Juno Gromis 400kV Power Line

Deviation at Tronox Mines

Avifaunal Impact Assessment

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1. Introduction

WildSkies previously conducted an avifaunal impact assessment for the proposed Kudu Juno 400kV power line (Smallie & Van Rooyen, 2006). More recently, Eskom proposed a deviation to the proposed route in the vicinity of Tronox Mines, for which an avifaunal impact assessment was conducted (Afzelia, 2016).

In 2020 a second deviation at Tronox Mines was proposed by Eskom. WildSkies Ecological Services (Pty) Ltd (WildSkies) was appointed by Coastal & Environmental Services (CES) to conduct an avifaunal impact assessment for the deviation. The proposed deviation (approximately 15km long) is shown in Figure 1.

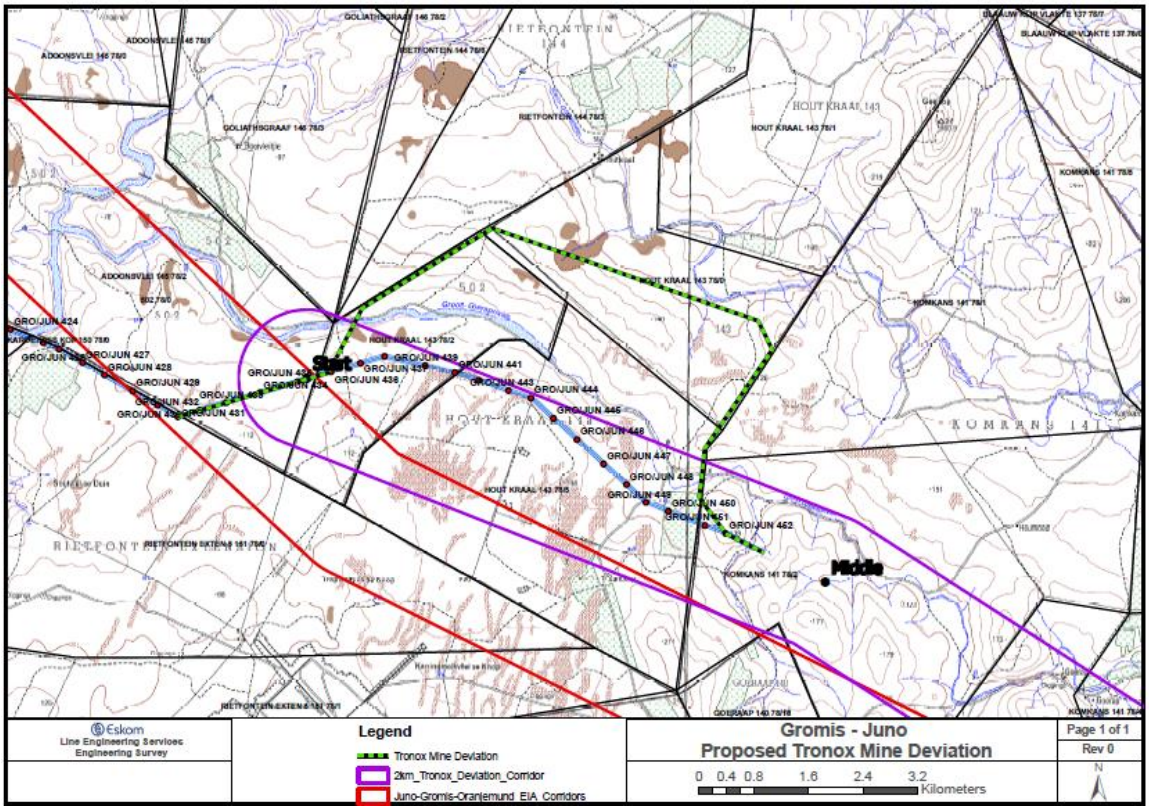

Figure 1. The locality map provided by Eskom.

The scope of work is described in more detail as follows:

- An avifaunal impact assessment is to be undertaken as part of the Basic Assessment Process for the Part 2 EA and EMPr amendment process for the 15km deviation required to the Juno-Gromis 400kV power line. This 15km deviation is located near Nuwerus within the Matzikama Local Municipality, West Coast District in the Western Cape. The original route of the power line, which was approved to traverse land owned by Tronox Mine, now

requires a deviation to avoid this portion of land as a result of the prospecting drilling results.

- The main objective of the avifaunal study is to determine the impact that the construction of a 15km power line deviation will have on the local bird population, to determine sensitive areas and provide mitigation measures to reduce the impacts of the power line.

    - The sensitivity of the study area is to be mapped in terms of bird sensitivity;
    - Description of the existing avifaunal environment including a description of bird communities most likely to be impacted;
    - Identification and description of micro habitats and possible bird species that will utilise them;
    - Typical impacts that could be expected from the development will be listed as well as the expected impact on the bird communities, impacts will be quantified (if possible) and a full description of predicted impacts (direct and indirect) will be provided, as per Annexure D, CES Impact rating methodology;
    - Gaps in baseline data must be highlighted and discussed. An indication of the confidence levels to be given;
    - Potential impact on the birds must be assessed and evaluated according to the magnitude, spatial scale, timing, duration, reversibility, probability and significance; and
    - Practical mitigation measures to be recommended and discussed.

2. Methods

In predicting the interactions between the proposed development and birds, a combination of science, field experience and common sense is required. More specifically the methodology used to predict impacts in the current study was as follows:

- The various avifaunal data sets listed below and the micro habitats within the study area were examined to determine the likelihood of these relevant species occurring on or near the site, and the importance of the study area for these species.
- The power line route was surveyed by driving and walking as much as possible of the route. During this field work the following was conducted:
    - Identification of micro habitats/land use on site
        - Representative photographs of available micro habitats (e.g. dams, wetlands, crops, forestry etc.);
        - Identification of any sensitive receptors e.g. wetlands, roosts, raptor nests etc.; and

        - Identification of any constraints to power line routing. For example wetlands and dams that could be avoided with slight route amendment.
    - Primary avifaunal data collection:
        - Two walked transects of approximately 500m each along the power line route;
        - Conducted early morning or late afternoon.
- A list of priority bird species was determined for this assessment.
- The potential impacts of the proposed facility on these above species and habitats were described and evaluated.
- Recommendations were made for the management and mitigation of impacts.

In simple terms, this study assesses which bird species could occur on site, how important they are, how important the site is for them, how the project will affect them, and how to mitigate these effects.

The study made use of the following data sources:

- Bird distribution data of the Southern African Bird Atlas Project (SABAP1 – Harrison, Allan, Underhill, Herremans, Tree, Parker & Brown, 1997) obtained from the Avian Demography Unit of the University of Cape Town, in order to ascertain which species occur in the study area. The more recent SABAP2 data was consulted online at (http://sabap2.adu.org.za). The useful source www.mybirdpatch.org.za combines these two data sources.
- The regional conservation status of all bird species occurring in the aforementioned degree squares was then determined with the use of The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland (Taylor *et al,* 2015). The global conservation status was obtained from the IUCN (2021).
- The Important Bird and Biodiversity Areas of South Africa data (Marnewick *et al*. 2015) were consulted but no IBA's exist close to site (the closest being Olifants River Estaury 45km south of the site).
- The Co-ordinated Avifaunal Roadcount (CAR) data from South Africa (www.car.birdmap.africa) was consulted to determine its relevance. The closest routes are too far from the site (170km) to be relevant.
- The Co-ordinated Waterbird Count (CWAC) data was consulted (www.cwac.birdmap.africa) to determine whether any data is available for the site. The nearest CWAC site is too far from site (100km) to be relevant.
- Information on the micro-habitat level was obtained through visiting the area and obtaining a first-hand perspective.
- Primary data on bird species diversity and abundance was obtained by our own sampling on site.

- Satellite Imagery of the area was studied using Google Earth ©2021.
- The original avifaunal impact assessment (Smallie & Van Rooyen, 2006) and the more recent deviation report (Afzelia, 2016) were consulted for background information.

3. Description of the affected environment

3.1. Vegetation type & micro habitat

The site consists of seven vegetation types as shown in Figure 2 (Mucina & Rutherford, 2018). CES' own work on site determined that the majority of the power line is in fact Namaqualand Strandveld. Namaqualand Strandveld occurs within the Western and Northern Cape Provinces from Gemsboksvlei as far south as Donkins Bay. It occurs on the coastal peneplain and can penetrate deeply inland (up to 40km), particularly in the northern region of its extent and is typically separated from the coast by the Namaqualand Coastal Duneveld. This vegetation type is characterised by low growing shrubland, rich in species and dominated by erect and creeping succulent shrubs such as *Cephalophyllum, Didelta, Othonna, Ruschia, Tetragona* and *Roepera* as well as non-succulent shrubs such as *Eriocephalus, Lebeckia, Pteronia* and *Salvia.* It has a rich component of annual flora that flowers during the late winter/early spring. The threat status for this vegetation type is not provided by Mucina and Rutherford (2006) although it is noted that this vegetation is threatened by coastal mining for heavy metals. The conservation target for this species is 26% and none of this vegetation is currently statutorily conserved. Ten percent has been transformed.

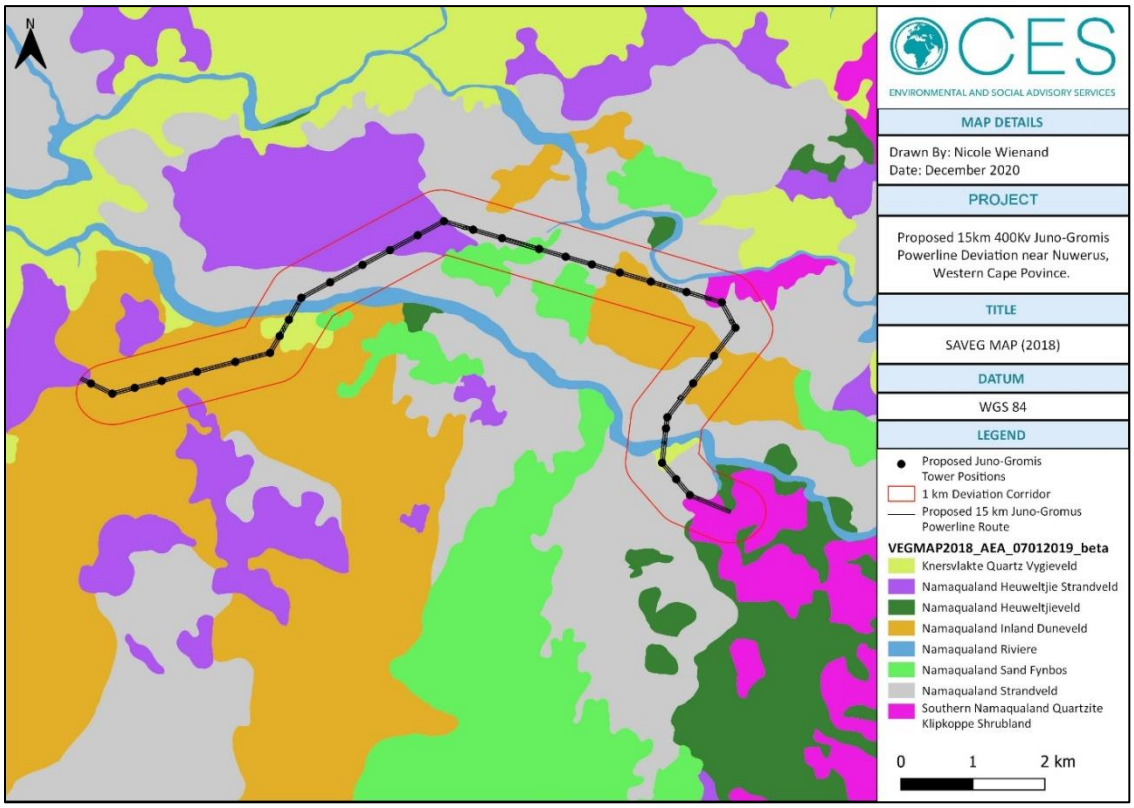

Figure 2. Vegetation types on site (map from CES).

For avifaunal purposes this is a low, open shrubland vegetation type and will accommodate avifauna suited to that structure of vegetation.

The micro habitats available to avifauna are often more informative than vegetation type, since they are determined by factors other than vegetation (e.g. land use, anthropogenic factors). The micro habitats available to birds on site are: strandveld, and riverine (including incised river banks). These are shown (amongst other site photographs) in Figure 3 below.

Figure 3. Site photographs.

3.2. Avifaunal community

The first and second Southern African Bird Atlas Projects (Harrison *et al*, 1997; and www.sabap2.adu.org.za) recorded a combined total of approximately 148 bird species in the broader area within which the proposed project is located. These are the species which could occur on the proposed site if conditions are right, but they have not been confirmed on site. Included amongst these 148 species are 9 regionally Red Listed bird species. Two of these, Black Harrier *Circus maurus* and Ludwig's Bustard *Neotis ludwigii* are Endangered, two are Vulnerable (Secretarybird *Sagittarius serpentarius* and Southern Black Korhaan *Afrotis afra*), and five are Near Threatened (Barlow's Lark *Calendulauda barlowi*, Greater Flamingo *Phoenicopterus ruber*, Lesser Flamingo *Phoenicopterus minor*, Double-banded Courser *Rhinoptilus africanus*, and Chestnut-banded Plover *Charadrius pallidus*).

Our own work on site recorded 38 bird species (27 by general inventory and a further 11 by walked transect). Two of these 38 species are regionally Red Listed: Secretarybird and Southern Black Korhaan.

Walked transects on site recorded a total of 17 small bird species. The most abundant of these was Mountain Wheatear *Oenanthe monticola*, followed by White-throated Canary *Crithagra albogularis*

and White-backed Mousebird *Colius colius*. No regionally Red Listed or otherwise priority bird species were recorded by this method.

Table 1. Summary Walked Transect data.

Common name	***Taxonomic name***	**Birds**	**Records**
Mountain Wheatear	*Oenanthe monticola*	6	1
White-throated Canary	*Crithagra albogularis*	5	2
White-backed Mousebird	*Colius colius*	4	1
Cape Weaver	*Ploceus capensis*	3	1
Capped Wheater	*Oenanthe pileata*	3	1
Karoo Prinia	*Prinia maculosa*	3	2
Namaqua Warbler	*Phragmacia substriata*	3	2
Spike-heeled Lark	*Chersomanes albofasciata*	3	2
Ant-eating Chat	*Myremcochichla arnoti*	2	1
Familiar Chat	*Cercomela familiaris*	2	2
Karoo Chat	*Cercomela schlegelii*	2	1
Karoo Lark	*Calendulauda albescens*	2	2
Bokmakierie	*Telophorus zeylonus*	1	1
Cape Bunting	*Emberiza capensis*	1	1
Common Fiscal	*Lanius collaris*	1	1
Grey-backed Sparrow Lark	*Eremopterix verticalis*	1	1
Lark-like Bunting	*Emberiza impetuani*	1	1

Appendix 2 presents the bird atlas data for the site and includes the species we recorded on the site. Table 2 summarises the priority bird species for the site and their likelihood of occurrence on site and possible impacts. Two priority species (Secretarybird & Southern Black Korhaan) were confirmed on site by our own work, and a third (Ludwig's Bustard) is considered Probable for occurring on site. These species are particularly susceptible to collision with overhead power lines. These species could occur anywhere on site in the strandveld and are not associated with any particular habitat feature. This means that the collision risk will be high for the full section of power line.

Table 2. Priority bird species for the site.

Common name	Taxonomic name	SAB AP1	SAB AP2	Taylor et al 2015	TOPS list	IUCN 2021	Endemic	Recorded on site	Likelihood of occurring on site	Possible impacts
Bustard, Ludwig's	*Neotis ludwigii*	1	1	EN	VU	EN			Probable	Collision with earth wire
Harrier, Black	*Circus maurus*	1		EN		EN	1		Possible	Collision with earth wire
Sandpiper, Curlew	*Calidris ferruginea*	1		LC		NT			Unlikely	-
Courser, Double-banded	*Rhinoptilus africanus*	1		NT		LC			Possible	Habitat destruction
Flamingo, Greater	*Phoenicopterus ruber*	1	1	NT		LC			Unlikely	-
Lark, Barlow's	*Calendulauda barlowi*	1		NT		LC			Possible	Habitat destruction
Flamingo, Lesser	*Phoenicopterus minor*	1	1	NT		NT			Unlikely	-
Plover, Chestnut-banded	*Charadrius pallidus*	1		NT		NT			Possible	Habitat destruction
Korhaan, Southern Black	*Afrotis afra*		1	VU		VU	1	1	Confirmed	Collision with earth wire
Secretarybird	*Sagittarius serpentarius*	1		VU		EN		1	Confirmed	Collision with earth wire

4. Assessment of impacts

4.1. Original findings

The original avifaunal impact assessment made the following findings:

Significant impacts identified by this study are as follows:

Collision with earth wires

- This impact is anticipated to be the most significant of this proposed line on birds.
- Ludwig's Bustard and Kori Bustard. Medium significance without mitigation, low with mitigation. Our confidence that this impact will occur is high, but confidence in where exactly on the line the impact will occur is only medium at this stage. The final walk through during the construction phase will result in much greater confidence.
- White Pelican – particularly at the Orange River crossing. This is medium without mitigation but is relatively easily mitigated for so low significance with mitigation.
- Greater and Lesser Flamingo at the Orange River crossing and any dams/pans that may exist close to the final alignment. This is relatively easily mitigated for so has low significance with mitigation. Confidence in this prediction is only medium because the entire study area was not visited and so we cannot be sure whether there are dams/pans in some areas.
- Secretarybird almost anywhere in the study area, in natural vegetation. This impact is difficult to mitigate for since it is such a wide ranging species and so remains medium significance with mitigation. Confidence that the impact will occur is high, but confidence in the exact location of the impact is only medium.
- White Stork in arable areas. This impact is relatively easily mitigated for as the exact location is known. Confidence is thus high.

- Assorted non Red Data water bird species, ibises and spoonbill in close proximity to rivers, dams and drainage lines. This impact is relatively easily mitigated for so the significance with mitigation is low. Confidence in this impact occurring and its locality is high.

- Korhaans almost anywhere in natural vegetation in the study area. Mitigation for this impact will result in it being of low significance. Our confidence in the impact occurring is high, but confidence in where it will occur is medium.

Disturbance during construction and maintenance activities

- Martial Eagle whilst breeding. Since effective mitigation for this is difficult given the constraints that construction contractors have and the duration of construction activities, this impact is rated as medium significance both with and without mitigation. Confidence in this assessment is medium to high as the species is known to breed on the existing Oranjemund Gromis 275kV power line currently.
- Ludwig's Bustard & Kori Bustard – particularly while breeding (approx July to Sep). Since mitigation is difficult, this impact is medium both with and without mitigation. Confidence in this impact occurring is high, although the exact locality of breeding of this species cannot be predicted and will hopefully be identified early in the construction phase.
- Peregrine Falcon – particularly while breeding (approximately Sep to Oct) in the vicinity of the Orange River crossing. Since probably only two towers will be involved with this crossing, mitigation should be possible (detailed below), so significance without mitigation is medium and with mitigation is low. Confidence in this assessment is medium to high as the species has been recorded breeding at this site in recent years (Anderson pers comm. van Rooyen pers. obs).

- Karoo Lark in natural vegetation, coastal dunes. Mitigation is difficult hence significance with and without mitigation is rated as medium. Confidence in this impact occurring is high, although the exact location along the line is not known.
- Assorted raptor species such as the Black Eagle, almost anywhere in the study area – particularly whilst breeding. As mentioned above, mitigation of this impact is difficult and so significance remains medium even with mitigation. Confidence in this impact occurring is high, but confidence in the location is medium.

Habitat destruction during construction and maintenance activities

- Since the entire study area and broader area is extremely uniform in terms of potential for birds, this is not anticipated to be a significant impact.

Impact of birds on quality of supply

- This may occur on any towers that have available perching/nesting areas above conductors – most likely only the strain towers as the proposed tower structure is cross rope suspension tower

Recommended mitigation measures for the identified impacts are as follows:

Collision with earth wires

- Certain sections of line will need to be marked with a suitable marking device in order to mitigate for collision of certain korhaans, Ludwig's and Kori Bustard. These areas will most likely be predominantly the flat areas. These areas will need to be identified by the EWT once the exact position of the line is determined and individual tower positions have been surveyed and pegged. It is therefore strongly recommended that a final avifaunal "walk through" is conducted during the construction phase.
- Line crossing the Orange River and all other rivers should be marked with a suitable marking device on the actual span crossing the river itself and one span either side.
- Line crossing any obvious drainage lines should be marked with a suitable marking device on only the span crossing the drainage line itself.
- Line crossing or adjacent to arable lands should be marked with a suitable marking device. "Adjacent to" is defined as within one span of.
- Line crossing or adjacent to either dams or pans should be marked with a suitable marking device. "Adjacent to" is defined as within one span of.

NOTE: Although many of the above identified areas can be easily identified by various "lay staff" on the project once construction begins, it is absolutely essential that an avifaunal "walk through" be done in order to identify those areas that are more difficult to distinguish such as those for the korhaans and bustards. Since this "walk through" would involve covering every single span of the line – it would make sense to identify all spans for marking on the line at the same time.

Disturbance during construction and maintenance activities

- In order to minimise disturbance of any raptors breeding nearby during construction, any such nests should be identified and reported to the EWT. In particular, the Environmental Control Officers for the project should be encouraged to identify such sites. Advice will then be given on how best to deal with the situation on a case by case basis.
- All construction and maintenance activities should be undertaken according to generally accepted environmental best practice guidelines.
- Similarly with Ludwig's and Kori Bustard nests (and in fact any bird species)

Habitat destruction during construction and maintenance activities

- Although habitat destruction was not rated as a significant impact on any of the Red Data or non Red Data species, all construction & maintenance activities should be carried out according to generally accepted environmental best practice guidelines so as to avoid impacting unnecessarily on the birds habitat in the area.

Impact of birds on quality of supply

- All towers on this line that have suitable perching or nesting substrate directly above conductors should be fitted with Bird Guards as per the Eskom standard guidelines – this will in all likelihood be only the strain type towers

More recently the Afzelia (2016) study made the following conclusions:

"Endangered", two are considered "Vulnerable" and "Near Threatened" (Barnes 2014). Avian species likely to be impacted by the proposed power line development include locally resident or transient raptors (Martial Eagle) and large terrestrial birds (Secretarybird, Blue Crane, Ludwig's Bustard and Kori Bustard).

Avifaunal activity within arid areas, in which the deviated power line corridor is located, is driven by rainfall events as this influences the growth of vegetation, presence of prey items and most notably the presence of water. As a result, avian populations tend to follow these rainfall events. This makes it very difficult to predict the abundance of avian species within this biome.

The impacts associated with the proposed 400kV power line project include:

- Destruction and alteration of avian habitats;
- Disturbance and displacement of birds; and
- Collision on associated overhead power lines.

Collisions with the earth wire is the main impact associated with the power line deviation. In order to mitigate this impact, it is imperative that earth wires crossing important avian habitats (agricultural lands, rivers, drainage lines and avian flyways) are fitted with anti-collision marking devices to increase the visibility of the power line and reduce likelihood of collisions. These must be Eskom approved anti-collision devices that are durable as the area is prone to strong winds.

The deviation of the route at the three localities is not deemed significant from avifaunal perspective. However, marking of the power line within sensitive avifaunal areas of the deviated power line route is imperative to mitigating the impact of this project.

4.2. Current findings

The potential impacts on avifauna have been assessed in Table 3 according to the standard criteria provided by CES (see Appendix 1).

Destruction of avifaunal habitat during construction and maintenance of the power line will be of Low Negative Significance both pre and post mitigation. Required mitigation consists mainly of measures to limit the amount of natural vegetation impacted on.

Disturbance of birds in the study area during construction of the power line will be of Low Negative Significance. This is since no sensitive bird species are known to breed on or near the site and so disturbance will have a relatively small effect on local bird populations.

Electrocution of large birds such as eagles on the power line pylons will be of Low Negative Significance pre mitigation since the clearances on a 400kv power line are sufficient to be safe for all perching birds. No mitigation is required for this impact.

Collision of large birds in flight with the overhead power line will be of Moderate Negative Significance pre mitigation. This should be mitigated to Low Negative Significance by installing line

marking devices onto the earth wire of the power line on high risk sections according to standard methods.

4.3. Required mitigation measures

To summarise, the following mitigation measures are necessary:

- A pre-construction avifaunal walk down should be conducted to:
  - Confirm final layout and identify any sensitivities that may arise between the conclusion of the EIA process and the construction phase.
  - Identify any sensitive species breeding on site that may arise between the conclusion of the EIA process and the construction phase.
- The earth wires on high risk sections should be fitted with an approved anti bird collision line marking device to make cables more visible to birds in flight and reduce the likelihood of collisions.
- All construction activities should be strictly managed according to generally accepted environmental best practice standards, so as to avoid any unnecessary impact on the receiving environment.
- All temporary disturbed areas should be rehabilitated according to the site's rehabilitation plan, following construction.

Table 3. Summary of formal assessment of impacts on avifauna (see Appendix 1 for criteria)

PROJECT COMPONENTS	CAUSE AND COMMENT	EFFECT				SIGNIFICANCE WITHOUT MITIGATION	REVERSIBILITY	MITIGATION MEASURES	SIGNIFICANCE OF IMPACT WITH MITIGATION
		DURATION	EXTENT	CONSEQUENCE / SEVERITY	PROBABILITY				
		(SIGNIFICANCE WITHOUT MITIGATION)					(SIGNIFICANCE WITH MITIGATION)		
Impact: Habitat destruction during construction									
Overhead power line	During construction vegetation is altered or moved for the project footprint. This destroys avifauna habitat, makes it less useful to birds, or less attractive to sensitive species.	Permanent	Localised	Slight	Definite	**LOW NEGATIVE**	Very difficult	A pre-construction avifaunal walk down should be conducted to confirm final layout and identify any sensitivities that may arise between the conclusion of the EIA process and the construction phase. All construction activities should be strictly managed according to generally accepted environmental best practice standards, so as to avoid any unnecessary impact on the receiving environment. All temporary disturbed areas should be rehabilitated according to the site's rehabilitation plan, following construction.	**LOW NEGATIVE**
Impact: Disturbance of birds during construction & operations									

PROJECT COMPONENTS	CAUSE AND COMMENT	EFFECT				SIGNIFICANCE WITHOUT MITIGATION	REVERSIBILITY	MITIGATION MEASURES	SIGNIFICANCE OF IMPACT WITH MITIGATION
		DURATION	EXTENT	CONSEQUENCE / SEVERITY	PROBABILITY				
		(SIGNIFICANCE WITHOUT MITIGATION)					(SIGNIFICANCE WITH MITIGATION)		
Overhead power line	Birds are disturbed by construction or operations activities & their survival or reproduction is compromised. Most applicable with breeding sensitive bird species.	Short term	Study area	Slight	Possible	**LOW NEGATIVE**	Moderate	An avifaunal walk down should be conducted to confirm final layout and identify any sensitive species breeding on site that may arise between the conclusion of the EIA process and the construction phase. All construction activities should be strictly managed according to generally accepted environmental best practice standards, so as to avoid any unnecessary impact on the receiving environment.	**LOW NEGATIVE**
Impact: Electrocution of birds on power line & in substations									
Overhead power line	Large birds are electrocuted whilst perched on pylons, by bridging the critical clearances between phases or phase –earth hardware.	Permanent	Global	Slight	Unlikely on 400KV	**LOW NEGATIVE**	Very difficult	None required	**LOW NEGATIVE**
Impact: Collision of birds on overhead power line									

PROJECT COMPONENTS	CAUSE AND COMMENT	EFFECT				SIGNIFICANCE WITHOUT MITIGATION	REVERSIBILITY	MITIGATION MEASURES	SIGNIFICANCE OF IMPACT WITH MITIGATION
		DURATION	EXTENT	CONSEQUENCE / SEVERITY	PROBABILITY				
		(SIGNIFICANCE WITHOUT MITIGATION)					(SIGNIFICANCE WITH MITIGATION)		
Overhead power lines	Birds in flight collide with overhead cables (conductors or earth wires) whilst in mid-flight. This occurs when they don't see the cables until too late to take evasive action.	Permanent	Global	Severe	Possible	**MODERATE NEGATIVE**	Very difficult	A pre-construction avifaunal walk down should be conducted to confirm final layout and identify any new sensitivities. The earth wires on high risk sections should be fitted with an approved anti bird collision line marking device to make cables more visible to birds in flight and reduce the likelihood of collisions.	**LOW NEGATIVE**

5. Conclusions

We make the following findings with respect to the proposed power line route deviation:

- Destruction of avifaunal habitat during construction and maintenance of the power line will be of Low Negative Significance both pre and post mitigation. Required mitigation consists mainly of measures to limit the amount of natural vegetation impacted on.
- Disturbance of birds in the study area during construction of the power line will be of Low Negative Significance. This is since no sensitive bird species are known to breed on or near the site and so disturbance will have a relatively small effect on local bird populations.
- Electrocution of large birds such as eagles on the power line pylons will be of Low Negative Significance pre mitigation since the clearances on a 400kV power line are sufficient to be safe for all perching birds. No mitigation is required for this impact.
- Collision of large birds in flight with the overhead power line will be of Moderate Negative Significance pre mitigation. This should be mitigated to Low Negative Significance by installing line marking devices onto the earth wire of the power line on high risk sections according to standard methods.

To summarise, the following mitigation measures are necessary:

- A pre-construction avifaunal walk down should be conducted to:
    - Confirm final layout and identify any sensitivities that may arise between the conclusion of the EIA process and the construction phase.
    - Identify any sensitive species breeding on site that may arise between the conclusion of the EIA process and the construction phase.
- The earth wires on this full section of power line should be fitted with an approved anti bird collision line marking device to make cables more visible to birds in flight and reduce the likelihood of collisions.
- All construction activities should be strictly managed according to generally accepted environmental best practice standards, so as to avoid any unnecessary impact on the receiving environment.
- All temporary disturbed areas should be rehabilitated according to the site's rehabilitation plan, following construction.

If these mitigation measures are implemented correctly we recommend the proposed project be authorised to proceed.

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Appendix 1. Criteria used for the formal assessment of impacts

The following standard rating scales have been defined for assessing and quantifying the identified impacts. This is necessary since impacts have a number of parameters that need to be assessed. The identified impacts have been assessed against the following criteria:

Six factors are considered when assessing the significance of the identified issues, namely:

1. **Significance** - Each of the below criterion (points 2-6 below) are ranked with scores assigned, as presented in Table 1 to determine the overall significance of an activity. The total scores recorded for the effect (which includes scores for duration; extent; consequence and probability) and reversibility / mitigation are then read off the matrix presented in Table 9-1, to determine the overall significance of the issue. The overall significance is either negative or positive.
2. **Consequence/severity** - the consequence scale is used in order to objectively evaluate how severe a number of negative impacts might be on the issue under consideration, or how beneficial a number of positive impacts might be on the issue under consideration.
3. **Extent** - the spatial scale defines the physical extent of the impact.
4. **Duration** - the temporal scale defines the significance of the impact at various time scales, as an indication of the duration of the impact.
5. The **probability** of the impact occurring - the likelihood of impacts taking place as a result of project actions arising from the various alternatives. There is no doubt that some impacts would occur (e.g. loss of vegetation), but other impacts are not as likely to occur (e.g. vehicle accident) and may or may not result from the proposed development and alternatives. Although some impacts may have a severe effect, the likelihood of them occurring may affect their overall significance.
6. **Reversibility / Mitigation** – The degree of difficulty of reversing and/or mitigating the various impacts ranges from very difficult to easily achievable. The four categories used are listed and explained in Table 9-1 below. Both the practical feasibility of the measure, the potential cost and the potential effectiveness is taken into consideration when determining the appropriate degree of difficulty.

The relationship of the issue to the temporal scale, spatial scale and the severity are combined to describe the overall importance rating, namely the significance of the assessed impact.

The impact is first classified as a positive (+) or negative (-) impact. The impact then undergoes an evaluation according to a set of criteria.

Ranking of Evaluation Criteria.

Effect	Duration

	Short term	Less than 5 years
	Medium term	Between 5-20 years
	Long term	More than 20 years
	Permanent	Over 40 years or resulting in a permanent and lasting loss
	Extent	
	Localised	Impacts affect a small area of a few hectares in extent. Often only a portion of the project area.
	Study area	The proposed site and its immediate surroundings.
	Municipal	Impacts affect the Nelson Mandela Bay Metropolitan Municipality, or any towns within the municipality.
	Regional	Impacts affect the wider area or the Eastern Cape Province as a whole.
	National	Impacts affect the entire country.
	International/Global	Impacts affect other countries or have a global influence.
	Consequence/severity	
	Slight	Slight impacts or benefits on the affected system(s) or party(ies)
	Moderate	Moderate impacts or benefits on the affected system(s) or party(ies)
	Severe/ Beneficial	Severe impacts or benefits on the affected system(s) or party(ies)
	Probability	
	Definite	More than 90% sure of a particular fact. Should have substantial supportive data.
	Probable	Over 70% sure of a particular fact, or of the likelihood of that impact occurring.
	Possible	Only over 40% sure of a particular fact, or of the likelihood of an impact occurring.
	Unsure/Unlikely	Less than 40% sure of a particular fact, or of the likelihood of an impact occurring.
Reversibility/ Mitigation	**Impact Reversibility / Mitigation**	
	Easy	The impact can be easily, effectively and cost effectively mitigated/reversed
	Moderate	The impact can be effectively mitigated/reversed without much difficulty or cost
	Difficult	The impact could be mitigated/reversed but there will be some difficultly in ensuring effectiveness and/or implementation, and significant costs
	Very Difficult	The impact could be mitigated/reversed but it would be very difficult to ensure effectiveness, technically very challenging and financially very costly

Impacts Severity Rating

Impact severity *(The severity of negative impacts, or how beneficial positive impacts would be on a affected system or affected party)*	
Very severe	**Very beneficial**
An irreversible and permanent change to the affected system(s) or party(ies) which cannot be mitigated. For example the permanent loss of land.	A permanent and very substantial benefit to the affected system(s) or party(ies), with no real alternative to achieving this benefit. For example the vast improvement of sewage effluent quality.
Severe	**Beneficial**
Long term impacts on the affected system(s) or party(ies) that could be mitigated. However, this mitigation would be difficult, expensive or time consuming, or some	A long term impact and substantial benefit to the affected system(s) or party(ies). Alternative ways of achieving this benefit would be difficult, expensive or

combination of these. For example, the clearing of forest vegetation.	time consuming, or some combination of these. For example an increase in the local economy.
Moderately severe	**Moderately beneficial**
Medium to long term impacts on the affected system(s) or party (ies), which could be mitigated. For example constructing a sewage treatment facility where there was vegetation with a low conservation value.	A medium to long term impact of real benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are equally difficult, expensive and time consuming (or some combination of these), as achieving them in this way. For example a 'slight' improvement in sewage effluent quality.
Slight	**Slightly beneficial**
Medium or short term impacts on the affected system(s) or party(ies). Mitigation is very easy, cheap, less time consuming or not necessary. For example a temporary fluctuation in the water table due to water abstraction.	A short to medium term impact and negligible benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are easier, cheaper and quicker, or some combination of these.
No effect	**Don't know/Can't know**
The system(s) or party(ies) is not affected by the proposed development.	In certain cases it may not be possible to determine the severity of an impact.

Overall Significance Rating

OVERALL SIGNIFICANCE *(THE COMBINATION OF ALL THE ABOVE CRITERIA AS AN OVERALL SIGNIFICANCE)*	
VERY HIGH NEGATIVE	**VERY BENEFICIAL (VERY HIGH +)**
These impacts would be considered by society as constituting a major and usually permanent change to the (natural and/or social) environment, and usually result in severe or very severe effects, or beneficial or very beneficial effects. Example: The loss of a species would be viewed by informed society as being of VERY HIGH significance. Example: The establishment of a large amount of infrastructure in a rural area, which previously had very few services, would be regarded by the affected parties as resulting in benefits with VERY HIGH significance.	
HIGH NEGATIVE	**BENEFICIAL (HIGH +)**
These impacts will usually result in long term effects on the social and/or natural environment. Impacts rated as HIGH will need to be considered by society as constituting an important and usually long term change to the (natural and/or social) environment. Society would probably view these impacts in a serious light. Example: The loss of a diverse vegetation type, which is fairly common elsewhere, would have a significance rating of HIGH over the long term, as the area could be rehabilitated. Example: The change to soil conditions will impact the natural system, and the impact on affected parties (such as people growing crops in the soil) would be HIGH.	
MODERATE NEGATIVE	**SOME BENEFITS (MODERATE +)**
These impacts will usually result in medium to long term effects on the social and/or natural environment. Impacts rated as MODERATE will need to be considered by society as constituting a fairly important and usually medium term change to the (natural and/or social) environment. These impacts are real but not substantial. Example: The loss of a sparse, open vegetation type of low diversity may be regarded as MODERATELY significant.	
LOW NEGATIVE	**FEW BENEFITS (LOW +)**
These impacts will usually result in medium to short term effects on the social and/or natural environment. Impacts rated as LOW will need to be considered by the public and/or the specialist as constituting a fairly unimportant and usually short term change to the (natural and/or social) environment. These impacts are not substantial and are likely to have little real effect. Example: The temporary changes in the water table of a wetland habitat, as these systems are adapted to fluctuating water levels. Example: The increased earning potential of people employed as a result of a development would only result in benefits of LOW significance to people who live some distance away.	
NO SIGNIFICANCE	
There are no primary or secondary effects at all that are important to scientists or the public. Example: A change to the geology of a particular formation may be regarded as severe from a geological perspective, but is of NO significance in the overall context.	
DON'T KNOW	
In certain cases it may not be possible to determine the significance of an impact. For example, the primary or secondary impacts on the social or natural environment given the available information. Example: The effect of a development on people's psychological perspective of the environment.	

All feasible alternatives and the “no-go option” will be equally assessed in order to evaluate the significance of the “as predicted” impacts (prior to mitigation) and the “residual” impacts (that remain after mitigation measures are taken into account). The reason(s) for the judgement will be provided when necessary.

All impacts must have a “cause and comment”, a significance rating before mitigation, after mitigation and for the no-go option. Impacts should also indicate applicable mitigation measure/ recommendations to reduce the impact significance.

Appendix 2. Bird data for the site

Common name	Taxonomic name	SAB AP1	SAB AP2	Taylor et al 2015	TOPS list	IUCN 2021	Endemic	Recorded on site
Bustard, Ludwig's	*Neotis ludwigii*	1	1	EN	VU	EN		
Harrier, Black	*Circus maurus*	1		EN		EN	1	
Sandpiper, Curlew	*Calidris ferruginea*	1		LC		NT		
Courser, Double-banded	*Rhinoptilus africanus*	1		NT		LC		
Flamingo, Greater	*Phoenicopterus ruber*	1	1	NT		LC		
Lark, Barlow's	*Calendulauda barlowi*	1		NT		LC		
Flamingo, Lesser	*Phoenicopterus minor*	1	1	NT		NT		
Plover, Chestnut-banded	*Charadrius pallidus*	1		NT		NT		
Korhaan, Southern Black	*Afrotis afra*		1	VU		VU	1	1
Secretarybird, Secretarybird	*Sagittarius serpentarius*	1		VU		EN		1
Eagle, Booted	*Aquila pennatus*	1				LC		
Bulbul, Cape	*Pycnonotus capensis*		1				1	
Canary, Black-headed	*Serinus alario*	1					1	
Flycatcher, Fairy	*Stenostira scita*	1	1				1	
Francolin, Grey-winged	*Scleroptila africanus*		1				1	
Heron, Black-headed	*Ardea melanocephala*	1	1				1	1
Lark, Cape Clapper	*Mirafra apiata*	1	1				1	
Lark, Karoo	*Calendulauda albescens*	1	1				1	1
Lark, Large-billed	*Galerida magnirostris*	1	1				1	
Penduline-tit, Cape	*Anthoscopus minutus*	1	1				1	1
Prinia, Drakensberg	*Prinia hypoxantha*	1					1	
Prinia, Karoo	*Prinia maculosa*	1	1				1	
Sparrowlark, Black-eared	*Eremopterix australis*	1					1	
Starling, Pied	*Spreo bicolor*	1	1				1	
Tit-babbler, Layard's	*Parisoma layardi*	1	1				1	
Warbler, Namaqua	*Phragmacia substriata*		1				1	1
Weaver, Cape	*Ploceus capensis*	1	1				1	
Avocet, Pied	*Recurvirostra avosetta*	1						
Barbet, Acacia Pied	*Tricholaema leucomelas*		1					
Bee-eater, European	*Merops apiaster*	1	1					1
Bishop, Yellow	*Euplectes capensis*	1						
Bokmakierie, Bokmakierie	*Telophorus zeylonus*	1	1					1
Bunting, Cape	*Emberiza capensis*	1	1					1
Bunting, Lark-like	*Emberiza impetuani*	1	1					1
Buzzard, Jackal	*Buteo rufofuscus*	1	1					1
Canary, Cape	*Serinus canicollis*		1					
Canary, White-throated	*Crithagra albogularis*	1	1					1
Canary, Yellow	*Crithagra flaviventris*	1	1					
Cape Bunting	*Emberiza capensis*							1
Cape Crow	*Corvus capensis*							1
Cape Wagtail	*Motacilla capensis*							1
Cape Weaver	*Ploceus capensis*							1
Chat, Anteating	*Myrmecocichla formicivora*	1	1					1
Chat, Familiar	*Cercomela familiaris*	1	1					1

Chat, Karoo	*Cercomela schlegelii*	1	1	1
Chat, Sickle-winged	*Cercomela sinuata*	1		
Chat, Tractrac	*Cercomela tractrac*	1		
Cisticola, Grey-backed	*Cisticola subruficapilla*	1	1	
Common Waxbill	*Estrilda astrild*			1
Coot, Red-knobbed	*Fulica cristata*		1	
Cormorant, Bank	*Phalacrocorax neglectus*	1		
Cormorant, Cape	*Phalacrocorax capensis*	1		
Cormorant, Crowned	*Phalacrocorax coronatus*	1		
Cormorant, White-breasted	*Phalacrocorax carbo*	1		
Crombec, Long-billed	*Sylvietta rufescens*	1	1	
Crow, Pied	*Corvus albus*	1	1	
Dove, Laughing	*Streptopelia senegalensis*	1	1	
Dove, Namaqua	*Oena capensis*	1	1	1
Eagle-owl, Spotted	*Bubo africanus*	1	1	1
Eremomela, Yellow-bellied	*Eremomela icteropygialis*	1		
European Bee-eater	*Merops apiaster*			1
Fiscal, Common (Southern)	*Lanius collaris*	1	1	1
Flycatcher, Chat	*Bradornis infuscatus*	1	1	
Gannet, Cape	*Morus capensis*	1		
Goose, Egyptian	*Alopochen aegyptiacus*	1	1	
Goose, Spur-winged	*Plectropterus gambensis*	1	1	
Goshawk, Southern Pale Chanting	*Melierax canorus*	1	1	1
Grebe, Black-necked	*Podiceps nigricollis*	1		
Grebe, Little	*Tachybaptus ruficollis*	1	1	
Greenshank, Common	*Tringa nebularia*	1		
Grey-backed Sparrow-Lark	*Eremopterix verticalis*			1
Guineafowl, Helmeted	*Numida meleagris*	1		
Gull, Grey-headed	*Larus cirrocephalus*	1		
Gull, Hartlaub's	*Larus hartlaubii*	1		
Gull, Kelp	*Larus dominicanus*	1		
Harrier-Hawk, African	*Polyboroides typus*	1		
Heron, Grey	*Ardea cinerea*	1	1	
Ibis, Hadeda	*Bostrychia hagedash*		1	
Karoo Prinia	*Prinia maculosa*			1
Kestrel, Greater	*Falco rupicoloides*	1		
Kestrel, Rock	*Falco rupicolus*	1	1	
Kingfisher, Giant	*Megaceryle maximus*	1		
Kite, Black-shouldered	*Elanus caeruleus*	1		1
Knot, Red	*Calidris canutus*	1		
Korhaan, Black	*Eupodotis afra*	1		
Lapwing, Blacksmith	*Vanellus armatus*	1	1	
Lapwing, Crowned	*Vanellus coronatus*	1	1	
Lark, Agulhas Clapper	*Mirafra marjoriae*	1		
Lark, Cape Long-billed	*Certhilauda curvirostris*	1	1	
Lark, Eastern Clapper	*Mirafra fasciolata*	1		

Lark, Karoo Long-billed	*Certhilauda subcoronata*	1		
Lark, Red-capped	*Calandrella cinerea*	1	1	1
Lark, Spike-heeled	*Chersomanes albofasciata*	1	1	1
Martin, Brown-throated	*Riparia paludicola*	1	1	
Martin, Rock	*Hirundo fuligula*	1	1	
Masked-weaver, Southern	*Ploceus velatus*	1		
Mountain Wheatear	*Oenanthe monticola*			1
Namaqua Dove	*Oena capensis*			1
Ostrich, Common	*Struthio camelus*	1	1	1
Owl, Barn	*Tyto alba*		1	
Oystercatcher, African Black	*Haematopus moquini*	1		
Pied Crow	*Corvus albus*			1
Pied Starling	*Lamprotornis bicolor*			1
Pigeon, Speckled	*Columba guinea*	1	1	1
Pipit, African	*Anthus cinnamomeus*	1		
Plover, Common Ringed	*Charadrius hiaticula*	1		
Plover, Grey	*Pluvialis squatarola*	1		
Plover, Kittlitz's	*Charadrius pecuarius*	1		
Plover, Three-banded	*Charadrius tricollaris*	1	1	
Plover, White-fronted	*Charadrius marginatus*	1		
Prinia, Spotted	*Prinia hypoxantha*	1		
Reed-warbler, African	*Acrocephalus baeticatus*		1	
Rock Kestrel	*Falco rupicolus*			1
Ruff, Ruff	*Philomachus pugnax*	1		
Sanderling, Sanderling	*Calidris alba*	1		
Sandgrouse, Namaqua	*Pterocles namaqua*	1	1	
Sandpiper, Common	*Actitis hypoleucos*	1		
Sandpiper, Marsh	*Tringa stagnatilis*	1		
Scrub-robin, Karoo	*Cercotrichas coryphoeus*	1	1	
Shelduck, South African	*Tadorna cana*	1	1	
Shoveler, Cape	*Anas smithii*		1	
Snake-eagle, Black-chested	*Circaetus pectoralis*	1		
Sparrow, Cape	*Passer melanurus*	1	1	1
Sparrow, House	*Passer domesticus*	1	1	
Sparrowlark, Grey-backed	*Eremopterix verticalis*	1	1	
Starling, Common	*Sturnus vulgaris*	1	1	
Stilt, Black-winged	*Himantopus himantopus*	1	1	
Stint, Little	*Calidris minuta*	1		
Stonechat, African	*Saxicola torquatus*	1	1	1
Sunbird, Dusky	*Cinnyris fuscus*	1	1	
Sunbird, Malachite	*Nectarinia famosa*	1	1	
Sunbird, Southern Double-collared	*Cinnyris chalybeus*	1	1	
Swallow, Barn	*Hirundo rustica*	1		
Swallow, White-throated	*Hirundo albigularis*	1	1	
Swift, Alpine	*Tachymarptis melba*	1		
Swift, Little	*Apus affinis*	1	1	
Swift, White-rumped	*Apus caffer*	1		
Teal, Cape	*Anas capensis*	1		
Teal, Red-billed	*Anas erythrorhyncha*		1	

Thick-knee, Spotted	*Burhinus capensis*	1		
Thrush, Karoo	*Turdus smithi*		1	
Tit, Grey	*Parus afer*	1	1	
Turnstone, Ruddy	*Arenaria interpres*	1		
Turtle-dove, Cape	*Streptopelia capicola*	1	1	
Wagtail, Cape	*Motacilla capensis*	1	1	
Warbler, Rufous-eared	*Malcorus pectoralis*	1	1	
Wheatear, Capped	*Oenanthe pileata*	1	1	1
Wheatear, Mountain	*Oenanthe monticola*	1	1	
Whimbrel, Common	*Numenius phaeopus*	1		
White-necked Raven	*Corvus albicollis*			1