Proposed Expansion of Ash Disposal Facilities at Hendrina Power Station

SPECIALIST AVIFAUNAL IMPACT ASSESMENT

EIA REPORT
November 2011

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EXECUTIVE SUMMARY

Eskom Power Generation is proposing an approximately 200 hectare ash dam to be constructed at the Hendrina Power Station in the Mpumalanga Province. Lidwala Consulting Engineers (SA) (Pty) Ltd was appointed to undertake the required Environmental Impact Assessment (EIA), and subsequently appointed the EWT to undertake an avifaunal specialist assessment of the proposed site alternatives in the study area. Five alternative sites were proposed for the new ash dam, and the results of the scoping phase identified Alternative E, to be the preferred option. Studies during the EIA phase, then focused on this site, as well as the associated infrastructure, which included overhead transmission power lines, and new underground pipe-lines

The South African Bird Atlas Project (SABAP) records 193 and 221 bird species in the study area, of which 16 are Red Listed Species (Harrison *et al*,1997) and one species is protected internationally under the Bonn Convention on Migratory Species. SABAP 2, Coordinated Waterbird Count (CWAC) data and CAR data were also considered. The focal species for the study were determined to be the following: Greater Flamingo, Lesser Flamingo, Grey-crowned Crane, Denham's Bustard, Blue Korhaan, Southern Bald Ibis, and White Stork.

This avifaunal study used a set methodology as well as various data sets, and then, by looking at the focal Species which could occur in the area, as well as assessing the availability of bird micro habitats, the possible impacts of the development were then assessed. In general terms, the impacts that could be associated with a project of this nature include: loss of habitat for certain species, collision of birds with the overhead cables; electrocution; and disturbance of birds. Sensitive avifaunal areas of the site were mapped, and these areas may require collision mitigation in the form of bird-flight diverters, should associated power lines pass through. The exact spans requiring mitigation will be determined during the EMP phase of the project.

It was concluded that the proposed project and associated infrastructure can be built provided that the various mitigation measures recommended in this report are implemented. From an avifaunal perspective, the biggest concern is the associated power-lines, and line alternative 1 is more preferred.

DECLARATION OF INDEPENDANCE

Specialist Investigator

Andrew Pearson is employed by the Endangered Wildlife Trust's Wildlife and Energy Programme as a specialist investigator for conducting avifaunal specific specialist reports. Andrew has a Four Year BSc in Conservation Ecology, certificates in Environmental Law, as well as five years experience in the environmental management field. The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information.

Declaration of Independence

All specialist investigators specified above declare that:

- We act as independent specialists for this project.
- We consider ourselves bound by the rules and ethics of the South African Council for Natural Scientific Professions.
- We do not have any personal or financial interest in the project except for financial compensation for specialist investigations completed in a professional capacity as specified by the Environmental Impact Assessment Regulations, 2006.
- We will not be affected by the outcome of the environmental process, of which this report forms part of.
- We do not have any influence over the decisions made by the governing authorities.
- We do not object to or endorse the proposed developments, but aim to present facts and our best scientific and professional opinion with regard to the impacts of the development.
- We undertake to disclose to the relevant authorities any information that has or may have the potential to influence its decision or the objectivity of any report, plan, or document required in terms of the Environmental Impact Assessment Regulations, 2006.
- Should we consider ourselves to be in conflict with any of the above declarations, we shall formally submit a Notice of Withdrawal to all relevant parties and formally register as an Interested and Affected Party.

Terms and Liabilities

- This report is based on a short term investigation using the available information and data related to the site to be affected. No long term investigation or monitoring was conducted.
- The Precautionary Principle has been applied throughout this investigation.
- The specialist investigator, and the Endangered Wildlife Trust, for whom he/she works, does not accept any responsibility for the conclusions, suggestions, limitations and recommendations made in good faith, based on the information presented to them, obtained from these assessments or requests made to them for the purposes of this assessment.
- Additional information may become known or available during a later stage of the process for which no allowance could have been made at the time of this report.
- The specialist investigator withholds the right to amend this report, recommendations and conclusions at any stage should additional information become available.
- Information, recommendations and conclusions in this report cannot be applied to any other area without proper investigation.
- This report and all of the information contained herein remain the intellectual property of the Endangered Wildlife Trust.
- This report, in its entirety or any portion thereof, may not be altered in any manner or form or for any purpose without the specific and written consent of the specialist investigator as specified above.
- Acceptance of this report, in any physical or digital form, serves to confirm acknowledgment of these terms and liabilities.

Signed on the 7th November 2011 by Andrew Pearson in his capacity as specialist investigator for the Endangered Wildlife Trust's Wildlife and Energy Programme.

1. Introduction

1.1. Background

Eskom Power Generation is proposing an approximately 200 hectare ash dam to be constructed at the Hendrina Power Station in the Mpumalanga Province. Lidwala Consulting Engineers (SA) (Pty) Ltd was appointed to undertake the required Environmental Impact Assessment (EIA), and subsequently appointed the EWT to undertake an avifaunal specialist assessment of the proposed site alternatives in the study area. This assessment comprised of an initial screening phase (encompassing an 8 km radius centered on the Power Station), followed by scoping and EIA phases. The Scoping phase advised the plan of Study for the EIA phase. For the compilation of this scoping report, a site visit was conducted on 4th May 2011. An additional site visit was conducted during the EIA phase on the 26th October 2011. Five alternative sites were proposed, and the results of the scoping phase identified Alternative E, to be the preferred option. Studies during the EIA phase, then focused on this site, as well as the associated infrastructure, which included overhead transmission power lines, and new underground pipe-lines

The site alternative E, falls within Quarter Degree Grid Square (QDGS) 2629BA, while data from QDGS 2529DC, was also considered due to its close proximity to the site. Within these Quarter Degree Grid Squares, the South African Bird Atlas Project (SABAP) records 193 and 221 bird species of which 16 are Red Listed Species (Harrison *et al*, 1997) and one species is protected internationally under the Bonn Convention on Migratory Species. In addition, the broader study area includes 2 Coordinated Waterbird Count (CWAC) areas which are regarded as sites important for water birds either by virtue of the species present or the numbers in which they are represented.

In light of the above, the study area is important for avifauna and it is imperative that all sensitive habitats are conserved. The proposed Ash Dam should therefore only be constructed, along with its associated infrastructure, if the recommendations and mitigations of this report are followed.

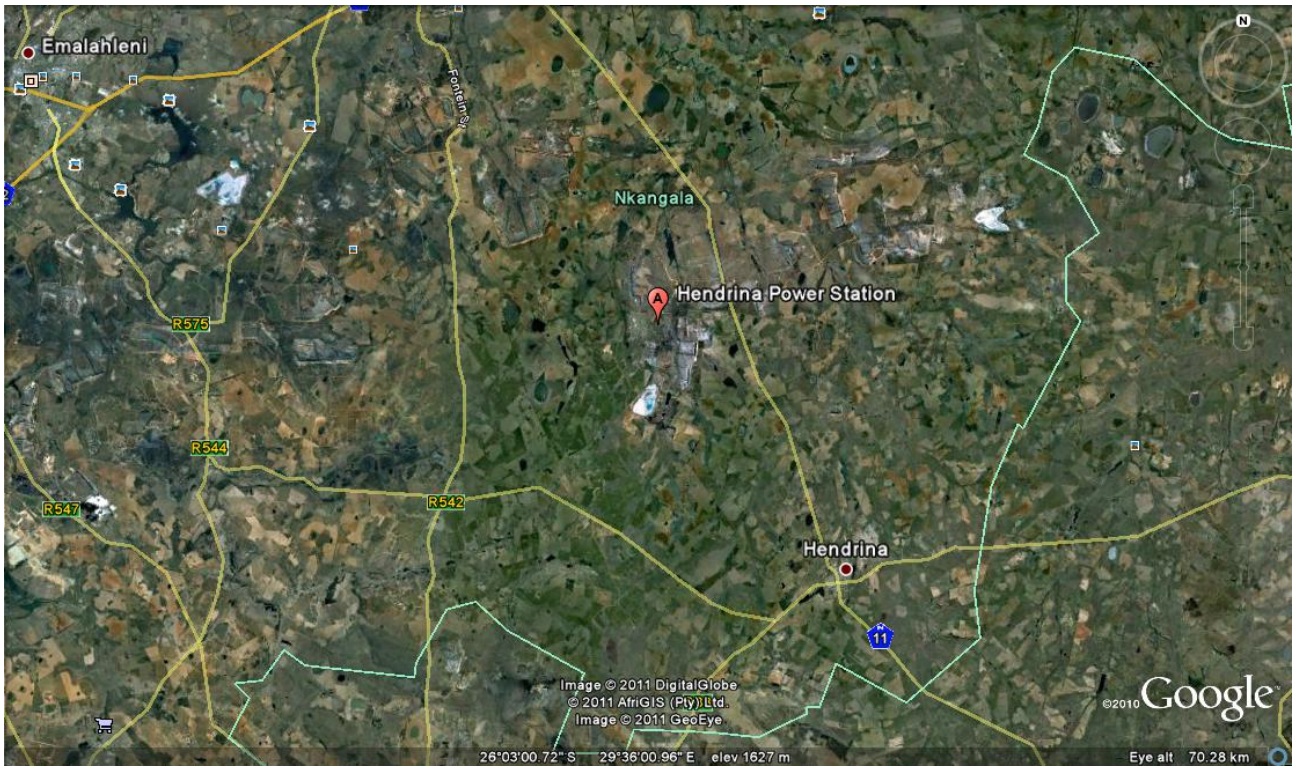

Figure 1: Google Earth Image showing the location of Hendrina Power Station in relation to regional and national roads, as well as the Towns of Emalahleni and Hendrina

1.2. Objectives of the report

The following objectives for the EWT avifaunal study were adopted:

- **Describe affected environment and determine status quo:** The existing environment will be described and the bird communities most likely to be impacted will be identified. Different bird micro-habitats will be described as well as the species associated with those habitats.
- **Identify Red Data species** potentially affected by the proposed power lines and substation
- **Describe focal species:** Threatened bird species (as per red data book status), will be identified, and species most likely to be impacted upon will be identified.
- **Identification of sensitive sites:** The bird sensitive sections of the study area will be assessed.
- **Identification of impacts:** The potential impacts on the birds will be identified.
- **Rate Impacts:** The significance of the impacts will be rated as per a standard set of criteria.

- **Compare Alternatives:** Give a comparative assessment of the environmental impacts related to alternatives proposed.
- **Propose and explain mitigation measures:** Practical mitigation measures will be recommended and discussed.
- **Identify and address any other aspects** related to avifauna in the study area that should be incorporated into the reports.

1.3. Legislative Framework

The legal position with regard to the protection of birds is governed primarily through the National Environmental Management Biodiversity Act 10 of 2004, its regulations (i.e. Threatened or Protected Species Regulations), various provincial ordinances and nature conservation acts. All of these broadly concur, that actions that are taken with regard to nesting birds on power lines could have legal implications. Actions which lead to death or injury of a listed species may also have legal implications.

1.4. Study approach and methodology

The study was initially conducted from a desk top level during a pre-screening phase. Using various GIS layers, 1:50 000 topographical maps and Google earth images, key features within the study area were identified and mapped using ARCGIS 9.3 and were assigned a sensitivity rating as is tabled below.

Table 1: Sensitivity analysis

	Description
Lower Sensitivity	Built up areas, roads, mines, existing ash dams, railway lines and high voltage power lines
Medium Sensitivity	Remaining cultivated lands and farm lands
Higher Sensitivity	Wetlands, rivers and streams, farm dams, CWAC sites,

In addition all Sensitivity areas were buffered as follows:

- 250m for high sensitivity areas
- 100m for high voltage Eskom lines
- 200m for sensitivity areas.

The resultant sensitivity Map is shown in figure 9. Site alternative E, falls primarily in Medium to Lower sensitivity zones.

The various data sets discussed below under "sources of information" were collected. This data was examined to determine the location and abundance of sensitive Red Data species in the study area. Various site visits were conducted. Bird micro-habitats were then identified and described. The impacts of the proposed project on birds were then predicted.

1.5. Sources of Information

The following information sources were consulted in order to conduct this study:

- Bird distribution data of the Southern African Bird Atlas Project (SABAP – Harrison et al, 1997) obtained from the Avian Demography Unit (ADU) of the University of Cape Town, as a means to ascertain which species occur within the study area. A data set was obtained for these quarter degree squares (TABLE 2).
- The SABAP 2 data for the relevant Pentads was also consulted.
- Data from the Co-ordinated Avifaunal Road count project (CAR – Young, Harrison, Navarro, Anderson & Colahan, 1997) for the "Mpumalanga Precinct".
- Data from the Co-ordinated Waterbird Count (CWAC) project was also consulted to determine whether any CWAC sites exist in the study area (Taylor, Navarro, Wren- Sargent, Harrison & Kieswetter, 1999).
- The Important Bird Areas of southern Africa (IBA) project data (Barnes 1998) was consulted to determine its relevance to this project.
- The conservation status of all bird species occurring in the aforementioned quarter degree square was determined with the use of The Eskom Red Data book of birds of South Africa, Lesotho and Swaziland (Barnes, 2000).
- Electronic 1:50 000 maps were obtained from the Surveyor General.
- High resolution satellite imagery from Google Earth was used to aid in the identification of micro-habitats

1.6. Assumptions and Limitations of this study

This study made the assumption that the above 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.
- Sources of error in the SABAP database, particularly inadequate coverage of some quarter degree squares. This means that the reporting rates of species may not be an accurate reflection of the true densities in quarter degree squares that were sparsely covered during the data collecting period.
- During the site visit, it was not possible to access the entire extent of all proposed sites.
- Predictions in this study are based on experience of these and similar species in different parts of South Africa. Bird behavior can never be entirely reduced to formulas that will hold true under all circumstances.

2. Description of the Project

Eskom Power Generation is proposing an approximately 200 hectare ash dam to be constructed at the Hendrina Power Station in the Mpumalanga Province. Five alternative sites were proposed, and the results of the scoping phase identified Alternative E, to be the preferred option. The location of site alternative E, in relation to the Hendrina Power station and associated infrastructure can be seen in figures 2 and 3 below. This site will require the re-routing of three existing 132kv power lines. Two alternative corridor options were proposed for this activity, and are assessed and compared in this study.

Alternative 1: One of the three lines is routed to the north of the ash dam site, following an existing road that forms the northerly boundary of the ash dam site. The remaining two lines are routed initially further west and then follow an existing tar road to the south west of the ash dam site, and then follow the eastern boundary of the ash dam site, before rejoining the original power line route. *Alternative 2:* This involves re-routing all three lines, initially west, and then south of the proposed ash dam site. The corridor follows existing powerlines for only a small portion of its length. Passes through cultivated lands, as well as in close proximity to a seasonal pan.

The project will also include the installation of additional infrastructure, in the form of new underground pipelines. Only one route is proposed (see figure 3), to the south of the ash dam site, for the re-routing of the existing pipeline

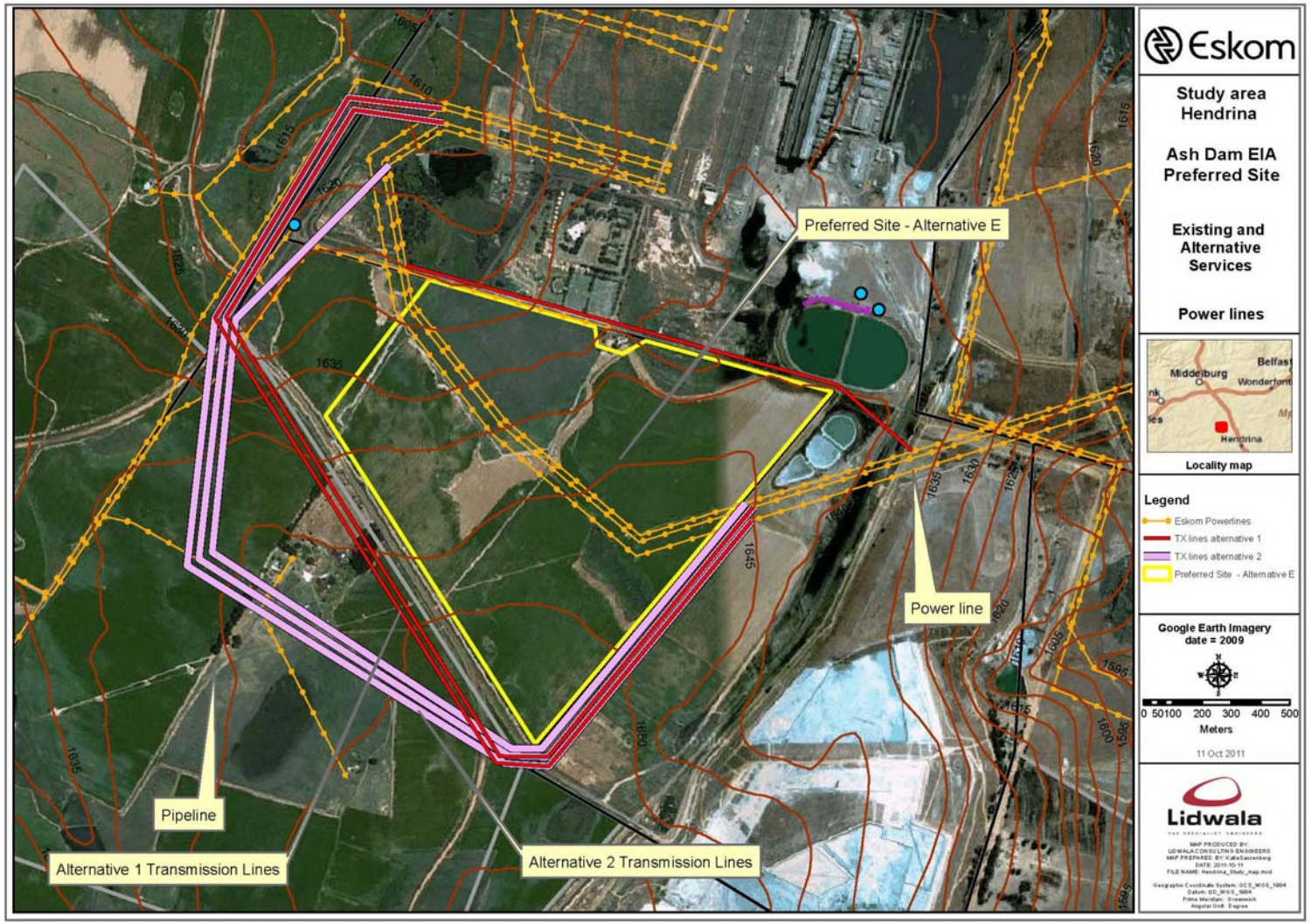

Figure 2: Map showing the proposed ash dam site (alternative E), existing power-lines, as well as the proposed route alternatives for the new transmission line corridor (source: LIDWALA).

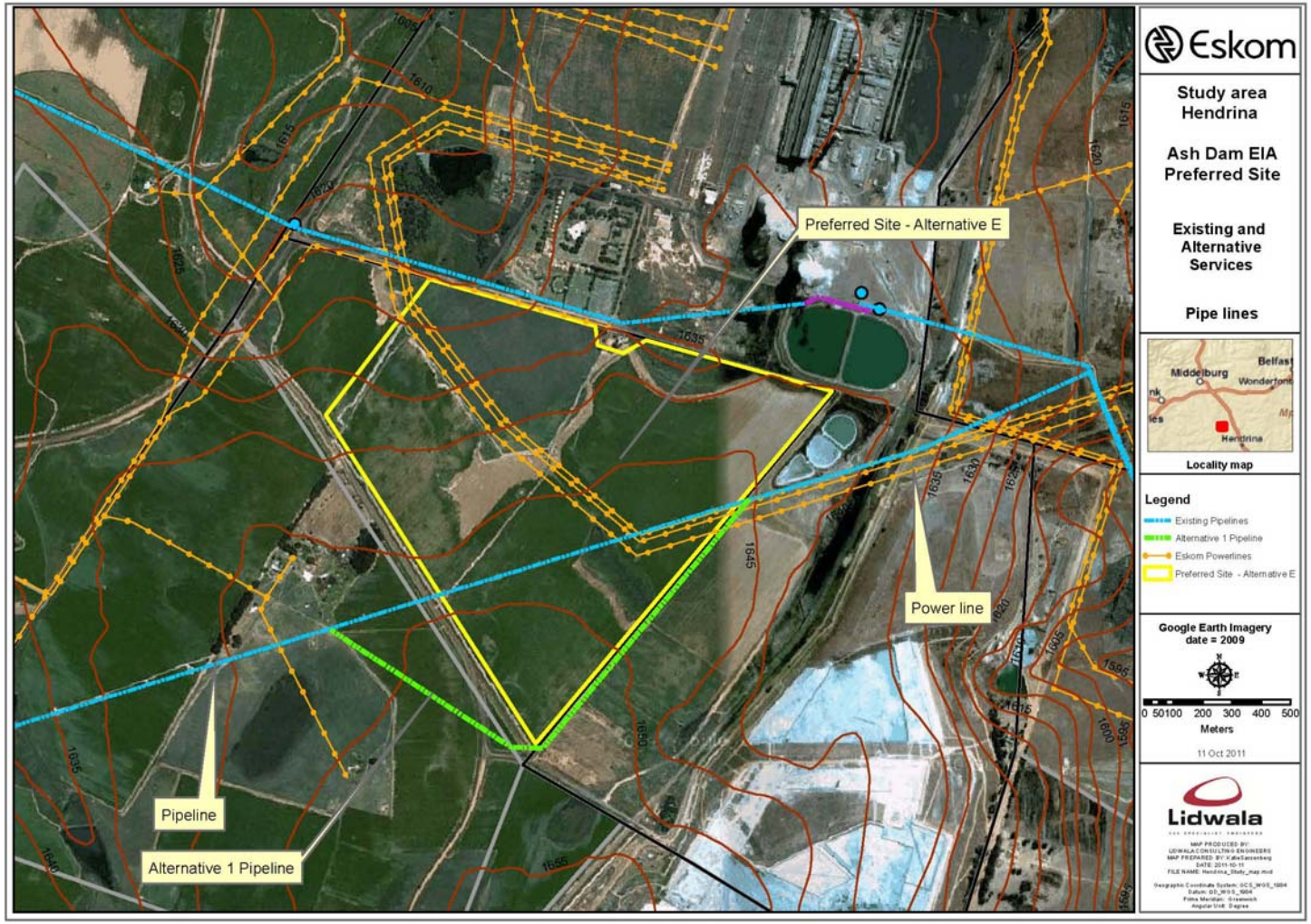

Figure 3: Map showing the proposed ash dam site (alternative E), existing power-lines and pipe-lines, as well as the proposed route for the pipe-line deviation (source: LIDWALA).

3. Description of the Affected Environment

3.1. Regional Overview

Data on the bird species that could occur in the study area and their abundance was obtained from the Southern African Bird Atlas Project (Harrison *et al*, 1997). This data provided an indication of the bird species that were recorded in the quarter Degree Square within which this proposed project falls, i.e. 2629BA, and a nearby QDGS, 2529DC.

Table 2: Red Listed bird species recorded in the quarter degree squares (2629BA and 2529DC) within which the study area is located (Harrison *et al*, 1997). Report rates are percentages of the number of times a species was recorded by the number of times the square was counted. Conservation status is classified according to Barnes (2000).

Total Cards		66	64
Total Species		193	221
Total Breeding Species		44	27
Name	**Conservation status**	**2629BA report rate**	**2529DC report rate**
Botha's Lark	EN	2	-
Southern Bald Ibis	VU	5	14
African Marsh-Harrier	VU	2	-
Lesser Kestrel	VU	3	13
African Grass Owl	VU	2	2
Denham's Bustard	VU	-	2
White-bellied Korhaan	VU	-	2
Yellow-billed Stork	NT	3	-
Greater Flamingo	NT	27	36
Lesser Flamingo	NT	8	17
Secretarybird	NT	3	5
Black Harrier	NT	2	-
Pallid Harrier	NT	-	2
Blue Korhaan	NT	3	2
Black-winged Pratincole	NT	5	2
Black Stork	NT	-	5
White Stork	Bonn	11	14

EN=Endangered; VU=Vulnerable; NT=Near-threatened; Bonn=Protected Internationally under the Bonn Convention on Migratory Species.

The SABAP data lists 1 Endangered, 6 Vulnerable and 9 near threatened species as occurring within the study area. In addition, one species, the White Stork is protected internationally under the Bonn Convention on Migratory Species.

Two CWAC sites occur in the study area. A potential CWAC site is any body of water, other than the oceans, which supports a significant number of birds. This definition includes natural pans, vleis, marshes, lakes, rivers, estuaries and lagoons as well as the whole gamut of manmade impoundments. The two CWAC sites are Oranje Pan and Coetzeespruit Dam. Key IUCN Listed species recorded at the CWAC sites include the Greater Flamingo and African Marsh-Harrier.

CAR route MM03 of the Mpumalanga Precinct runs in close proximity to the Study area. Southern Bald Ibis was the only key species recorded on this route during the study period.

The 2629BA QDGS also incorporates part of an Important Bird Area (IBA) - Amersfoort-bethal-carolina District. Although this IBA falls outside of the 8km study radius, it is known to hold a large proportion (>10%) of the global population of the endangered Botha's Lark (Barnes 1998). This species favors short dense, natural grassland found on plateaus and upper hill slopes. Such habitat was not observed at any of the proposed sites for this project. The majority of the study area comprised of agricultural lands, planted pastures, vleis and dams which are habitats not usually preferred by Botha's Lark. The Globally threatened Wattled Crane was listed as a vagrant to this IBA, while other key listed species recorded include Southern Bald Ibis, Lesser Kestrel, Blue Crane, African Grass Owl, Lanner Falcon and Blackwinged Lapwing. However, of these only the Southern Bald Ibis, African Grass Owl and Lesser Kestrel were recorded in the SABAP1 data from the QDGS, and the fact that the study area does not fall within the IBA, suggests that those species not recorded in SABAP1 data, are unlikely to occur on site.

3.1.1. Southern African Bird Atlas Project 2

SABAP 2 data was also consulted, with the two pentads in the study area, 2600_2935 and 2555_2935, recording totals of 70 and 78 species respectively. Only one card had been submitted for pentad 2600_2935, while three counts have been conducted in pentad 2555_2935 to date. This represents insufficient

data to be considered an accurate indication of species present or absent. It was noted, however, that pentad 2555_2935 had report rates of 33% (i.e. 1 of 3 counts) for both Greater and Lesser Flamingoes. The preferred site alternative falls within the pentad 2600_2935, which had only been counted once, with Greater Flamingo being the only relevant species recorded. From and additional two pentads in the broader area which had been counted more than twice (2555_2935, and 2555_2930), the following species observed are relevant: Lesser Kestrel; Amur Falcon; Lesser Flamingo and Greater Flamingo.

Interestingly, 14 (which is the vast majority) of the relevant species identified in the SABAP 1 data (i.e. Table 3), have not been recorded in the SABAP 2 data for the pentads examined. This however, does not necessarily mean that these species do not occur here, or that they have moved from the area, post SABAP1, but may merely be due to the low counting effort of the pentads, or selective micro habitat counting by the SABAP2 field counters. Furthermore, one must be cautious when comparing these data sets, as the pentads represents far smaller sampling areas than the QDGS's, as well as different sampling efforts.

3.1.2 Bird Micro-habitats

An examination of the micro habitats available to birds was conducted. These are generally evident at a much smaller spatial scale than vegetation types, and are determined by a host of factors such as vegetation type, topography, land use and man-made infrastructure. The following micro-habitats were identified in the study area.

Cultivated Lands and Pasture

Figure 4: Cultivated lands in the study area. This picture was taken at Alternative site E.

Figure 5: Cultivated land and pasture, to the west of the site. Note the centre pivot irrigation system, often favored for perching by Crane species.

Figure 6: A view of a portion of the proposed ash dam site, showing cultivated pastures.

Arable or cultivated land as well as pastures, represents a significant feeding area for many bird species in any landscape for the following reasons: through opening up the soil surface, land preparation makes many insects, seeds, bulbs and other food sources readily accessible to birds and other predators; the crop or pasture plants cultivated are often eaten themselves by birds, or attract insects which are in turn eaten by birds; during the dry season arable lands often represent the only green or attractive food sources in an otherwise dry landscape. Arable lands exist in this study area, mostly planted to pasture or corn at the time of site visit. Relevant bird species that may be attracted to these areas include the Denham's Bustard, Southern Bald Ibis and White Stork.

Drainage Lines and Wetlands

Figure 7: A drainage line, in the broader area, with evidence of erosion.

Figure 8: The drainage line pictured above in figure 7, leads to this wetland area, which was the extension of a large dam.

Drainage lines and wetlands are an important form of habitat to numerous species. Drainage lines are often surrounded by natural grasslands, which may provide habitat for species such as African Grass Owl and Botha's lark. Various

waterfowl, such as ducks and geese, may make use of these areas. Figures 7 and 8 above, were taken in the broader area, and no such large wetlands were observed on site alternative E, itself. Some small wet area, to the north of the proposed site was observed, and is shown in figure 9.

Figure 9: A "marshy" wetland area, between the proposed site and the Hendrina Power Station.

Man-made Dams

Figure 10: A dam observed in the broader study area.

Artificially constructed dams have become important attractants to various bird species in the South African landscape. Various waterfowl frequent these areas and crane species often use dams to roost in communally. Birds such as flamingos and African Spoonbills may make use of these areas. Therefore dams are a key element of this study.

Pans

The broader area is scattered with numerous natural pans. May of these depressions do not always fill with water, and are only obvious pans in the rainy season. Pans are important attractants to various bird species in the South African landscape. Various waterfowl frequent these areas and crane species may often use pans to roost in communally. Birds such as Coots, Grebes, Ducks, Geese, Terns, Flamingos and African Spoonbills may make use of these areas.
A medium sized pan was observed (Figure 11), just to the south of the study area, close to the proposed power line alternative 2. However, this pan was found to be dry on inspection during the site visit, but may have water and attract birds during, and soon after, the rainy season. A large, full pan ("Blinkpan") was observed (see figures 12 and 13) approximately 5km west of the proposed site, with an estimated 1000+ individual Flamingos present (both Greater and Lesser Flamingos in equal numbers).

Figure 12: A large natural pan observed in the broader study area, where up to 1000 flamingos were counted during the second site visit in October 2011.

Figure 13: Both Greater and Lesser Flamingos were observed at this pan, "Blinkpan", approximately 5km west of the study site.

Open Grassland

Figure 14: One of the few natural grassy areas observed in the broader study area.

Grasslands represent a significant feeding area for many bird species, as well as possible breeding areas for others such as the African Grass Owl. Specifically, these open grassland patches typically attract the Blue Crane, Grey Crowned Crane (which have been identified in the nearby IBA discussed above) Sothern Bald Ibis, Secretarybird, White-bellied Korhaan, Denham's Bustard and White Stork. The grassland patches are also a favourite foraging area for game birds such as francolins and Helmeted Guineafowl. This in turn attracts large raptors because of both the presence and accessibility of prey. Very few patches of natural grassland are present on site.

Stands of Alien Trees

Figure 15: Patches of alien trees were observed in the east the study area.

These areas will mostly be important to physically smaller bird species and passerines, as well as providing roosting for certain raptors and larger species such as Geese and Ibises.

Table 3 below shows the micro habitats that each Red Data bird typically frequents in the study area. It must be stressed that birds can and will, by virtue of their mobility, utilise almost any areas in a landscape from time to time. However, the analysis below represents each species' most preferred or normal habitats. These locations are where most of the birds of that species will spend

most of their time – so logically that is where impacts on those species will be most significant. The likelihood of the species occurring (i.e. making use of the site for purposes such as foraging, feeding, hunting, nesting and breeding, or regularly flying over as part of a regular flyway) within the proposed ash dam site, or along the proposed line alternatives, is shown below, and is merely a prediction by the author based on available information, and experience.

Table 3: Preferred Micro-habitats and likelihood of occurrence on site of Red Data species recorded in the relevant QDGS's.

Species	**Preferred Micro-habitat**	**Likelihood of occurrence on site**
Botha's Lark	Long, mature natural grassland	Unlikely
Southern Bald Ibis	Grassland	Likely
African Marsh-Harrier	Dams and Wetlands	Possible
Lesser Kestrel	Arable lands and Grasslands	Possible
African Grass Owl	Grasslands	Possible
Denham's Bustard	Cultivated lands and Grasslands	Possible
White-bellied Korhaan	Cultivated lands and Grasslands	Possible
Yellow-billed Stork	Cultivated lands and Grasslands	Possible
Greater Flamingo	Dams and wetlands	Possible
Lesser Flamingo	Dams and Wetlands	Possible
Secretarybird	Cultivated lands and Grasslands	Unlikely
Black Harrier	Cultivated lands and Grasslands	Possible
Pallid Harrier	Grasslands and Wetlands	Unlikely
Blue Korhaan	Cultivated lands and Grasslands	Possible
Black-winged Pratincole	Cultivated lands and Grasslands	Possible
Black Stork	Rivers and Kloofs	Unlikely
White Stork	Cultivated lands and Grasslands	Likely

3.1.3 Personal observations

Appendix 1 shows the sightings list of birds observed on site and within the broader study area (i.e. within an approximate radius of 6km from the preferred ash dam site), during the two site visits. This list is merely for indicative purposes, and this list represents incidental observations (which could be

positively identified). Data from this list needs to be used with caution, as observations over such a short period, in only two seasons, cannot be taken as a true indication of the presence of all bird species in the area. In particular, the target species for this study are threatened, rare species, so the likelihood of seeing one during the site visit periods was limited. This study has therefore attached far more weight to the secondary data sources such as the bird atlas projects (SABAP1 and SABAP2) which collected data over a far longer period, and more diverse conditions. It must be noted that many "non Red Data" bird species also occur in the study area and could be impacted on by the power line. Although this impact assessment focuses on Red Data species, the impact on non Red Data species is also assessed, albeit in less detail. Furthermore, much of the mitigation recommended for Red Data species will also protect non Red Data species in the study area.

3.1.4 Focal Species List

Determining the focal species for this study, i.e. the most important species to be considered, is a four step process. Firstly, the micro-habitats available on site were identified. An analysis of the above existing avifaunal data represents the second step, i.e. which species occur in the area at significant abundances. The third step is to identify those species (which may be present based on the above two steps), and are more likely to be impacted upon by the ash dam and associated power-line. This step called on the vast experience of the EWT in evaluated and investigating electrical infrastructure impacts on birds (these impacts are discussed in more detail below). In general, large, heavy flying birds are more vulnerable to collision with over-head powerlines, while perching Raptors are more vulnerable to electrocution. Smaller species and passerines are vulnerable to displacement and habitat loss. The fourth and final step was to consider the species conservation status or other reasons for protecting the species. This involved primarily consulting the Red List bird species (Barnes 2000) as in Table 2.

The resultant list of 'target/focal species' for this study is as follows: Greater Flamingo, Lesser Flamingo, and Grey-crowned Crane, Denham's Bustard, Blue Korhaan, Southern Bald Ibis, and White Stork. In some cases, these species serve as surrogates for other similar species (as mitigation will be effective for both), examples being White Stork for Black Stork, and Blue Korhaan for White-bellied Korhaan. Assorted more common species will also be

relevant to this study, but it is believed that the above target species will to a large extent serve as surrogates for these in terms of impact assessment and management.

4. Findings

4.1. Ash Dam

Alternative 1 - Site E:

This site received a site preference ranking of 4 during the scoping study, and was thus preferred from an avifaunal perspective. It is situated closest to the Power Station, and was also the smallest of the proposed alternatives. It consists primarily of cultivated lands ("mielie fields"). It has many disturbed areas such as roads and powerlines in close proximity. However, the following impacts are identified.

- Construction phase

  The greatest predicted Impact of Ash dams on avifauna are the **destruction of habitat** and **disturbance** of birds during construction. During the construction phase, habitat destruction and alteration inevitably takes place. Habitat destruction is anticipated to be the most significant impact in this study area. However, this can be minimized and mitigated should the smallest alternative be chosen. Similarly, the above mentioned construction and maintenance activities impact on bird through disturbance, particularly during bird breeding activities. Disturbance of birds is anticipated to be of lower significance than habitat destruction.

- Operational phase

  Leachate from fly ash dams can contain heavy metals (Theism and Marley, 1979) which could result in **contamination of surrounding water sources**, used by water birds in the study area. Correct placing of the new dam, away from wetlands, dams and water bodies, will help to mitigate this impact.

Alternative 2 – No-go:

The current status quo would be maintained by not implementing the proposed Ash Dam. The current farming activities will continue and the land use will not

change. Presence and abundance of bird species, as described in the Avifaunal Scoping Report, would remain the same. Purely in terms of impacts on avifauna, this option would have the least impacts.

4.2. Transmission lines

Because of its' size and prominence, electrical infrastructure constitutes an important interface between wildlife and man. Negative interactions between wildlife and electricity structures take many forms, but two common problems in southern Africa are electrocution of birds (and other animals) and birds colliding with power lines (Ledger 1983; Verdoorn 1996; Kruger 1999; Van Rooyen 1999; Van Rooyen 2000). Other problems are electrical faults caused by bird excreta when roosting or breeding on electricity infrastructure, (Van Rooyen & Taylor 1999) and disturbance and habitat destruction during construction and maintenance activities. The following is a description of the predicted impacts for the various Corridor Alternatives, during the associated phases of the project.

Alternative Corridor 1:

- Construction phase

  Habitat destruction. During the construction phase of power lines some habitat destruction and alteration inevitably takes place. This happens with the construction of access roads, and the clearing of servitudes, as well as clearing vegetation at the substation site. Servitudes have to be cleared of excess vegetation at regular intervals in order to allow access to the line for maintenance, to prevent vegetation from intruding into the legally prescribed clearance gap between the ground and the conductors and to minimize the risk of fire under the line which can result in electrical flashovers. These activities have an impact on birds breeding, foraging and roosting in or in close proximity of the servitude through modification of habitat. Habitat destruction is anticipated to be of low to moderate significance in this study area.

Disturbance. Similarly, the above mentioned construction and maintenance activities impact on bird through disturbance, particularly during bird breeding activities. Disturbance of birds is anticipated to be of low significance.

- Operational phase

Electrocutions. Electrocution of birds on overhead lines is an important cause of unnatural mortality of raptors and storks. It has attracted plenty of attention in Europe, USA and South Africa (APLIC 1994; van Rooyen & Ledger 1999). Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (van Rooyen 2004). Electrocution is possible on 132kV lines, depending on the exact pole structure used. For this study, **it is assumed that a bird friendly structure will be used, and the detailed impact assessment below, is based on this assumption**. Therefore, the impact of electrocution is likely to be of low significance for the proposed power line.

Collisions. Collisions are the biggest single threat posed by transmission lines to birds in southern Africa (van Rooyen 2004). Most heavily impacted upon are bustards, storks, cranes and various species of water birds. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines (van Rooyen 2004, Anderson 2001). Unfortunately, many of the collision sensitive species are considered threatened in southern Africa. The Red Data species vulnerable to power line collisions are generally long living, slow reproducing species under natural conditions. Some require very specific conditions for breeding, resulting in very few successful breeding attempts, or breeding might be restricted to very small areas. These species have not evolved to cope with high adult mortality, with the results that consistent high adult mortality over an extensive period could have a serious effect on a population's ability to sustain itself in the long or even medium term. Many of the anthropogenic threats to these species are non-discriminatory as far as age is concerned (e.g. habitat destruction, disturbance and power lines) and therefore contribute to adult mortality, and it is not known what the cumulative effect of these impacts could be over the long term. Collision with the proposed line of certain large flying bird species such as Greater

Flamingo, Lesser Flamingo, White Stork and Southern Bald Ibis is a possibility.

Nesting of birds on pylons is in fact a positive impact on avifauna, but may impact negatively on the quality of electrical supply by causing electrical faults. In some cases the nest material may pose problems to the pylons structural integrity through added weight, and there is an increased fire risk due to the fuel load of these massive nests.

Disturbance: Routine maintenance of pylons and power lines could result in disturbance of certain bird species during the operational life span of the power line. This is especially true for breeding birds in the vicinity, as well as those that may roost or nest on the structures.

- De-commissioning phase

  During this phase it is possible that there may be an impact of **disturbance** on avifauna, as detailed above.

Alternative Corridor 2:

- Construction phase

  Habitat destruction. During the construction phase of power lines some habitat destruction and alteration inevitably takes place. This happens with the construction of access roads, and the clearing of servitudes, as well as clearing vegetation at the substation site. Servitudes have to be cleared of excess vegetation at regular intervals in order to allow access to the line for maintenance, to prevent vegetation from intruding into the legally prescribed clearance gap between the ground and the conductors and to minimize the risk of fire under the line which can result in electrical flashovers. These activities have an impact on birds breeding, foraging and roosting in or in close proximity of the servitude through modification of habitat. Habitat destruction is anticipated to be of low to moderate significance in this study area.

Disturbance. Similarly, the above mentioned construction and maintenance activities impact on bird through disturbance, particularly during bird breeding activities. Disturbance of birds is anticipated to be of moderate significance.

- Operational phase

Electrocutions. Electrocution of birds on overhead lines is an important cause of unnatural mortality of raptors and storks. It has attracted plenty of attention in Europe, USA and South Africa (APLIC 1994; van Rooyen & Ledger 1999). Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (van Rooyen 2004). Electrocution is possible on 132kV lines, depending on the exact pole structure used. For this study, **it is assumed that a bird friendly structure will be used, and the detailed impact assessment below, is based on this assumption**. Therefore, the impact of electrocution is likely to be of low significance for the proposed power line.

Collisions. Collisions are the biggest single threat posed by transmission lines to birds in southern Africa (van Rooyen 2004). Most heavily impacted upon are bustards, storks, cranes and various species of water birds. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines (van Rooyen 2004, Anderson 2001). Unfortunately, many of the collision sensitive species are considered threatened in southern Africa. The Red Data species vulnerable to power line collisions are generally long living, slow reproducing species under natural conditions. Some require very specific conditions for breeding, resulting in very few successful breeding attempts, or breeding might be restricted to very small areas. These species have not evolved to cope with high adult mortality, with the results that consistent high adult mortality over an extensive period could have a serious effect on a population's ability to sustain itself in the long or even medium term. Many of the anthropogenic threats to these species are non-discriminatory as far as age is concerned (e.g. habitat destruction, disturbance and power lines) and therefore contribute to adult mortality, and it is not known what the cumulative effect of these impacts could be over the long term. Collision with this proposed line alternative, of certain large flying bird species such as Greater Flamingo, Lesser Flamingo, White Stork and Southern Bald Ibis

is a slightly higher possibility, and this impact is expected to be of moderate significance.

Nesting of birds on pylons is in fact a positive impact on avifauna, but may impact negatively on the quality of electrical supply by causing electrical faults. In some cases the nest material may pose problems to the pylons structural integrity through added weight, and there is an increased fire risk due to the fuel load of these massive nests.

Disturbance: Routine maintenance of pylons and power lines could result in disturbance of certain bird species during the operational life span of the power line. This is especially true for breeding birds in the vicinity, as well as those that may roost or nest on the structures.

- De-commissioning phase

  During this phase it is possible that there may be an impact of **disturbance** on avifauna, as detailed above.

Alternative 3 – No-go:

- Construction phase
  N/A

- Operational phase

  The current status quo would be maintained by not re-routing the power line. The existing line would remain, with its current possible impacts of Collision and Electrocution, as discussed above.

4.3. Pipelines

Alternative Route 1:

- Construction phase

  The impacts of pipelines on avifauna are only expected during the construction phase in the form of **habitat destruction and disturbance**. Habitat destruction caused by construction will have some impact on avifauna, but as discussed elsewhere the habitat in this landscape is relatively uniform and disturbed and so this impact is unlikely to be too significant. Furthermore, much of the area can be re-habilitated to its

original state, once the pipelines have been laid underground. Disturbance of avifauna, especially breeding birds is likely to occur to some minor extent, but is not likely to be too significant.

Alternative 2 – No-go:

The current status quo would be maintained by not constructing pipelines. The current farming activities will continue and the land use will not change. Presence and abundance of bird species, as described in the Avifaunal Scoping Report, would remain the same.

5. Assessment of impacts

All of the predicted impacts above, have been rated for significance, as per a standard set of criteria (supplied by Lidwala Consulting Engineers (SA) (Pty) Ltd, and shown below in Appendix B). The ratings were done both for the construction (Appendix C) and Operational (Appendix D) phases of the project.

6. Mitigation and Management Measures

6.1. Ash Dam

- *Construction Phase*

Impact	*Mitigation*
Habitat destruction	Strict control should be maintained over all activities during construction, in particular heavy machinery and vehicle movements, and staff. It is difficult to mitigate properly for this as habitat destruction covering the entire ash dam footprint is inevitable. However, it is important to ensure that the construction **Environmental Management Plan** incorporates guidelines as to how best to minimize this impact, and ensure that only designated areas are impacted upon, as per the design.
Disturbance	Strict control should be maintained over all

	activities during construction. It is difficult to mitigate properly for this as some disturbance is inevitable. **During Construction, if any of the "Focal Species" identified in this report are observed to be roosting and/or breeding in the vicinity, the EWT is to be contacted for further instruction.**

- *Operational phase*

Impact	*Mitigation*
Leachate contamination of surrounding water sources	Ensuring that the construction Operational Management Plan incorporates guidelines as to how best to minimize this impact. Eskom must implement it existing Environmental procedures accordingly.

6.2. Transmission Lines

- Construction Phase

Impact	*Mitigation*
Habitat destruction	Strict control should be maintained over all activities during construction, in particular heavy machinery and vehicle movements, and staff. It is difficult to mitigate properly for this as some habitat destruction is inevitable. It is important to ensure that the construction **Environmental Management Plan i**ncorporates guidelines as to how best to minimize this impact.
Disturbance	Strict control should be maintained over all activities during construction. It is difficult to mitigate properly for this as some disturbance is inevitable. **During Construction, if any of the "Focal Species" identified in this**

	report are observed to be roosting and/or breeding in the vicinity, the EWT is to be contacted for further instruction.

- Operational Phase

Impact	*Mitigation*
Collision	Mark the relevant sections of line (i.e. those within the sensitivity zones, as depicted in figure 16 below) with appropriate marking devices. These sections of line, and the exact spans, will be finalised as part of the Environmental Management Programme (EMP) phase, once power-line routes are finalised and pylon positions are pegged.
Electrocution	All new pylon structures should make use of a "bird friendly" monopole structure, fitted with a bird perch, as per Eskom standard guidelines.
Nesting of birds on Tower structures and disturbance during routine maintenance.	No nests may be removed, without first consulting the EWT's Wildlife and Energy Program (WEP). During maintenance, if any of the "Focal Species" identified in this report are observed to be roosting and/or breeding in the vicinity, the EWT is to be contacted for further instruction**.**

6.3. New Pipe lines.

- Construction phase:

Impact	*Mitigation*
Habitat destruction	Strict control should be maintained over all activities during construction, in particular heavy machinery and vehicle movements,

	and staff. It is difficult to mitigate properly for this as some habitat destruction is inevitable. It is important to ensure that the construction **Environmental Management Plan i**ncorporates guidelines as to how best to minimize this impact.
Disturbance	Strict control should be maintained over all activities during construction. It is difficult to mitigate properly for this as some disturbance is inevitable. **During Construction, if any of the "Focal Species" identified in this report are observed to be roosting and/or breeding in the vicinity, the EWT is to be contacted for further instruction.**

Figure 16 below shows proposed the proposed power-line deviation alternatives, as well as sensitive zones (see red dotted polygons), through which overhead power-line sections may require collision mitigation. For line alternative 1, this includes an area to the west of the ash dam site, close to some wetlands, as well as a small section at the north east corner of the ash dam site. It is likely that alternative 2 will require more mitigation, as it passes to the north of a natural season al pan, on farm land to the south of the ash dam site, while alternative 1 will follow an existing tar road to the south of the ash dam site.

The exact spans of line requiring collision mitigation will be finalized by the EWT, once the preferred alternative is chosen and exact tower positions have been pegged. It is recommended that an avifaunal "site walkthrough" be conducted in order to achieve this, although a desk-top review may be possible (at the discretion of the avifaunal specialist) should time, cost or other constraints, not allow for an additional site visit

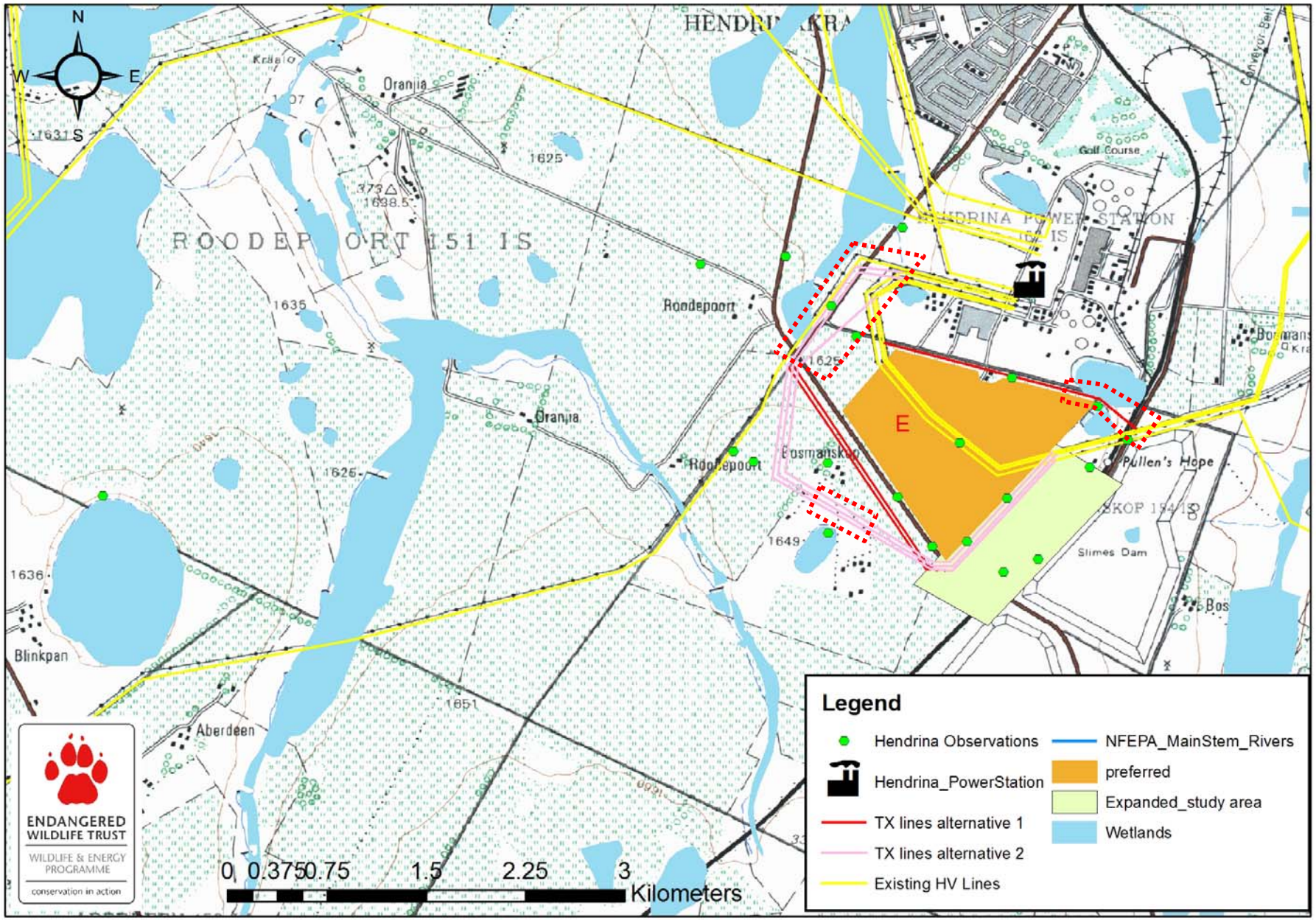

Figure 16: Map showing preferred ash dam site E, expanded study area, existing HV electrical infrastructure, wetlands, site visit observation points, proposed power-line deviation alternatives, as well as sensitive zones (see red dotted polygons), through which overhead power-line sections may require collision mitigation.

7. Conclusions

In conclusion, the proposed ash dam, as well as associated infrastructure can be built, provided that the various mitigation measures recommended in this report are implemented. From an avifaunal perspective, the overhead power-line poses the greatest threat to the majority of the red-listed focal species identified. Furthermore the following conclusions and recommendations are made:

- Habitat destruction and disturbance are impacts that are associated with all activities of the proposed project, however they are not expected to be highly significant, and should they be mitigated for as per this report and the use of the Construction EMP.
- Should any of the focal species be found to be nesting, breeding or roosting on the site, during any future phase, the EWT should be contacted for further instruction.
- Collisions are expected to be the largest impact of this project and thorough line marking is required to mitigate for this, regardless of which line option (1 or 2) is chosen.
- Over-head power-line alternative 1, appears to pass through less sensitive areas, and is more preferred.
- An “avifaunal walk through” or “desk top finalisation” is recommended in order to identify the exact spans of line for marking to mitigate for bird collisions.
- Provided that the high risk sections of line are mitigated in the form of marking, the impact should be contained. The EWT, through its partnership with Eskom and ongoing international networking, is well aware of the room for improvement on the effectiveness of line marking devices. However, it is our view that currently available devices, although not 100 % effective, would provide an acceptable level of mitigation for this project.
- Provided that a bird-friendly monopole structure is used for all new pylon structures in the project, as discussed elsewhere in the report, the impact of electrocution should be contained.

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Appendix A: List of species observed in the study area during the two site visits

Seq	Common name	Taxonomic name
41	Hamerkop, Hamerkop	Scopus umbretta
40	Quelea, Red-billed	Quelea quelea
39	Starling, Pied	Spreo bicolor
38	Widowbird, Fan-tailed	Euplectes axillaris
37	Turtle-Dove, Cape	Streptopelia capicola
36	Cormorant, Reed	Phalacrocorax africanus
35	Dove, Laughing	Streptopelia senegalensis
34	Duck, Yellow-billed	Anas undulata
33	Moorhen, Common	Gallinula chloropus
32	Widowbird, Red-collared	Euplectes ardens
31	Tern, Whiskered	Chlidonias hybrida
30	Teal, Red-billed	Anas erythrorhyncha
29	Stonechat, African	Saxicola torquatus
28	Spurfowl, Swainson's	Pternistis swainsonii
27	Spoonbill, African	Platalea alba
26	Prinia, Tawny-flanked	Prinia subflava
25	Pigeon, Speckled	Columba guinea
24	Lapwing, Blacksmith	Vanellus armatus
23	Kite, Black-shouldered	Elanus caeruleus
22	Ibis, Glossy	Plegadis falcinellus
21	Ibis, Hadeda	Bostrychia hagedash
20	Ibis, African Sacred	Threskiornis aethiopicus
19	Heron, Squacco	Ardeola ralloides
18	Heron, Black-headed	Ardea melanocephala
17	Fiscal, Common	Lanius collaris
16	Guineafowl, Helmeted	Numida meleagris
15	Grebe, Little	Tachybaptus ruficollis
14	Goose, Spur-winged	Plectropterus gambensis
13	Goose, Egyptian	Alopochen aegyptiacus
12	Flycatcher, Fiscal	Sigelus silens
11	Flamingo, Lesser	Phoenicopterus minor
10	Flamingo, Greater	Phoenicopterus ruber
9	Egret, Great	Egretta alba
8	Egret, Cattle	Bubulcus ibis
6	Dove, Red-eyed	Streptopelia semitorquata
5	Crow, Pied	Corvus albus

4	Cormorant, White-breasted	Phalacrocorax carbo
3	Coot, Red-knobbed	Fulica cristata
2	Chat, Anteating	Myrmecocichla formicivora
1	Bulbul, Dark-capped	Pycnonotus tricolor

Appendix B:

The Significance Rating Scales – for an EIA
Example 3

Issues are assessed in terms of the following criteria:

- The **nature**, a description of what causes the effect, what will be affected and how it will be affected;
- The physical **extent**, wherein it is indicated whether:
  - 1 - the impact will be limited to the site;
  - 2 - the impact will be limited to the local area;
  - 3 - the impact will be limited to the region;
  - 4 - the impact will be national; or
  - 5 - the impact will be international;
- The **duration**, wherein it is indicated whether the lifetime of the impact will be:
  - 1 - of a very short duration (0–1 years);
  - 2 - of a short duration (2-5 years);
  - 3 - medium-term (5–15 years);
  - 4 - long term (> 15 years); or
  - 5 - permanent;
- The **magnitude of impact on ecological processes**, quantified on a scale from 0-10, where a score is assigned:
  - 0 - small and will have no effect on the environment;
  - 2 - minor and will not result in an impact on processes;
  - 4 - low and will cause a slight impact on processes;
  - 6 - moderate and will result in processes continuing but in a modified way;
  - 8 - high (processes are altered to the extent that they temporarily cease); or
  - 10 - very high and results in complete destruction of patterns and permanent cessation of processes;
- The **probability of occurrence**, which describes the likelihood of the impact actually occurring. Probability is estimated on a scale where:
  - 1 - very improbable (probably will not happen;
  - 2 - improbable (some possibility, but low likelihood);

    - 3 - probable (distinct possibility);
    - 4 - highly probable (most likely); or
    - 5 - definite (impact will occur regardless of any prevention measures);
- the **significance**, which is determined through a synthesis of the characteristics described above (refer formula below) and can be assessed as low, medium or high;
- the **status**, which is described as either positive, negative or neutral;
- the degree to which the impact can be reversed;
- the degree to which the impact may cause irreplaceable loss of resources; and
- the *degree* to which the impact can be mitigated.

The **significance** is determined by combining the criteria in the following formula:

S = (E+D+M)*P; where

S = Significance weighting
E = Extent
D = Duration
M = Magnitude
P = Probability

The **significance weightings** for each potential impact are as follows:

- **< 30 points:** Low (i.e. where this impact would not have a direct influence on the decision to develop in the area),
- **31-60 points:** Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),
- **> 60 points:** High (i.e. where the impact must have an influence on the decision process to develop in the area).

Appendix C: Assessment of Impacts during the Construction phase.

Hendrina Ash Dam - EIA and Waste License Application

Avifaunal Impact Assessment

Significance Rating Table

Construction Phase									
Ash Dam - Site E									
Potential Impact	**Mitigation**	**Extent (E)**	**Duration (D)**	**Magnitude (M)**	**Probability (P)**	**Significance (S=(E+D+M)*P)**		**Status (+ve or -ve)**	**Confidence**
Disturbance	**Nature of impact:**	Noise and movement, from staff and machinery, may disturb avifauna, and nests may be disturbed.							
	with	2	1	2	3	**15**	**Low**	-	Medium
	without	2	1	4	4	**28**	**Low**	-	Medium
	degree to which impact can be reversed:	Partially reversible							
	degree of impact on irreplaceable resources:	Low							
Habitat destruction	**Nature of impact:**	Permanent removal of habitat that is used, or may be used, by avifauna.							
	with	1	5	4	5	**50**	**Medium**	-	Medium
	without	1	5	4	5	**50**	**Medium**	-	Medium
	degree to which impact can be reversed:	Irreversible							

	degree of impact on irreplaceable resources:	medium							
Ash Dam - No-Go Alternative									
Potential Impact	**Mitigation**	**Extent (E)**	**Duration (D)**	**Magnitude (M)**	**Probability (P)**	**Significance (S=(E+D+M)*P)**		**Status (+ve or -ve)**	**Confidence**
N/A	**Nature of impact:**								
	with								
	without								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
Pipeline Route 1									
Potential Impact	**Mitigation**	**Extent (E)**	**Duration (D)**	**Magnitude (M)**	**Probability (P)**	**Significance (S=(E+D+M)*P)**		**Status (+ve or -ve)**	**Confidence**
Disturbance	**Nature of impact:**	Noise and movement, from staff and machinery, may disturb avifauna, and nests may be disturbed.							
	with	2	1	2	3	**15**	**Low**	-	Medium
	without	2	1	4	4	**28**	**Low**	-	Medium
	degree to which impact can be reversed:	Partially reversible							
	degree of impact on irreplaceable resources:	Low							
Habitat destruction	**Nature of impact:**	Permanent removal of habitat that is used, or may be used, by avifauna.							
	with	1	3	2	5	**30**	**Low**	-	Medium
	without	1	3	2	5	**30**	**Low**	-	Medium

	degree to which impact can be reversed:	Partially reversible							
	degree of impact on irreplaceable resources:	Low							
Pipeline Route 2									
Potential Impact	**Mitigation**	**Extent (E)**	**Duration (D)**	**Magnitude (M)**	**Probability (P)**	**Significance (S=(E+D+M)*P)**		**Status (+ve or -ve)**	**Confidence**
Disturbance	**Nature of impact:**	Noise and movement, from staff and machinery, may disturb avifauna, and nests may be disturbed.							
	with	2	1	2	3	**15**	**Low**	-	Medium
	without	2	1	4	4	**28**	**Low**	-	Medium
	degree to which impact can be reversed:	Partially reversible							
	degree of impact on irreplaceable resources:	Low							
Habitat destruction	**Nature of impact:**	Permanent removal of habitat that is used, or may be used, by avifauna.							
	with	1	3	2	5	**30**	**Low**	-	Medium
	without	1	3	2	5	**30**	**Low**	-	Medium
	degree to which impact can be reversed:	Partially reversible							
	degree of impact on irreplaceable resources:	Low							
Pipeline - No-Go Alternative									
Potential Impact	**Mitigation**	**Extent (E)**	**Duration (D)**	**Magnitude (M)**	**Probability (P)**	**Significance (S=(E+D+M)*P)**		**Status (+ve or -ve)**	**Confidence**
N/A	**Nature of impact:**								
	with								

	without								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
Transmission Line - Corridor 1									
Potential Impact	**Mitigation**	**Extent (E)**	**Duration (D)**	**Magnitude (M)**	**Probability (P)**	**Significance (S=(E+D+M)*P)**		**Status (+ve or -ve)**	**Confidence**
Disturbance	**Nature of impact:**	Noise and movement, from staff and machinery, may disturb avifauna, and nests may be disturbed.							
	with	1	1	2	3	**12**	**Low**	-	Medium
	without	2	1	4	4	**28**	**Low**	-	Medium
	degree to which impact can be reversed:	Partially reversible							
	degree of impact on irreplaceable resources:	Low							
Habitat destruction	**Nature of impact:**	Permanent removal of habitat that is used, or may be used, by avifauna.							
	with	1	2	2	4	**20**	**Low**	-	Medium
	without	1	2	2	5	**25**	**Low**	-	Medium
	degree to which impact can be reversed:	Partially reversible							
	degree of impact on irreplaceable resources:	Low							
Transmission Line - Corridor 2									
Potential Impact	**Mitigation**	**Extent (E)**	**Duration (D)**	**Magnitude (M)**	**Probability (P)**	**Significance (S=(E+D+M)*P)**		**Status (+ve or -ve)**	**Confidence**
Disturbance	**Nature of impact:**	Noise and movement, from staff and machinery, may disturb avifauna, and nests may be disturbed.							

	with	1	1	4	3	**18**	**Low**	-	Medium
	without	2	1	6	4	**36**	**Medium**	-	Medium
	degree to which impact can be reversed:	Partially reversible							
	degree of impact on irreplaceable resources:	Low							
Habitat destruction	**Nature of impact:**	Permanent removal of habitat that is used, or may be used, by avifauna.							
	with	1	2	4	4	**28**	**Low**	-	Medium
	without	1	2	6	5	**45**	**Medium**	-	Medium
	degree to which impact can be reversed:	Partially reversible							
	degree of impact on irreplaceable resources:	Low							

Transmission Line - No-Go Alternative

Potential Impact	**Mitigation**	**Extent (E)**	**Duration (D)**	**Magnitude (M)**	**Probability (P)**	**Significance (S=(E+D+M)*P)**		**Status (+ve or -ve)**	**Confidence**
N/A	**Nature of impact:**								
	with								
	without								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								

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Avifaunal Impact Assessment

Significance Rating Table

Operational Phase

Ash Dam - Site E

Potential Impact	Mitigation	Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
Contamination of surrounding water.	**Nature of impact:**	Leachate containing heavy metals could result in contamination of water sources, used by water birds.							
	with	2	4	4	2	**20**	**Low**	-	Low
	without	2	4	6	3	**36**	**Medium**	-	Low
	degree to which impact can be reversed:	Reversible							
	degree of impact on irreplaceable resources:	Low							

Ash Dam - No-Go Alternative

Potential Impact	Mitigation	Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
N/A	**Nature of impact:**								
	with								
	without								

	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
Pipeline Route 1									
Potential Impact	**Mitigation**	**Extent (E)**	**Duration (D)**	**Magnitude (M)**	**Probability (P)**	**Significance (S=(E+D+M)*P)**		**Status (+ve or -ve)**	**Confidence**
N/A	**Nature of impact:**								
	with								
	without								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
Pipeline Route 2									
Potential Impact	**Mitigation**	**Extent (E)**	**Duration (D)**	**Magnitude (M)**	**Probability (P)**	**Significance (S=(E+D+M)*P)**		**Status (+ve or -ve)**	**Confidence**
N/A	**Nature of impact:**								
	with								
	without								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
Pipeline - No-Go Alternative									
Potential Impact	**Mitigation**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**		**Status**	**Confidence**

		(E)	(D)	(M)	(P)	(S=(E+D+M)*P)		(+ve or -ve)	
N/A	**Nature of impact:**								
	with								
	without								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								

Transmission Line - Corridor 1

Potential Impact	Mitigation	Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
Electrocution	**Nature of impact:**	Bird perches on pylon and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components, resulting in death or severe injury.							
	with	1	4	2	1	**7**	**Low**	-	High
	without	1	4	4	2	**18**	**Low**	-	High
	degree to which impact can be reversed:	Low							
	degree of impact on irreplaceable resources:	medium							
Collisions	**Nature of impact:**	Collision or red data species with the overhead line (usually the earth wire).							
	with	1	4	2	2	**14**	**Low**	-	High
	without	1	4	4	3	**27**	**Low**	-	High
	degree to which impact can be reversed:	Low							
	degree of impact on irreplaceable resources:	medium							
Disturbance	**Nature of impact:**	Routine maintenance of pylons and power lines could result in disturbance of certain bird species							

	with	1	2	4	2	**14**	**Low**		medium
	without	2	2	4	3	**24**	**Low**		medium
	degree to which impact can be reversed:	High							
	degree of impact on irreplaceable resources:	Low							

Transmission Line - Corridor 2

Potential Impact	**Mitigation**	**Extent (E)**	**Duration (D)**	**Magnitude (M)**	**Probability (P)**	**Significance (S=(E+D+M)*P)**		**Status (+ve or -ve)**	**Confidence**
Electrocution	**Nature of impact:**	Bird perches on pylon and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components, resulting in death or severe injury.							
	with	1	4	2	1	**7**	**Low**	-	High
	without	1	4	4	2	**18**	**Low**	-	High
	degree to which impact can be reversed:	Low							
	degree of impact on irreplaceable resources:	medium							
Collisions	**Nature of impact:**	Collision or red data species with the overhead line (usually the earth wire).							
	with	1	4	2	3	**21**	**Low**	-	High
	without	1	4	4	4	**36**	**Medium**	-	High
	degree to which impact can be reversed:	Low							
	degree of impact on irreplaceable resources:	medium							
Disturbance	**Nature of impact:**	Routine maintenance of pylons and power lines could result in disturbance of certain bird species							
	with	1	2	4	2	**14**	**Low**		medium
	without	2	2	4	3	**24**	**Low**		medium

	degree to which impact can be reversed:	High							
	degree of impact on irreplaceable resources:	Low							
Transmission Line - No-Go Alternative									
Potential Impact	**Mitigation**	**Extent (E)**	**Duration (D)**	**Magnitude (M)**	**Probability (P)**	**Significance (S=(E+D+M)*P)**		**Status (+ve or -ve)**	**Confidence**
N/A	**Nature of impact:**								
	with								
	without								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								