. Thus, it is also possible that the type of dust carried from the site could have more impact than the actual concentration.

As highlighted by the poultry specialist, should the increased dust affect the bearings of the fans and, hence, their performance leading to poorer ventilation, ammonia levels would increase, which also damages the respiratory tracts of the birds and can lead to secondary infections.

Another uncertainty is that the levels of dust will depend on contractor performance and adherence to dust control measures. Whilst it may be quite feasible to mitigate dust levels down to 75% as modelled for a 21 ha area, if the initial construction platform being cleared and worked on after blasting is bigger or contractor performance is poor, then the dust levels may increase. However, even if all 30 ha are initially disturbed, it is unlikely all 30 ha will be completely bare and be worked at the same time. In this case, dust may only be generated primarily where the current machinery is working and more recent earthworks are occurring, i.e. a smaller area.

The bulk earthwork construction activities will be the phase during which dust impacts occur. In Section 5.4, the estimated timeframe for this phase of civil works is eight months. This programme was based on the Lambda Sub-station, which does not show any major blasting requirement in the programme. Considering that initial blasting will take at least four months, it is feasible to assume that there will be an approximate 12 month period where increased dust will be a risk.

The significance of dust impacts on RCL's poultry cannot be predicted with certainty. This assessment has found that dust levels are certainly likely to be increased around the RCL houses during at least this initial 8-12 month construction period. Whilst the significance of these risks could be very low depending on all the uncertain variables, there is also the possibility that it could significantly increase disease and mortality in either one or all three of the nearest laying farms. If the latter occurred, these impacts would be highly significant for RCL's production throughout KZN.

Based on the findings of the poultry specialist that effects will be most likely on the closest house in the direct path of a 'dust storm', and the modelling which shows L14 to be most significantly affected, this assessment concludes that L14 is the farm at most risk. L14 is also the only farm with open houses, which would allow more dust to enter. However, although L1 and L2 are closed houses, there are still possible risks associated with increased dust levels, which could negatively affect the fans.

Section 11.4.4.2 proposes a mitigation approach that seeks to address and manage these uncertainties, as precautionary measures to maintain Rainbow's production levels during the initial construction phase.

11.4.2.3 Noise and vibrations

It is clear from the specialist input and literature that chickens are extremely sensitive to unusual activities and disturbances. Incidences such as sudden loud noises can startle the birds which at times can result in panic and piling, with some deaths resulting. There is also research evidence that specific or continuous loud noises or music stimuli can result in stress and fear in laying hens. This stress can lead to increased susceptibility to infections and disease and/or a drop in production. The poultry specialist classified noise and vibrations as important risks to address.

RCL representatives claim that they have noticed production drops across all the laying farms, at times as much as 5-7% decreases, on the day after thunderstorms. Production can then take approximately 3-5 days to recover depending on the age of the flock (personal communication, Mr A Reddy).

However, as stated by the poultry specialist, some flocks could become accustomed to specific noises if repeated over time and may be no longer stressed by them. An example is the noise caused by tractor lawn mowers that RCL use to cut their lawns.

For L14, the nearest laying farm, the noise from general construction activities was calculated to be less than 60 dBA, whilst during the operational phase it is predicted to be less than 50 dBA. The measured residual (existing) noise level 15 metres outside these buildings was in excess of 50 dBA. The noise will be higher inside the house with the ventilator fan and poultry sounds. Thus, during the daytime active period of the birds, the birds are not likely to be disturbed by construction noise. Yet, any construction activities during the night-time could disturb the birds resting cycle, with negative consequences. However, night-time construction is not anticipated as specified in the EMPR.

Nevertheless, it is the sudden audible noise and vibration or rattling of infrastructure from blasting which could result in fright incidences in the birds.

The blasting specialist has shown that the vibration and air blast pressures expected from blasting are low and are not anticipated to affect the birds. Yet, the modelled noise calculations indicate that at L14, the audible noise could range from anywhere between 51.5 dBA to 92.1 dBA. If, as some research shows, there is an approximate 25 dB difference between measured air blast (dBL) and audible noise, then the noise level per blast for each of the three nearest farms will be approximately: L14 - 65.9 dBA; L1 – 61.0 dBA; and L2 - 63.0 dBA.

In a similar manner as for dust, these results can be challenging to interpret. It is technically possible to conduct this blasting based on the design provided and there is a significant likelihood that the birds will not be disturbed or stressed if the noise levels are around the 60-65 dBA level (similar to a normal conversation/busy office). However, if as other calculations indicate, the audible noise from blasting could possibly range up to around 90 dBA (similar to being 7.5 m from passing motorbike or truck) and will occur twice a week for around four months, then it is likely to increase the stress levels of the birds and affect their production levels.

Audible noise is also affected by vegetation, buildings and other structures. Thus, there is the possibility that even if blasting noises are modelled or heard outside the buildings at the high end of the decibel scale, within particular houses depending on their exact topography or orientation, the experience could be far less. This is particularly the case for farms L1 and L2 which are closed farms further away. Alternatively, a poorly drilled or overcharged blast hole on a cloudy day could result in louder noise levels than predicted in the model.

Due to its proximity to the site, L14 is again the farm that is most likely to be affected by audible noises that may potentially result in production losses.

As mentioned in the blasting specialist report, blasting can be designed and conducted safely to cause no significant disturbance even within the centre of a large urban area. Thus, whilst it is quite possible that the audible noise could be low and have no effect, there is also the possibility that, considering a worst case scenario, for a four to five month period it could increase the stress and disturbance levels within the poultry houses. This could have a significant knock-on effect to RCL's production throughout KZN.

The risks and challenge of designing mitigation are discussed in the following section.

11.4.2.4 Mitigation challenges and risks

This assessment has found that RCL may potentially be affected by noise and dust during the initial construction phase. After this phase of bulk earthworks and site levelling has been completed, there will be no significant risks that need mitigation.

There is an approximate two month period in the year when the laying cycle ends and the houses are being cleaned out for the next flock. An ideal mitigation measure would be to complete all the most significant blasting and dust generating activities during this period. This may be possible within two months to undertake the bulk of the blasting work, or at least the blasting closest to RCL within this period. However, two months may be too short and there is always the risk of project start up and delays not coinciding directly with this period.

This assessment has found that it is not possible to predict with certainty exactly how either blasting noise or dust may affect RCL's chickens. For any of these impacts, it has not been possible to predict the significance of associated losses. These could be relatively low, such as just the loss of a few hundred birds out of thousands, or possibly a day's production loss whist the birds settle after a single incident. Alternatively, construction disturbance could significantly lower production at a nearby farm for that year's entire laying lifecycle. The numerous variables and assumptions involved in the calculations make it difficult to predict how accurately the modelled results will compare with real time conditions, and how these impacts will be experienced by the chickens, being biological entities that have a range of tolerances.

Thus, it seems quite possible that construction could occur without the poultry inside the laying farms even being aware of any blasting disturbance or noise. Dust impacts could also be feasibility mitigated (certainly for smaller areas). However, if blasting needs to occur over a shorter duration, then larger areas will need to be blasted and cleared as part of the initial earthworks. This could increase the significance of dust impacts.

If significant impacts, which cannot be mitigated, are likely to occur, with resulting losses affecting RCL's production cycle, the financial implications for RCL will be significant. Without compensation this could be a fatal flaw. However, considering that no impacts of significance have been identified during the operational phase and the only major negative impacts occur during the initial phase of the construction period, solutions to these issues need to be investigated, particularly as these construction impacts are not certain and may not have any impact on RCL.

Should this assessment recommend the no-development option in the knowledge that there is a fair possibility that no significant negative impacts on RCL will occur, the implications of a delay for Eskom and KZN, in general, in terms of electrical infrastructure upgrades will be significant. A possible mitigation option could be to relocate the nearest RCL laying farm(s). Yet, this will also be expensive and time consuming, and in the light of the uncertainties, should preferably be avoided. To undertake such a relocation process, Eskom would need to be sure of the significance of the impacts and that there is no effective alternative mitigation.

To wait for construction and blasting to commence to confirm if mitigation has been correctly designed and if RCL may still be affected will be too late. Once a contractor is appointed, construction delays on a project of this size carry significant penalties for delays or standing time. Hence, the financial risk for Eskom could also be significant.

To this end, it is recommended that a test blast be conducted to confirm that the blast design is effective and noise predictions are accurate. This test blast would be one single blast based on the current blast design proposed. The test area to be cleared and blasted would be approximately 38 m x 38 m or 1,444 m². This test blast should be done once Eskom has procured the property but should be done a reasonable number of months prior to the contractor commencing. This will allow additional mitigation measures to be negotiated if necessary and/or blast designs to be reviewed and put in place prior to a contractor commencing.

As shown in Figure 26, due to the scaled depth of burial, little to no surface effects are expected from the blast. However, because the blast design requires that the bulk of the soil above the rock remain in place, only the topsoil and grass would need to be removed. The test area could then be rehabilitated, if necessary, by simply replacing the topsoil and grass. When or if construction commences thereafter will not matter, as the rock in this area will have already been broken up and could be removed with an excavator. The advantages of this approach are as follows:

- Eskom, RCL and independent parties will be able to witness and accurately monitor and measure if there is likely to be any noise disturbance from blasting and if the poultry are even aware of the blast.
- Also, because it is possible to undertake blasting without immediately commencing earthworks, it will be feasible to then design an appropriate blasting and earthworks mitigation strategy that ensures there are no significant impacts upon RCL. Such a strategy could include options such as:
  - Separating the blasting contract from the main sub-station and earthworks contract if necessary. This may reduce the potential financial and project risks to Eskom if any delays in blasting occur due to bad weather or other on-site factors.

- If significant or potential impacts are identified during the test blast, then for some areas, additional soil cover could be brought in to further mitigate impacts, or a berm could be erected to reduce noise, and/or blasting could be programmed to ensure that the areas nearest to L14 are done only during the cleaning out cycle when no poultry are present.
- If noise is not an issue, but dust is still a concern, then the platform areas to be cleared for blasting at the same time could be reduced, which would extend the blasting programme, but would minimise the risk of dust impacts. Alternatively, additional dust mitigation measures could be incorporated.
- If feasible, after blasting the bulk earthworks could be phased to ensure that large areas near RCL do not need to be all opened up at the same time. For example, earthworks around Platform 1 could be delayed until Platforms 2 and 3 are no longer generating dust loads. Thus, cumulative dust loads will be minimised when necessary bulk earthworks are occurring.

This approach will allow both the short-term noise and dust impacts to be managed in such a way that it minimises the risks to both RCL and Eskom.

11.4.3 Natal Zoological Gardens

The Natal Zoological Gardens (NZG) is the sensitive receptor located the furthest away from the proposed sub-station site and with arguably the least sensitive animals. Based on the specialist findings, it is clear that the wild animals and birds as well as the breeding parrots will not be significantly impacted by the proposed sub-station.

Nevertheless, even though it is unlikely that any animals will be affected by blast noise or disturbance, monitoring of any possible behaviour changes or stresses should be undertaken initially as a precaution.

Construction traffic will not pass the NZG and whilst it is likely that some construction noise may be heard, due to the distance from the site, it will not be at significantly high levels (having being modelled at between 45-50 dBA for the NZG). During operation, the animals and birds will not be affected.

The potential negative tourism or economic impacts on the NZG have been dealt with in Section 10.7.

11.4.4 Recommendations for mitigation

11.4.4.1 African Bird of Prey Sanctuary and Raptor Rescue

The Africa Bird of Prey Sanctuary and Raptor Rescue centre plays an important role in the research, education and conservation of raptors in South Africa. Should the project proceed, there is a significant and likely risk that the Sanctuary will downscale its activities and have a reduced ability to raise funds from donors. Thus, it is recommended that the entire Sanctuary be relocated. It is important that this relocation is timed and planned so that potential impacts from noise and traffic during the initial earthworks stage of construction do not put at risk the success of the Bearded Vulture Breeding programme.

The EAP believes it is important that components of the Sanctuary's operation are not separated out as qualifying for mitigation or not, as the entire operation is based on an integrated set of activities, location criteria, staff and resource availability. These cannot be separated without the Sanctuary's conservation and operational abilities being compromised.

Thus, the following actions are recommended:

- Eskom is responsible for ensuring and demonstrating that the relocation can and will be undertaken without affecting the success of the Bearded Vulture Breeding Programme, or the future success and revenues of the ABOPS operation. In this regard, ABOPS have prepared terms of reference to help guide negotiations and discussions. These terms of reference are included in Appendix 1. A Memorandum of Understanding is also in the process of being prepared to guide negotiations and define roles and responsibilities.
- The DEA Biodiversity Section and EKZN Wildlife also have an interest and responsibility in the Bearded Vulture Breeding Programme. Thus, the EAP recommends that representatives from these authorities be identified to be part of all relevant negotiations and relocation agreements. The timing of agreements and the relocation programme relative to the birds in captivity and the implementation of the relocation needs to ensure that the Bearded Vulture Breeding Programme, and the long-term success of ABOPS, is not jeopardised in any way.
- The identification of a suitable alternative site is likely to be challenging and time-consuming and, thus, it is recommended that ABOPS and Eskom commence the search for potential sites as soon as possible, even prior to authorisation being granted.
- Negotiations for relocation should take into account that the relocation of the Sanctuary may require, among others, a search for new sites, land negotiation, new raptor permits, land-use zoning, construction and special transport arrangements to the new site, whilst some of the existing ABOPs conservation activities and programmes continue.

11.4.4.2 RCL

There is the potential for the production at some of RCL's nearby laying houses to be negatively impacted, but as discussed in Section 11.4.2.4, the significance of these impacts cannot be projected with certainty.

Thus, the following actions are recommended:

- At an appropriate time prior to construction commencing, Eskom should confirm if RCL Foods still own the adjacent properties or another similar poultry producer. If RCL Foods, or another producer, still owns the property, Eskom should negotiate with them if any farm management and production strategies could suitably mitigate any potential poultry losses during construction. For example, if production has been drastically cut in relation to the available facilities, then facilities not affected could rather be used during the initial construction phase.
- If still necessary, at an appropriate time prior to construction commencing, Eskom should undertake a single test blast on a portion of the site. This test should be based on the proposed blast design. During this test, appropriate monitoring devices and stations should be set up. These are envisaged to include:

- To record flock reactions, noise meters and video cameras should be set up inside each of the six houses at each of the three nearest farms, L14, L1 and L2.
- Seismograph/s and noise meters should be set up outside each of these farms.
- Videos of the blast and dust generated, and also the wind speeds and direction, should be recorded.

- Based on these results, Eskom must design and agree to a feasible construction mitigation strategy with RCL. This strategy should consider the following:
  - The closing up of the houses for L14 to become light-tight to ensure that light and dust during construction will have less chance of being able to enter the houses.
  - Design suitable dust covers or screens for the fans and ventilation openings to ensure that they will catch any dust and prevent it from entering the houses.
  - Programme as far as possible the phasing of blasting and earthworks on the different platforms to be scheduled so that areas nearest to L14 are done during the cleaning out period, and/or extra mitigation is implemented if required.
- If suitable mitigation and programming will not sufficiently mitigate the risks to RCL's production, Eskom should negotiate a compensation scale with RCL for any substantiated losses which occur as a result of the initial construction phase, and/or Eskom should negotiate the relocation of RCL's L14 farm.
- During construction, all mitigation measures of the EMPR regarding good construction management to control dust and noise, as well as staff control, sanitation and waste control must be implemented and monitored to reduce as far as possible any poultry or biosecurity risks.
- The light mitigation measures recommended in Section 10.9.5 must be implemented.
- Eskom needs to consult with RCL and review and agree on the need for any screens or blinds to ensure no light enters the closest houses. This needs to be monitored by RCL and Eskom once the lights are operational to ensure that potential impacts have been sufficiently mitigated. It is recommended that this be done in the cleaning out period, where it will be possible to monitor inside the houses at night, whilst the lights are turned on and off.

11.4.4.3 Natal Zoological Gardens

It is recommended that the ECO, in conjunction with Natal Zoological staff, undertake visual monitoring of animals at the Natal Zoological Gardens and Natal Lion Park to confirm that the animals are not being unduly stressed or frightened by any blasting activities. If behaviour changes and stresses are identified, appropriate mitigation measures should be designed.

11.5 Can the construction and operation of the Isundu Sub-station be detrimental to the health and safety of local communities?

There are two aspects underlying this issue, viz. the health effect of EMFs during operation of the electrical infrastructure and the increased health and safety risks during construction.

11.5.1 Electromagnetic Fields

Stakeholders living near to electrical infrastructure often raise concerns around the health impacts of long-term exposure to EMFs.

Extensive research has been undertaken world-wide in this regard by international groups such as the International Commission for Non-Ionising Radiation Protection (ICNIRP) and the World Health Organisation. Eskom complies with the exposure guidelines for electric and magnetic fields as given by the ICNIRP.

Transmission line tower heights and servitude widths as well as the perimeter fence line of the sub-station are calculated based on these exposure guidelines. To reduce public exposure, no residences are allowed within transmission line servitudes.

As calculated by the EMF specialist, the electric and magnetic field strengths outside the sub-station will be significantly less than ICNIRP public exposure values.

Thus, the EAP believes the health impacts upon humans and animals from either sub-stations or associated transmission lines has not been shown to be significant and current Eskom design parameters are sufficient mitigation to address potential impacts.

11.5.2 Safety and security

Large construction projects will typically result in an increase in vehicle and pedestrian traffic, and the temporary migration of people either to work or to seek work. The health and safety issues associated with this increased traffic and movement in the area are as follows:

- An increased risk in the spread of diseases (including sexually transmitted diseases such as HIV/AIDS).
- Increased safety and security risks to neighbouring/surrounding settlements due to an increase in trespassing, poaching and unauthorised access onto private property.
- Increased traffic accidents and road safety risks.

Whilst the construction of the sub-station may attract employment seekers, it must be recognised that construction staff will not be staying on site but will be transported onto site each day. In addition, there is already a lot of vehicle and pedestrian traffic in this area as the P477 is the access road through the settlements developing to the east of the sub-station. Any significant construction occurring at the proposed Mayibuye Game Reserve or Aloe Wildlife Estate is likely to also result in an influx of employment seekers (i.e. the proposed sub-station will not be the only contributor to vehicle and pedestrian traffic).

These issues are relatively standard items associated with the construction of any project across or nearby private land, and will be addressed predominately by the implementation of the mitigation measures detailed hereunder which have been incorporated into the EMPR (Appendix 6).

11.5.3Recommendations for mitigation

- Increased spread of disease.
  - All construction staff should go through an HIV and AIDS education awareness course prior to the project commencing.
  - Education material regarding general hygiene, HIV and AIDS, and sexually transmitted diseases should be easily available.
  - Condoms should be easily available, free of charge.
- Increased criminal activity.
  - All Eskom employees and subcontractors should be easily identifiable.
  - Security personnel should be employed on the construction sites.
  - For the sub-station site, no access to farms should be required and Eskom employees and subcontractors must be instructed not to trespass on neighbouring farms.
- Increased poaching.
  - Eskom must ensure that access is controlled on the land acquired for the substation site and that poaching, illegal settlement and/or harvesting of trees do not occur.
- Reduced road safety.
  - Strict speed restrictions should be applied and enforced.
  - All vehicles on site and transporting materials to site should be in a roadworthy condition.
  - Road signs and warning signs should be placed in suitable areas, in particular, high danger zones.
- Increased fire hazard.
  - No open fires should be allowed on site.
  - Fire fighting equipment should be available on all construction sites and in all construction vehicles.
  - Fire is a general risk in the area which is important during operations which will need to be managed by Eskom, for example, the preparation of fire-breaks.

11.6 What effects will the construction of Isundu Sub-station have on cultural heritage resources?

The specialist found no heritage resources on site apart that the farm buildings are older than 60 years and, therefore, generally protected in terms of the Heritage Act.

During the original VSHA EIA, the heritage specialist recommended either of two transmission line corridors to minimise the impact on visually sensitive heritage resources. In both recommended corridors the heritage specialist included the corridor section in which the 2 x 400 kV transmission lines are proposed to tie-in from the proposed Isundu Sub-station to the existing Hector-Ariadne transmission line. Therefore, from a heritage perspective, the proposed 2 x 400 kV transmission lines do not pose a risk to heritage resources.

11.6.1 Recommendations for mitigation

- A permit application to destroy these buildings will need to be approved by Amafa prior to construction commencing.
- A heritage practitioner should complete a ‘walk-through’ of the final sub-station location, the final selected transmission line router and all other activity areas (access roads, construction camps, etc.) prior to the start of any construction activities and assess direct impacts on discrete resources such as archaeological

and paleontological sites. Mitigation can usually be achieved by micro-adjustment of tower positions, the exclusion of sensitive areas, basic recording and/or obtaining a permit for alteration, destruction or removal from Amafa aKwaZulu-Natali.

- It is important for the Environmental Control Officer (ECO) and all other persons responsible for site management and excavation to be made aware that heritage artefacts often occur beneath the ground. Should any resources be identified, the following actions should be taken immediately:
  - All construction within a radius of at least 20 m of the resource site should cease. This distance should be increased at the discretion of supervisory staff if heavy machinery or explosives could cause further disturbance to the suspected heritage resource.
  - This area must be marked using clearly visible means, such as barrier tape, and all personnel should be informed that it is a no-go area.
  - A guard should be appointed to enforce this no-go area if there is any possibility that it could be violated, whether intentionally or inadvertently, by construction staff or members of the public.
  - No measures should be taken to cover up the suspected heritage resource with soil, or to collect any remains such as bone or stone.
  - If a heritage practitioner has been appointed to monitor the project, she/he should be contacted and a site inspection arranged as soon as possible.
  - If no heritage practitioner has been appointed to monitor the project, the head of archaeology at Amafa's Pietermaritzburg office should be contacted (telephone 033 3946 543).
  - The South African Police Services should be notified by an Amafa staff member or an independent heritage practitioner if human remains are identified. No SAPS official may disturb or exhume such remains, whether of recent origin or not.
  - All parties concerned should respect the potentially sensitive and confidential nature of the heritage resource, particularly human remains, and refrain from making public statements until a mutually agreed time.
  - Any extension of the project beyond its current footprint involving vegetation and/or earth clearance should be subject to prior assessment by a qualified heritage practitioner, taking into account all information gathered during the initial HIA.

11.7 How will earthworks during construction, and stormwater during and after construction, affect the surrounding water courses and environment?

Overall, the impact of the proposed development on groundwater and hydrology was found to be of low significance by the specialists, provided that mitigation measures are implemented.

Should there be spills of polluting substances during construction or operation, the surrounding watercourses and the environment could be at risk of being contaminated. The increased area of hardened surfaces will also increase stormwater runoff (quantity and velocity), which potentially can erode surrounding soils and cause sedimentation of watercourses.

The proposed Isundu Sub-station, when fully developed, will have an infrastructure footprint of approximately 45 - 60 ha whilst for the initial phase of development, the sub-station is likely to have a footprint in the region of 30 ha.

During construction, mitigation measures as contained in the EMPR for any spillages such as oil and diesel as well as the provisions for storage and emergency spill protocols, need to be implemented. Erosion control measures will also be monitored to ensure erosion from the terrace does not result in sedimentation of the surrounding streams.

The sub-station is situated on a high point with the drainage from the site going in three directions. Earthworks will include constructing a terrace. Importantly, the bulk of the sub-station footprint consists of clean steel structures in beds of crushed stone, limiting the amount of hard surfaces that generate stormwater.

During operation, there will be areas of road, concrete slabs and buildings, from which all runoff will be directed and dissipated into the surrounding veld. This will form part of the storm-water management plan to be prepared as part of the detailed design phase.

During construction, portable toilets will be used and serviced regularly. During operation, there will be few staff members on site and all sewage will be directed into a sealed conservancy tank. This will be emptied when required and the contents disposed at a licensed waste water treatment works.

Thus, there will be no significant risk of pollution to the surrounding water courses or groundwater, and run-off from the site will be controlled to address any potential erosion hazards.

11.7.1 Recommendations for mitigation

Recommended mitigation includes:

- Implement the stormwater and pollution mitigation measures proposed in the EMPR.
- The design and construction of the conservancy tank is to be signed-off by a professionally registered engineer.
- The operational monitoring of waste and run-off is to be undertaken as proposed in the EMPR.

11.8 What cumulative effects will the proposed Isundu Sub-station contribute, considered in association with impacts arising from other activities in the region?

A cumulative impact is an incremental impact upon the environment that results from the impact of a proposed action when added to past, existing and reasonably foreseeable future actions. Cumulative effects can be both positive and negative.

The construction of a sub-station and additional transmission lines will naturally add to any cumulative impacts already likely to occur from a wide range of development interventions, i.e. increased employment, increased investment, reduced grass cover, increased flight hazard risk, etc. It is not the purpose of this EIA to identify and assess each component of the environment that could and does change as society develops.

The aim of this section is to focus on the key cumulative impacts raised as concerns by stakeholders and identified by the specialists, as well as those ones associated with the project that may trigger different development pathways.

In this regard, two key cumulative impacts are identified, namely: (a) the combined impact of current and future transmission lines into and out of the sub-station, on surrounding enterprises and (b) the cumulative aesthetic changes caused by the location of the sub-station and associated transmission lines resulting in a shift from an ecotourism land use to industrial or other land uses.

11.8.1 Cumulative impact of future transmission lines on surrounding enterprises

The possible alignment and impact of future transmission lines is a concern for surrounding landowners. Whilst Eskom currently has specific transmission lines in their planning framework, it would be unwise to assume that a large national investment for a strategic sub-station such as the proposed Isundu Sub-station, would not attract future transmission lines.

It is not possible to predict or determine with any certainty what transmission lines would be required in the future and from which direction they may come. This is dependent on the location and size of future power demands and the location of power generation.

However, for this sub-station, it is possible to give a relatively good prediction of what future transmission lines may be required and their possible alignment, as illustrated in Figure 32.

As outlined in Section 5.2.1 the following immediate transmission lines are planned for implementation:

- 1 x 765 kV transmission line (the authorised VSHA transmission line).
- 2 x 400 kV double-circuit transmission lines from the sub-station to tie into the existing Hector-Ariadne 400 kV double-circuit transmission lines approximately 4 km away.
- 2 x 400 kV lines from the proposed Isundu Sub-station to the proposed Mbewu Sub-station near Empangeni.

The preferred alignment for the 2 x 400 kV double-circuit transmission lines from the sub-station to the existing Hector-Ariadne 400 kV double-circuit transmission line is as shown in Figure 32. This infrastructure will consist of four 400 kV transmission lines on two sets of towers. Only one pair of 400 kV transmission lines will be energised, whilst the other pair (2 x 400 kV) of transmission lines will be spare.

The proposed VSHA 765 kV transmission line will come from the north. The alignment will be within the authorised VSHA corridor. It is likely to run generally parallel to the existing Mersey-Hector 275 kV transmission where possible, although in the area near to the sub-station it is likely to be aligned to the east of the RCL farms.

The proposed corridors for the 2 x 400 kV Isundu-Mbewu transmission lines have not yet been finalised. These lines will exit the sub-station from the east as depicted in black in Figure 32 and then could either take a south-easterly or north-easterly alignment. This will be determined by technical considerations and the environmental authorisation process that will need to be undertaken for these transmission lines.

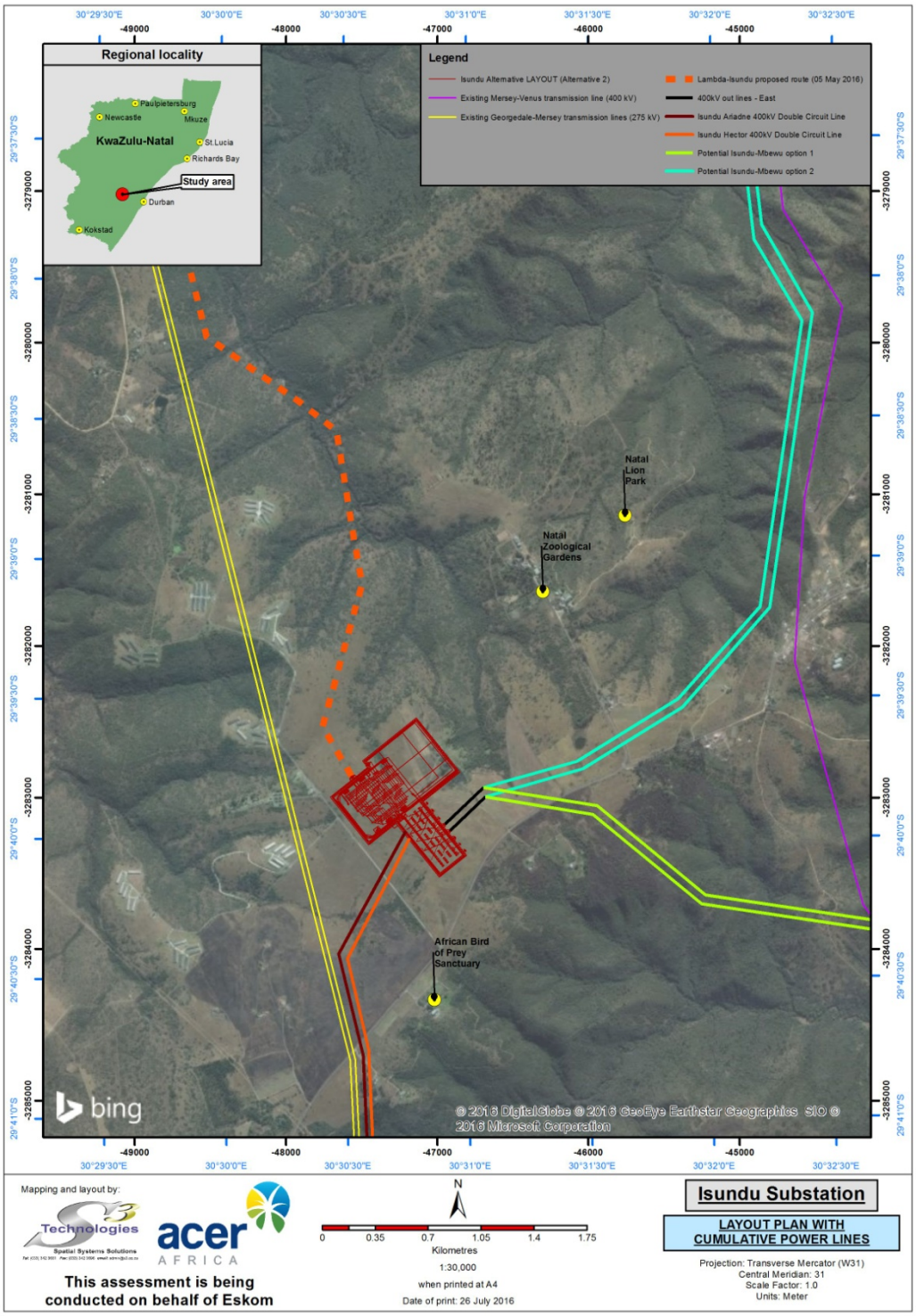

Figure 32 Cumulative impact of transmission lines

The transmission lines mentioned above are currently planned for implementation. The Isundu site and layout design will still have sufficient space to accommodate additional transmission lines if required at some point into the future. The available space will potentially accommodate the following additional transmission lines:

- 1 x 765 kV or High Voltage Direct Current (HVDC) transmission line.
- 2 x 400 kV transmission lines.

When or if these transmission lines may be required is not certain but in all likelihood any future 765 kV or HVDC transmission line would need to come from the north, as South Africa's power stations are all to the north. If additional capacity is then needed to take the power out of the sub-station, the transmission lines could either enter the Isundu Sub-station 400 kV bays from the west or east.

If coming from the west, then it would most likely tie into the two spare 400 kV transmission lines, thus, adding no cumulative impact to the immediate landowners surrounding the sub-station. If from the east, they will need to enter the sub-station approximately parallel to the Isundu-Mbewu 2 x 400 kV transmission lines but their alignment could be in any direction.

Thus, the potential impact of combined transmission lines over the short- to medium-term (i.e. next 5 - 25 years) on surrounding enterprises can be approximately predicted, with the immediate areas possibly most impacted from a visual perspective being those to the east of the sub-station, viz. the unplanned settlement areas developing and the Natal Lion Park. The proposed Mayibuye Game Reserve could also be affected visually depending on the alignment of the Isundu-Mbewu transmission lines.

11.8.2 Change in land-use development direction

The Mkhambathini LM, in particular, is concerned that the location of the sub-station will stop future development of the area for eco-tourism as planned. They have maintained throughout the process that the proposed sub-station is incompatible with the Municipal Strategic Development Framework and adopted Rural Planning Policy.

This issue is examined from two positions as outlined below.

11.8.2.1 Development Frameworks and Plans

The development of a sub-station will be on land currently designated for 'Agriculture Tourism'. As stated in the Strategic Development Framework document, 'The main objective for this zone is to maintain and enhance the existing rural tourism character and full range of rural-based tourism land uses and more intensive agriculture will therefore be encouraged…Large scale transformation such as exclusive residential estates should not be allowed[30]. However, rural housing projects to accommodate the rural poor will be allowed in appropriate locations. Development footprints in such areas will be kept as low as possible'.

[30] The EAP believes an exception must have been made for the Mayibuye Game Reserve because with hotels, conference centres and large exclusive plots, it does not appear to meet the planning criteria.

The fact that the proposed sub-station is not currently in line with the Municipal land-use framework does not itself constitute a fatal flaw. Indeed, if it did, then Eskom would only be able to plan infrastructure within designated industrial or service corridor areas. This would prevent Eskom from achieving its mandate to supply and distribute electricity throughout the country.

The Infrastructure Development Act, 2014 (Act 23 of 2014) aims to provide for the facilitation and co-ordination of public infrastructure development which is of significant economic and social importance to the Republic and to ensure that infrastructure development is given priority in planning, approval and implementation. The listed Strategic Integrated Projects to which the Act refers includes electricity transmission and distribution.

Section 8(4)(a) of this Act states that 'Every organ of state must ensure that its future planning or implementation of infrastructure or its future spatial planning and land-use is not in conflict with any strategic integrated project implemented in terms of this Act'.

Thus, although Eskom will need to apply for land-use re-zoning and other permissions from the Mkhambathini Local Municipality, the Local Municipality is also required to recognise that national infrastructure of strategic importance can take precedence over local planning objectives. This project forms an important part of the KZN Strengthening Programme, which aims to increase and strengthen the electricity transmission network to the KZN Midlands and southern KZN.

11.8.2.2 Potential trends and developments

The cumulative impact of the sub-station upon current land-use development objectives is important to consider, as are the cumulative impacts of other trends in the area on the Municipality's planned land-use development objectives.

The visual impact specialist found that due to topography, any significant visual impacts would be limited to an area focused on the ridgelines and higher ground immediately surrounding the proposed development. This development also falls within two landscape character areas, the urban fringe corridor and traditional rural settlements.

The presence of the sub-station and anticipated future lines is certainly likely to have some influence on development planning on the farms adjacent the sub-station along the P477 and it would extend the urban-fringe character of the landscape further along the P477.

The screening proposed as mitigation will reduce negative views from the road and, then, once turning into the Mayibuye Game Reserve, the views are over the valley in the opposite direction from the sub-station. Thus, the proposed sub-station and transmission line configuration, as shown in Figure 32, would not necessarily prevent or change all eco-tourism possibilities within this area of the municipality, particularly within the valley area of Mayibuye Game Reserve, from where the sub-station would not be seen.

However, it is also important to consider the pros and cons between different potential cumulative impacts. Whilst the sub-station location will potentially result in negative set-backs to this localised ridgeline area in terms of tourism planning, there may be far more significant cumulative economic set-backs to KZN if strategically important infrastructure, such as the KZN electricity grid, is not improved and increased in line with demand predictions.

The Mkhambathini LM is the second smallest municipality within the Umgungundlovu DM and their land-use designation of 'Agriculture Tourism' has been clearly influenced by the presence of Rainbow Farms, the Natal Zoological Gardens/Lion Park complex and ABOPS. Their flagship project, the Mayibuye Game Reserve is still to be developed but appears to be based on exaggerated income and employment returns. Thus, it is quite possible its full development and the anticipated economic/employment benefits may never be realised or be far less than anticipated, particularly in the light of ever-changing land-use trends and economic conditions.

There are other trends in the area, apart from this proposed project, which will also affect the Municipality's plans. RCL Foods is currently selling all its chicken farms in the area and relocating out of KZN. It seems highly unlikely that any of these poultry farms will be purchased by other poultry producers as the reason for RCL Foods downscaling its production is the difficult economic conditions being experienced in the domestic poultry industry.

This area is also of low agricultural potential and under land-claim, so alternative agricultural activities are not likely to be readily developed. These factors, along with the sale of the RCL farms, may increase the development pressure for alternative land-uses to be allowed by the municipality, in particular, housing (the municipality's land-use zonation does allow for rural housing projects in this area to accommodate the rural poor).

From the Google Earth images in Figure 33, it is clear that there is extensive housing pressure all around the Mayibuye Game Reserve, and that over the last seven years there has been significant unplanned housing development right up to the edge of the reserve just 2.5 km down the road from the proposed sub-station site on the same ridgeline. However, the houses being constructed in this area are not low-income housing for the rural poor, but rather large middle to high-income homes being constructed possibly without the necessary municipal approvals. This is not unique to the Mkhambathini Local Municipality and is occurring in many parts of the country.

This raises the following cumulative impact considerations:

- How will this unplanned development right on the Reserve's boundary continue to increase over the next 5-10 years and how will this affect the Mayibuye Game Reserve's ability to attract high-income investors?
- Will this pressure for housing result in any of the farms north of the P477 also becoming housing development sites over the next 10 years, planned or unplanned, due to the low agricultural potential of the area, the land claim and now RCL Food's sale of numerous properties?
- Should investors fail or delay to buy into the Mayibuye development, the anticipated jobs and income fail to materialise, there is a risk that pressure will increase within the community to use Mayibuye for housing. This pressure could be both through legal means but also through illegal encroachment.

Thus, although the sub-station will not necessarily put an end to all the tourism activities or potential of the area, it will be an additional factor that could have a negative influence and possibly even tip the balance towards non-conservation land-uses.

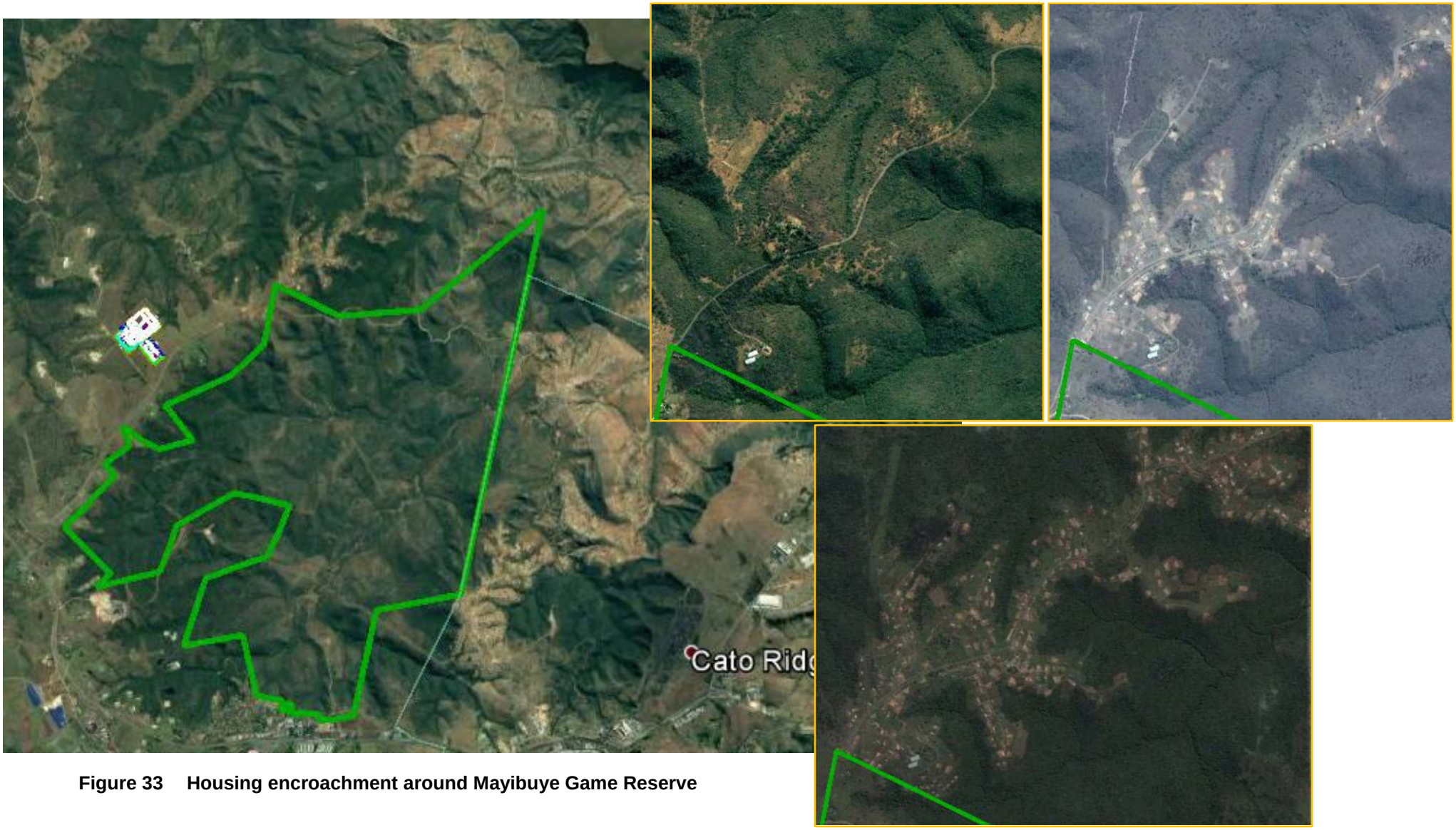

Figure 33 Housing encroachment around Mayibuye Game Reserve

However, if the no-development option for the sub-station is recommended and for various reasons, such as the national political pressure for land, current local housing encroachment, and over-exaggerated economic returns, Mayibuye's development plans do not materialise, the land-use in this area in 5-10 years may look quite different. Without RCL Foods as an agricultural 'anchor tenant' and if tourism development does not occur as planned, the municipality may be forced to consider other land-use options to unlock other economic advantages of the area, such as it being close to the N3 and being suitable for housing. In this scenario, selecting the no-development option now would turn out to be a significantly costly error for both Eskom and also potentially the economy of KZN.

Eskom has found it a significant challenge to identify a suitable sub-station site that meets grid planning criteria in terms of location, being economically viable to construct and acceptable in terms of environmental impacts. Based on this and potential negative consequences to the KZN economy if not constructed, the EAP believes that the possible cumulative impact of the sub-station on tourism ventures still to be developed in an urban-fringe environment, are not sufficiently significant to warrant consideration of the no-development option.

12. SIGNIFICANCE OF POTENTIAL IMPACTS

12.1 Assessment

This Chapter deals with the assessment of the significance of the identified potential impacts, both with and without the management measures (mitigation) described in the relevant sections of Chapter 11. Impact tables, **where applicable** to the key issues, are provided (Tables 25 to 32).

Table 25 What are the potential economic and socio-economic impacts associated with the construction and operation of the proposed sub-station?

Impact	Mitigation	Nature	Extent	Duration	Intensity	Frequency	Probability	Reversibility	Irreplaceability	Significance	Confidence
Positive national and regional economic benefits											
The impact of national and regional economic benefits from improved electricity supply and transmission capacity											
During construction	Without	Positive	Regional	Short-term	Medium	Once-off	Highly probable	N/a	N/a	Medium	High
	With	Positive	Regional	Short-term	Medium	Once-off	Highly probable	N/a	N/a	Medium-High	High
During operation	Not required	Positive	Regional	Long-term	Medium	Continuous	Highly probable	N/a	N/a	High	High
Economic impacts on local enterprises*											
The impact upon the local economy from the large investment associated with the construction of the sub-station											
During construction	Without	Positive	Local	Short-term	Medium	Once-off	Probable	N/a	N/a	Medium-Low	Medium
	With	Positive	Local	Short-term	Medium	Once-off	Highly probable	N/a	N/a	High	Medium
During operation	Without	Positive	Local	Long-term	Low	Continuous	Probable	N/a	N/a	Low	Medium
	With	Positive	Local	Long-term	Low	Continuous	Highly probable	N/a	N/a	Low - Medium	Medium
Economic & Socio-Economic Impacts of the No Development Option											
The implications of the no-development option in terms of delayed improvement of the electricity transmission network and reduced security of supply											
During construction	Without	Negative	Local	Short-term	Medium	Once-off	Definite	N/a	N/a	High	High
	With (sub-station constructed)	Positive	Local	Short-term	High	Once-off	Highly probable	N/a	N/a	High	High
During operation	Without	Negative	National	Permanent	High	Continuous	Definite	N/a	N/a	High	High
	With (sub-station constructed)	Positive	National	Permanent	High	Continuous	Definite	N/a	N/a	High	High

* Positive local impacts are considered here, possible negative impacts on adjacent enterprises are assessed in the relevant sections.

Table 26 What impacts will the construction and operation of Isundu Sub-station have on the natural environment (flora and fauna) of the site?

Impact	Mitigation	Nature	Extent	Duration	Intensity	Frequency	Probability	Reversibility	Irreplaceability	Significance	Confidence
Sub-station site flora											
The impact of clearing and the permanent loss of the vegetation currently on the proposed sub-station site											
During construction	Without	Negative	Local	Permanent	High	Once-off	Definite	Low	No	Medium	Medium
	With	Negative	Local	Permanent	Medium	Once-off	Definite	Low	No	Low	Medium
During operation	Without	Negative	Local	Permanent	Medium	Once-off	Highly probable	Low	No	Medium-Low	Medium
	With	Negative	Local	Permanent	Low	Once-off	Highly probable	Low	No	Low	Medium
Sub-station site wetlands											
The impact of clearing, and the permanent loss of the wetlands and seepage pans currently on the proposed sub-station site											
During construction	Without	Negative	Local	Permanent	High	Once-off	Definite	Low	No	High	Medium
	With	Negative	Local	Permanent	Medium	Once-off	Highly probable	Low	No	Medium	Medium
During operation	Without	Negative	Local	Permanent	High	Once-off	Highly probable	Low	No	High	Medium
	With	Negative	Local	Permanent	Medium	Once-off	Highly probable	Low	No	Medium	Medium
Sub-station site fauna											
The impact of the sub-station on fauna existing on the site and the available habitat in the area remaining for fauna											
During construction	Without	Negative	Local	Short-term	High	Once-off	Highly probable	Medium	Possible	Medium	Medium
	With	Negative	Local	Short-term	Low	Once-off	Highly probable	Medium	No	Low	Medium
During operation	Without	Negative	Local	Short-term	Low	Once-off	Highly probable	Medium	Possible	Medium	Medium
	With	Negative	Local	Short-term	Low	Once-off	Highly probable	Medium	No	Low	Medium

Table 26 continued

Impact	Mitigation	Nature	Extent	Duration	Intensity	Frequency	Probability	Reversibility	Irreplaceability	Significance	Confidence
Transmission line flora and wetlands											
The impact of clearing for construction and on-going servitude maintenance on the vegetation within and surrounding the proposed transmission line servitude											
During construction	Without	Negative	Local	Short-term	High	Once-off	Definite	Medium	No	Medium	High
	With	Negative	Local	Short-term	Medium	Once-off	Definite	Medium	No	Low	High
During operation	Without	Negative	Local	Permanent	Medium	Continuous	Probable	Medium	No	Medium	High
	With	Negative	Local	Permanent	Low	Continuous	Probable	Medium	No	Low	High
Transmission line fauna											
The impact of clearing habitat for construction and on-going servitude maintenance on the fauna within and surrounding the proposed transmission line servitude											
During construction	Without	Negative	Local	Short-term	Medium	Once-off	Probable	High	No	Medium	High
	With	Negative	Local	Short-term	Low	Once-off	Probable	High	No	Low	High
During operation	Without	Negative	Local	Permanent	Medium	Once-off	Probable	High	No	Medium	High
	With	Negative	Local	Permanent	Low	Once-off	Probable	High	No	Low	High

Table 27 How will the development of the Isundu Sub-station impact upon existing and developing tourism land-use plans[31] and other town planning initiatives?

Impact	Mitigation	Nature	Extent	Duration	Intensity	Frequency	Probability	Reversibility	Irreplaceability	Significance	Confidence
Town-planning land-use											
The impact of the sub-station on the on-going and future development of the area in terms of its current town-planning zonation											
During construction	Without	Negative	Local	Short-term	High	Once-off	Probable	Medium	No	Medium	High
	With	Negative	Local	Short-term	Medium	Once-off	Probable	Medium	No	Low	High
During operation	Without	Negative	Local	Permanent	High	Continuous	Probable	Medium	No	Medium-High	High
	With	Negative	Local	Permanent	Medium	Continuous	Probable	Medium	No	Low	High
Mayibuye Game Reserve											
The impact of the sub-station on the on-going development of the entire Mayibuye Game Reserve area in terms of attractiveness to tourists and investors											
During construction*	Without	Negative	Local	Short-term	High	Once-off	Probable	Medium	No	Medium - Low	Medium
	With	Negative	Local	Short-term	Medium	Once-off	Probable	Medium	No	Low	Medium
During operation	Without	Negative	Local	Permanent	Medium	Continuous	Definite	Low	No	Medium-High	Medium
	With	Negative	Local	Permanent	Medium-low	Continuous	Highly Probable	Low	No	Medium - low	Medium
Natal Lion Park and Zoological Gardens (from a tourism perspective)											
The impact of the sub-station on tourists visiting the Natal Lion Park and Zoological Gardens											
During construction	Without	Negative	Local	Short-term	Medium	Once-off	Definite	Medium	No	Medium	Medium
	With	Negative	Local	Short-term	Low	Once-off	Definite	Medium	No	Low	Medium
During operation	Without	Negative	Local	Permanent	Medium	Permanent	Improbable	Medium	No	Medium	Medium
	With	Negative	Local	Permanent	Low	Permanent	Improbable	Medium	No	Low	Medium

* It is assumed that the construction of the sub-station will occur prior to or at the same time as the construction of the main Mayibuye infrastructure components such as the hotel and conference centre.

31 The existing African Bird of Prey Sanctuary and Raptor Rescue centre is not included here but is dealt with in the next section.

Table 28 How will the construction and operation of the Isundu Sub-station impact upon surrounding enterprises dealing with sensitive animals and birds?

Table 28a African Bird of Prey Sanctuary and Raptor Rescue

Impact	Mitigation	Nature	Extent	Duration	Intensity	Frequency	Probability	Reversibility	Irreplaceability	Significance	Confidence
Feasibility of flying demonstrations											
The impact of construction traffic on the ambience of the flying show and the impact of increased electrical infrastructure on the risk of flying and losing raptors used in demonstrations											
During construction	Without	Negative	Regional	Short-term	High	Once-off	Highly Probable	Medium	No	High	High
	N/a*										
During operation	Without	Negative	Regional	Permanent	High	Continuous	Definite	Low	No	High	High
	N/a*										
Bearded Vulture Breeding Programme											
The impact of construction traffic noise disturbance and the additional risk variable it will introduce into the breeding of these critically endangered species											
During construction	Without	Negative	National/ International	Permanent	Medium	Continuous	Highly probable	Low	Yes	High	High
	N/a*										
During operation	Without	Negative	National/ International	Permanent	Low	Continuous	Improbable	Medium	Yes	Medium	High
	N/a*										
Economic viability of Sanctuary (tourism and donor support)											
The impact of the nearby sub-station and electrical infrastructure, and the risk they pose to raptors on the motivation of ABOPS owners and donors to continue to invest in the Sanctuary at this location											
During construction	Without	Negative	Regional	Short-term	High	Once-off	Highly probable	Medium	No	Medium-High	Medium
	N/a*										
During operation	Without	Negative	Regional	Permanent	High	Continuous	Highly probable	Low	No	High	High
	N/a*										

* This assumes that the Sanctuary will be at another location where no impact will occur (the recommended mitigation).

Table 28b Rainbow Chicken Limited

Impact	Mitigation	Nature	Extent	Duration	Intensity	Frequency	Probability	Reversibility	Irreplaceability	Significance	Confidence
Light impacts											
The impact of night-time light from the sub-station disturbing the resting cycle of the chickens and affecting laying production											
During construction	N/a										
	N/a										
During operation	Without	Negative	Local	Long-term	Low	Intermittent	Highly probable	High	No	High	Medium
	With	Negative	Local	Long-term	Low	Intermittent	Improbable	High	No	Low	High
Dust impacts											
The impact of dust from the construction site increasing respiratory problems or diseases in the chickens either increasing mortalities or affecting laying production											
During construction	Without	Negative	Local	Short-term	High	Periodic	Highly Probable	Medium	No	High	Medium-Low
	With	Negative	Local	Short-term	Medium	Periodic	Probable	High	No	Medium	Medium-Low
During operation	N/a										
	N/a										
Noise and vibrations											
The impact of sudden loud noises or vibrations, primarily from blasting, during construction increasing chicken stress and mortalities, thereby affecting laying production											
During construction	Without	Negative	Local	Short-term	High	Periodic	Highly Probable	Medium	No	High	Medium-Low
	With	Negative	Local	Short-term	Medium	Periodic	Probable	Medium	No	Medium	Medium-Low
During operation	Without	Negative	Local	Permanent	Medium	Continuous	Probable	Low	No	Medium	High
	With	Negative	Local	Permanent	Low	Continuous	Improbable	Low	No	Low	High

Table 28c Natal Zoological Gardens (from an animal perspective)

Impact	Mitigation	Nature	Extent	Duration	Intensity	Frequency	Probability	Reversibility	Irreplaceability	Significance	Confidence
The impact of sub-station noise, light, EMFs and dust on the animals at the Natal Zoological Gardens (the Lion Park enclosure is situated further to the east and will not be affected)											
During construction	Without	Negative	Local	Short-term	Low	Once-off	Improbable	High	No	Low	High
	N/a*										
During operation	Without	Negative	Local	Permanent	Low	Continuous	Improbable	High	No	Low	High
	N/a*										

* No significant impacts on the animals/birds have been identified, thus, no mitigation required or recommended.

Table 29 Can the construction and operation of the Isundu Sub-station be detrimental to the health and safety of local communities?

Impact	Mitigation	Nature	Extent	Duration	Intensity	Frequency	Probability	Reversibility	Irreplaceability	Significance	Confidence
Electromagnetic Fields											
The impact of electromagnetic fields generated by the proposed sub-station and transmission lines on the health of humans and animals											
During construction	N/a										
	N/a										
During operation	Without	Negative	Local	Permanent	Low	Continuous	Probable	Medium	No	Low-Medium	High
	With	Negative	Local	Permanent	Low	Continuous	Improbable	Medium	No	Low	High
Safety and security											
The impact of increased vehicle and pedestrian traffic on road safety, health and safety, and security (crime levels in the surrounding area)											
During construction	Without	Negative	Local	Short-term	Medium	Once-off	Highly Probable	Medium	No	Medium	Medium
	With	Negative	Local	Short-term	Medium	Once-off	Probable	High	No	Low	Medium
During operation	Without	Negative	Local	Permanent	Low	Continuous	Probable	Medium	No	Low	High
	With	Negative	Local	Permanent	Low	Continuous	Improbable	High	No	Low	High

Table 30 What effects will the construction of Isundu Sub-station have on cultural heritage resources?

Impact	Mitigation	Nature	Extent	Duration	Intensity	Frequency	Probability	Reversibility	Irreplaceability	Significance	Confidence
The impact of the proposed sub-station and proposed transmission lines on cultural heritage resources											
During construction	Without	Negative	Local	Short-term	Low	Once-off	Definite	Low	No	Medium	High
	With	Negative	Local	Short-term	Low	Once-off	Improbable	Low	No	Low	High
During operation	N/a										
	N/a										

Table 31 How will earthworks during construction, and stormwater during and after construction, affect the surrounding water courses and environment?

Impact	Mitigation	Nature	Extent	Duration	Intensity	Frequency	Probability	Reversibility	Irreplaceability	Significance	Confidence
The impact of earthworks and construction activities, and additional hard bare surfaces during operation to increase stormwater and pollution thereby affecting the surrounding water courses											
During construction	Without	Negative	Local	Short-term	Medium	Periodic	Highly Probable	Medium	No	Medium	High
	With	Negative	Local	Short-term	Low	Periodic f	Probable	High	No	Low	High
During operation	Without	Negative	Local	Permanent	Medium	Periodic	Probable	Medium	No	Medium	High
	With	Negative	Local	Permanent	Low	Periodic f	Improbable	Medium	No	Low	High

Table 32 What cumulative effects will the proposed Isundu Sub-station contribute, considered in association with impacts arising from other activities in the region?

Impact	Mitigation	Nature	Extent	Duration	Intensity	Frequency	Probability	Reversibility	Irreplaceability	Significance	Confidence
Cumulative impact of future transmission lines on surrounding enterprises											
The potential of additional transmission lines to further impact upon surrounding enterprises into the future											
During construction	N/a										
	N/a										
During operation	Without	Negative	Regional	Permanent	Medium	Continuous	Highly Probable	Low	No	Medium	Medium
	N/a*										
Change in land-use development direction											
The impact of future transmission lines to change development and land-use possibilities, particularly regarding eco-tourism											
During construction	Without	Negative	Local	Permanent	Medium	Continuous	Probable	Low	No	Medium	Medium
	N/a*										
During operation	Without	Negative	Local	Permanent	Medium	Continuous	Probable	Low	No	Medium	Medium
	N/a*										

* There is no mitigation that can be currently recommended, the impact on surrounding enterprises will need to be considered at the time as this will depend on how the enterprises and the area develop.

13. ENVIRONMENTAL IMPACT STATEMENT

The Environmental Impact Assessment undertaken for the proposed Isundu Sub-station has fulfilled the NEMA regulatory requirements. Key issues identified in Scoping have informed the specialist studies from which potential impacts were investigated and mitigation measures recommended.

By its nature, the construction and operation of a large sub-station and associated transmission lines will have a negative impact upon the local environment, both biophysical and socio-economic. However, due to the strategic national and provincial need to maintain and improve the electrical infrastructure network, the No-Development option is not considered feasible.

The proposed Isundu site is considered the most feasible site out of more than 25 alternative sites identified since Eskom commenced investigations in late 2008. Of the two layout alternatives assessed, Layout 2 is the recommended layout as it reduces the impact of the proposed and future transmission lines on the Mayibuye development to the south of the P477.

The preferred alignment of the turn-in 2 x 400 kV double-circuit transmission lines from the sub-station to tie into the existing Hector-Ariadne 400 kV double-circuit transmission lines approximately 4 km away, is to run on the east side, parallel to the existing 275 kV transmission line. This alignment does not affect RCL or the proposed Aloe Wildlife Estate and was the alignment requested by Mayibuye Game Reserve during the VSHA investigations.

There are a number of pre-construction mitigation measures, where timing is important, if negative impacts are to be avoided. These relate specifically to the following:

- The need to relocate the African Bird of Prey Sanctuary to ensure that the initial construction traffic, earthworks and blasting do not put at risk the Bearded Vulture Breeding programme.
- Should RCL Foods still be operating on the adjacent properties, then there may be the need to undertake a test blast in order to better confirm the uncertainties with regard to noise and dust and to adjust the blast design, mitigation activities and earthworks programme accordingly.
- Following this, there may be the need to negotiate closing up RCL's L14 laying farm to make it light tight and establish dust mitigation screens around the ventilation fans and openings of farms L14, L1 and L2. Monitoring equipment must also be installed prior to the commencement of site clearing, earthworks and blasting.
- The need to develop the required wetland mitigation areas to conserve the existing ecosystem services prior to site clearing commencing.
- The need to register a servitude on the land adjacent to the P477, also owned by the same landowner as the sub-station site, but a separate portion, to plant the line of visual screening trees around the same time as project construction commences.

Importantly, the nature of project planning and procurement, which focuses on construction, rather than mitigation, once authorisation is granted, presents a risk that a number of the above important mitigation measures will not be prioritised and completed prior to site handover. This would result in some the critical negative impacts not being avoided or mitigated.

However, with the proper timing and implementation of the proposed mitigation measures, the significance of negative impacts upon the environment will be reduced or avoided and the positive benefits of improved electrical infrastructure will be achieved.

14. OPINION ON ACTIVITY AUTHORISATION AND ASSOCIATED CONDITIONS

It is the opinion of the EAP that the proposed Isundu sub-station and turn-in transmission line can be authorised, based on the findings of the assessment process and conditional on the following outlined hereunder.

PRE-CONSTRUCTION

- Eskom is responsible for ensuring and demonstrating that the relocation of ABOPS can and will be undertaken without affecting the success of the Bearded Vulture Breeding Programme, or the future success and revenues of the ABOPS operation. In this regard, ABOPS have prepared terms of reference to help guide negotiations and discussions.
- The DEA Biodiversity Section and EKZN Wildlife also have an interest and responsibility in the Bearded Vulture Breeding Programme. Thus, the EAP recommends that representatives from these authorities be identified to be part of all relevant negotiations and relocation agreements. The timing of agreements and the relocation programme relative to the birds in captivity and the implementation of the relocation needs to ensure that the Bearded Vulture Breeding Programme, and the long-term success of ABOPS, is not jeopardised in any way.
- The identification of a suitable alternative site is likely to be challenging and time-consuming, and, thus, it is recommended that ABOPS and Eskom be encouraged to commence this search for possible sites as soon as authorisation has been granted.
- Negotiations for relocation should take into account that the relocation of the Sanctuary may require, among others, a search for new sites, land negotiation, new raptor permits, land-use zoning, construction and special transport arrangements to the new site, whilst some of the existing ABOPs conservation activities and programmes continue.
- At an appropriate time prior to construction commencing, Eskom should confirm if RCL Foods (or another similar poultry producer) still owns the adjacent properties. If RCL Foods still own the property, Eskom and RCL Food should negotiate management and production strategies that could suitably mitigate any potential losses during construction. For example, if production has been drastically cut in relation to the available facilities, then facilities not affected could rather be used during the initial construction phase.
    - If still necessary, then at an appropriate time prior to construction commencing and once Eskom owns the land, Eskom must undertake a test blast based on the current design at a suitable location on the site. This test must consider, where appropriate, the following monitoring activities:
        - Relevant equipment to confirm vibration levels at each of the three closest RCL farms.
        - Relevant equipment to confirm noise levels outside of each of the three closest farms and also inside the layer buildings. The noise inside and outside the buildings as a result of the grass cutting must also be recorded for reference.
        - Video equipment to record the blast; also set up within the houses of each farm to record if the birds startle or react during the blast.
        - Record the level of dust generated by the blast and the wind direction during monitoring.
    - If still necessary, Eskom should negotiate closing up Rainbow's L14 laying farm to make it light tight and establish suitable dust mitigation screens around the ventilation fans and openings of farms L14, L1 and L2. Necessary monitoring equipment must also be installed prior to the commencement of site clearing, earthworks and blasting (as specified in the mitigation measures).

- If still necessary and if suitable mitigation and programming will not sufficiently mitigate the risks to RCL's production, Eskom should negotiate a compensation scale with RCL for any substantiated losses which occur as a result of the initial construction phase, and/or Eskom should negotiate the relocation of RCL's L14 farm.

- ❑ An appropriate wetland ecosystem services replacement mitigation plan needs to be put in place to compensate for the loss of ecosystem services on the sub-station footprint. It is proposed that areas of natural grassland remaining intact within the sub-station boundary but outside the direct footprint of construction should be considered for the creation of these wetland pans as outlined in Section 11.2.1.1 and depicted in Figure 30.
- ❑ Undertake a vegetation survey prior to construction to identify any protected or rare/threatened species. This needs to be done at the right time of the year for flowering and will also need to identify any protected plants or trees to be impacted, once the final site has been demarcated.
- ❑ Once a preferred transmission line route has been selected, and prior to construction of the towers, input from the vegetation/wetland specialist and the fauna specialist is required on the final location of towers to minimise impacts on sensitive areas.
- ❑ Align the proposed double-circuit 400 kV line through the Mayibuye Game Reserve as per the vegetation specialist's recommendations, which will minimise the visual impact of servitudes and the need for new access roads.
- ❑ In all designs, Eskom must comply with the exposure guidelines for electric and magnetic fields as given by the ICNIRP.
- ❑ Eskom needs to involve an independent acoustic engineer during the design phase to provide input and guide the design and insulation of noisy plant and equipment in accordance with the recommendations provided in Section 10.8.4.

DURING CONSTRUCTION

- ❑ The mitigation measures in the EMPR must be effectively implemented.
- ❑ Implement the measures recommended by the visual impact specialist including:
  - Planting and maintaining screening vegetation along sections of the P477.
  - Implementing lighting recommendations to reduce the visual impact of night-time light.
- ❑ If still relevant, dust levels must be controlled at the nearby RCL layer houses. This mitigation needs to be partly achieved through the pre-construction activities, but must also be managed and monitored during construction. During construction, specific dust monitoring equipment must be erected and specific weather forecast and dust mitigation measures need to be developed and monitored.
- ❑ It is recommended that visual monitoring of animals at the Natal Zoological Gardens and Natal Lion Park be undertaken to confirm that the animals are not being unduly stressed or frightened by any blasting activities. If behaviour changes and stresses are identified, appropriate mitigation measures should be designed.
- ❑ Implement health and safety mitigation measures listed in Section 11.5.3 and carried through into the EMPR.
- ❑ Implement the cultural heritage mitigation measures listed in Section 11.6.1 and carried through into the EMPR.
- ❑ Implement the earthworks and stormwater management mitigation measures listed in Section 11.7.1 and carried through into the EMPR.
- ❑ Once the sub-station lights are operational, if still applicable, RCL and Eskom must undertake an inspection to ensure that any potential impacts have been sufficiently mitigated. Where it is found that light from the sub-station can still enter the nearby layer houses, Eskom needs to implement mitigation measures in consultation with RCL, either on the layer house or at the source.

DURING OPERATION

- During operation, the ongoing maintenance of servitudes and removal of alien plants are important. These have been incorporated into the EMPR.
- Once final layout designs have been approved for the Aloe Wildlife Estate, if authorised, Eskom needs to negotiate with the developer the need for and the location of screening trees to minimise visual impacts.

15. CONCLUDING REMARKS

This final EIAR has been prepared after a long process involving stakeholder consultation and participation, and obtaining a range of specialist input. The unique challenges associated with this project arise due to (a) the strategic importance of this infrastructure and the limitations outlined in terms of feasible alternative sites, and (b) the wide range of different land-use concerns bordering the proposed site.

The EAP believes that this final report and the proposed mitigation measures will balance these challenges to ensure that the positive benefits of the project are realised whilst the negative impacts are suitably mitigated.

This final report was made available for public review prior to submission to DEA, for consideration and final decision-making.

The public will be notified of DEA's decision on the final EIAR and the issuing of an Environmental Authorisation (EA), as well as the appeal procedure which should be followed should a member of the public wish to appeal the EA.

16. REFERENCES

ACER. 2015. *Environmental Impact Assessment for the proposed Isundu 765/400 kV Sub-station and turn-in transmission lines: Vegetation and Wetland Specialist Study.* Report prepared by ACER (Africa) Environmental Consultants for Eskom Holdings SOC Limited. July 2015.

Balmori A. 2005. *Possible effects of electromagnetic fields from phone masts on a population of White Stork (Ciconia ciconia)".* Electromagn. Biol. Med. 24, pp. 109119.

Bates MF, Branch WR, Bauer AM, Burger M, Marais J, Alexander GJ and de Villiers M (eds.). 2014. *Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland*. South African National Biodiversity Institute, Pretoria.

Bhattacharya, R and Roy, R. 2013. *Impacts of Communication Towers on Avians: A Review*. IJECT VOL. 4, IS S U E SP L – 1.

Botha G.A and Botha R.C.N. 2002.*Geological Description of Sheet 2930CB Pietermaritzburg Council for Geoscience.* Pietermaritzburg.

Burger, J. 1998. *Effects of motorboats and personal watercraft on flight behaviour over a colony of Common Terns.* Condor 100:528–534.

Campo, J. L., Gil, M. G. & Davila, S. G., 2005. *Effects of noise and music stimuli on stress and fear levels of laying hens of several breeds.* Applied Animal Behaviour Science, Volume 91, pp. 75-84.

Chloupek, P., Voslarova, E., Chloupek, J., Bedanova, I. Pistekova, V., & Vecerek, V. 2009. *Stress in Broiler Chickens Due to Acute Noise Exposure.* ACTA VET. BRNO 2009, 78: 93–98; doi:10.2754/avb200978010093\

Drennan Maud, 2016. *Geotechnical Investigation for the proposed Isundu 765/400kV Sub-station.* Report prepared for Eskom Holdings SOC Limited.

Dry, Dr. GC. 2015. *Wildlife ranching - an industry of the future*. 2015.

DWAF. 2008. *Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas.* Prepared by M. Rountree, A. L. Batchelor, J. MacKenzie and D. Hoare. Stream Flow Reduction Activities, Department of Water Affairs and Forestry, Pretoria, South Africa.

Everaert J. & Bauwens D. 2007. *A Possible Effect of Electromagnetic Radiation from Mobile Phone Base Stations on the Number of Breeding House Sparrows (Passer domesticus)* Electromagnetic Biology and Medicine. 26, pp. 63– 72.

Friedmann Y and Daly B. 2004. *Red Data Book of Mammals of South Africa: A Conservation Assessment*. Conservation Specialist Breeding Group, Endangered Wildlife Trust, South Africa.

Gladwin, D. N., Manc, K.M. and Villella, R. 1988. *Effects of aircraft noise and sonic booms on domestic animals and wildlife: bibliographic abstracts.* U.S. Fish Wildlife Service National Ecology Research Center, Ft. Collins, Co. NerC88/32., 78 p

Geopractica, 2012. *Preliminary comparative geotechnical report at two sites for the proposed new Isundu Sub-Station.* Eskom Holdings SOC Limited.

GroundTruth, 2015. *Environmental Impact Assessment for the Proposed Isundu 765/400 kV Sub-Station and Turn-In Transmission Lines. Fauna Specialist Report.* GroundTruth Water, Wetlands and Environmental Engineering. P O Box 2005. Hilton, 3245.

ICNIRP Guidelines. 2010. *Guidelines for Limiting Exposure to Time-Varying Electric and Magnetic Fields (1 Hz To 100 kHz). International Commission On Non-Ionizing Radiation Protection.* Available: http://www.Icnirp.Org/Cms/Upload/Publications/Icnirplfgdl.pdf (Accessed 18/06/2015)

Imani Development (SA) (Pty) Ltd, 2010. *Environmental Impact Assessment for the proposed Eskom* Venus-Sigma 765 kV Transmission Line (EIA: 12/12/20/1397/1) Sigma-Hector 2x400 kV Transmission *Lines (EIA: 12/12/20/1397/3). Economic Overview Specialist Report.* Prepared for ACER (Africa) Environmental Management Consultants.

Jacob, J. and Pescatore T. 2013. *Avian Respiratory System.* Report No. ASC-200, Cooperative Extension Service, University of Kentucky College of Agriculture, Food and Environment, Lexington, KY

Kotze, D., Marneweck, G., Batchelor, A., Lindley, D. & Collins, N. 2007. WET-EcoServices. *A technique for rapidly assessing ecosystem services supplied by wetlands*. WRC Report No TT 339/09, Water Research Commission, Pretoria.

Li, S., Li, H. Xin, H. and Burns, R. T. (2009). *Particulate matter emissions from a high-rise layer house in Iowa.* ASABE technical paper presented at the ASABE 2009 Annual International Meeting, Reno, NV. *American Society of Agricultural and Biological Engineers*, St Joseph, MI.

Macfarlane DM, Kotze DC, Ellery WN, Walters D, Koopman V, Goodman P and Goge C. 2007. WET-Health: *A technique for rapidly assessing wetland health*. WRC Report No TT 340/08, Water Research Commission, Pretoria

Minter LR, Burger M, Harrison JA, Braack HH, Bishop PJ and Kloefder D. 2004. *Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland*. 9SI/MAB SERIES Smithsonian Institute, Washington, U.S.A.

Mkhambathini IDP. 2013/14. *Integrated Development Plan.*

Monadjem A, Taylor, PJ, Cotterill, FPD and Schoeman MC. 2010. *Bats of Southern and Central Africa: A Biogeographic and taxonomic synthesis*. Wits University Press, Johannesburg.

Mucina, L. & Rutherford, M. (eds). 2006. *The vegetation of South Africa, Lesotho and Swaziland.* Strelitzia 19.

Naguib, M. *et al*., 2013. *Noise Annoys: effects of noise on breeding great tits depend on personality but not on noise characteristics*. Animal Behaviour, Volume 85, pp. 949-956.

NAMC, 2015*. Markets and Economic Research Centre Food Price Monitor Issue 2015/February*. National Agricultural Marketing Council

Nel JL, Murray KM, Maherry AM, Petersen CP, Roux DJ, Driver A, Hill L, Van Deventer H, Funke N, Swartz ER, Smith-Adao LB, Mbona N, Downsborough L and Nienaber S. 2011. *Technical report for the national freshwater ecosystem priority areas project.* WRC Report No. 1801/2/11, Water Research Commission, Pretoria.

O'Connor, E.A., Parker, M.O., Davey, E.L., Grist, H., Owen, R.C., Szladovits, B., Demmers, T.G.M., Wathes, C.M. and Abeyesinghe, S.M. 2011. *Effect of low light and high noise on behavioural activity, physiological indicators of stress and production in laying hens.* 2011. British Poultry Science. Volume 52, Number 6 pp. 666 —674.

Ortega, C. P. 2012. *Effects of noise pollution on birds: a brief review of our knowledge*. Ornithological Monographs, Volume 74, pp. 6-22.

Parliamentary Monitoring Group, 2013. *Status of poultry tariffs in SA & impact of proposed tariff increase for poultry imports: input by Competition Commission, South African Poultry Association & Association of Meat Importers and Exporters*. [Online] Parliamentary Monitoring Group. Available: https://pmg.org.za/committee-meeting/16346/

Pitts, Thoma O. Jackson and Jenniffer. 2010. *The Effects of Electric Transmission Lines on Property: A Literature Review.* 2010.

Quantec. 2015. *National Census 2011. Regional, Standardised 2013.* 2015.

Rutherford MC, Mucina L, Lotter, MC, Bredenkamp GJ, Smit JHL, Scott-Shaw R, Hoare DB, Goodman PS, Bezuidenhout H, Scott L, Ellis F, Powrie LW, Siebert F, Mostert TH, Henning BJ, Venter CE, Camp KGT, Siebert SJ, Matthews WS, Burrows JE, Dobson L, van Rooyen N, Schmidt E, Winter PJD, du Preez PJ, Ward RA, Williamson S and Hurter PJH. 2006. Savanna Biome. In: Mucina L and Rutherford MC (eds*.). The Vegetation of South Africa, Lesotho and Swaziland*. Strelitzia 19: 578-579. South African National Biodiversity Institute, Pretoria.

Scott-Shaw, C.R and Escott, B.J. (Eds). 2011*. KwaZulu-Natal Provincial Pre-Transformation Vegetation Type Map – 2011*. Unpublished GIS Coverage [kznveg05v2_1_11_wll.zip], Biodiversity Conservation Planning Division, Ezemvelo KZN Wildlife, P. O. Box 13053, Cascades, Pietermaritzburg, 3202.

Sonalya E.B. and Swan S.E.J. 2004.*Small-Scale Poultry Production.* Food and Agricultural Organization of the United Nations, Rome

Statistics South Africa*. Census 2011 Municipal Report.* KwaZulu-Natal (2012a)

UKAg (2014). *The Poultry Production Manual, Kentucky Poultry Energy Efficiency Project*, College of Agriculture Food and Environment, University of Kentucky, North Lexington, KY

US-EPA (1995). *SCREEN3 Model User's Guide*, EPA-454/B-95-004, US Environmental Protection Agency.

Voslarova, E., Chloupek, P., Chloupek, J., Bedanova, I., Pistekova, V and Vecerek, V. 2011. *The effects of chronic intermittent noise exposure on broiler chicken performance.* Animal Science Journal. Volume 82. Issue 4. Pages 601-606.

WHO. 2007. Extremely low frequency fields. Geneva: World Health Organization. (Environmental health criteria 238). *Exposure to extremely low frequency fields*. Backgrounder June 2007. Available : http://www.who.int/peh-emf/publications/facts/fs322/en/ (Accessed 18/06/2015).

Wolfe, M. Home Guides. *SFGate.* [Online] Demand Media. [Cited: 16 July 2015.] http://homeguides.sfgate.com/much-power-lines-lower-real-estate-value-2979.html.

APPENDIX 1: EIA APPLICATION & AUTHORITY CORRESPONDENCE

1.1. DEA Correspondence
- ❒ Original Application (October 2014)
- ❒ Acceptance of Scoping Report (September 2015)
- ❒ Acceptance of Draft EIA (October 2016).

1.2. DWS - WULA GA
1.3. Amafa Correspondence
1.4. ABOPS Terms of Reference
1.5. EAP's Details and Expertise

APPENDIX 2: PUBLIC PARTICIPATION DOCUMENTATION & CORRESPONDENCE

- Project Announcement
  - Background Information Document
  - Key Stakeholder Meetings
  - Media Adverts
  - On Site Notices
  - Stakeholder Correspondence
  - Stakeholder Letters and Comment Sheet

- Draft Scoping Report Announcement
  - Letter and Comment to I&APs
  - Letter to DEA
  - Media Adverts
  - Public Meetings
  - Stakeholder Correspondence

- Final Scoping Report Announcement
  - Letters to I&APs and Authorities (including proof of distribution)
  - Stakeholder Correspondence
  - Key Stakeholder Meetings – Presentations, Attendance Registers, Minutes

- Draft EIAR announcement
  - Letters to I&APs and Authorities (including proof of distribution)
  - Media Adverts
  - Stakeholder Correspondence
  - Key Stakeholder Meetings – Presentations, Attendance Registers, Minutes

APPENDIX 3: COMMENTS AND RESPONSES REPORT

- Comments and Responses Report (Project Announcement)
- Comments and Responses Report (Draft Scoping Report)
- Comments and Responses Report (updated for Draft EIA Report)
- Comments and Responses Report (Final EIA Report)

APPENDIX 4: STAKEHOLDER DATABASE

- Stakeholder Database

APPENDIX 5: SPECIALIST STUDIES

(Note that declarations of independence and expertise are in some instances included within the report and in others, as a stand alone page).

APPENDIX 6: DRAFT ENVIRONMENTAL MANAGEMENT PROGRAMME

- Draft Environmental Management Programme
- Appendices to Draft Environmental Management Programme
  - Appendix A: Eskom Standards
  - Appendix B: Revegetation and Rehabilitation Plan
  - Appendix C: Alien Invasive Management Plan
  - Appendix D: Erosion Management Plan
  - Appendix E: Stormwater Management Plan
  - Appendix F: Transportation and Traffic Management Plan
  - Appendix G: Open Space Management Plan
  - Appendix H: EAP Curriculum Vitae