CIVIL AVIATION SENSITIVITY STUDY IN SUPPORT OF AN ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED CONSTRUCTION OF THE 150KM BORUTHO-SILIMELA 400KV POWER LINE AND ITS ASSOCIATED INFRASTRUCTURE

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1 Background and Executive Summary

Institutional Situation

In March 2020, the National Department of Forestry, Fisheries and the Environment (DFFE) gazetted a Protocol (Appendix 6.10) that requires Environmental Assessment Practitioners (EAP's) to assess the environmental impact of proposed developments on nearby civil aviation facilities under the jurisdiction of the South African Civil Aviation Authority (SACAA). The SACAA, as agent for the International Civil Aviation Organisation (ICAO), is primarily concerned with civil aviation safety and security, while the DFFE is mandated to ensure that the environmental impact of developments on civil aviation infrastructure is within reasonable parameters. To this end the Protocol specifies distance limits that trigger specialist studies by civil aviation specialists. To assist EAP's, it developed a screening tool (Screening Tool) to allow them to undertake a preliminary assessment of the sensitivity of proposed developments. If this assessment indicates medium or higher sensitivity, then a specialist Civil Aviation Sensitivity Study (CASS) is necessary to verify or amend the assigned sensitivity level. Should the CASS conclude that the sensitivity is indeed medium or higher, a Civil Aviation Compliance Statement is then required.

Under parallel new regulations published in March 2023 by the SACAA (Amendment 26 of Part 139.01.30, Appendix 6.2), if a proposed project is with 8km of an aerodrome, then an Obstacle Approval application (CA139-27) may also be triggered once the project proceeds to construction i.e. after Environmental Authorisation is granted.

Project Description

NTC Group (Pty) Ltd company GA Environment (Pty) Ltd are undertaking an Environmental Impact Assessment and Environmental Management Programme Report ('EIA/EMPr') for the proposed 150km Borutho-Silimela 400kV Eskom powerline located between the Borutho Substation on farm Gillimberg 861 in Mokopane and running south to the proposed Silimela substation on farm Loskop Noord 12, near Marble Hall within the Lepelle-Nkumpi, Mogalakwena, Modimolle-Mookgophong and Ephriam Mogale Local Municipalities, Limpopo Province. The construction of the power line will aid Eskom in strengthening the power supply within Limpopo Province. The powerline route passes close to aerodromes as listed in Table 1, along a route indicated in Figure 2 (see Section 4).

While it is possible that on an individual basis (if the distance from the powerline route to a particular aerodrome exceeds 15km) certain aerodromes would not trigger a CASS, it has been deemed necessary to include all of them in the analysis. In respect of those closer than 8km to the powerline route, an Obstacle Assessment is also necessary in terms of Amendment 26 (March 2023) of the SA Civil Aviation Regulations.

Specialist Appointment

GWI Aviation Advisory (GWI) have been appointed as a specialist to undertake the CASS and to facilitate the future preparation and submission of the necessary Obstacle Approval Applications to the SACAA.

Should the CASS confirm that overall sensitivity remains medium or higher, it may be necessary to extend the Aeronautical Study, if requested by the CAA, and procure a Civil Aviation Compliance Statement, although this study in any event deals with the requirements of both a CASS, as required by the DFFE and those of the SACAA, to address overlapping issues and ensure a robust approach to both potential environmental and safety concerns.

Scope and Methodology

The CASS was conducted by GWI in terms of the DFFE Protocol, but also various SACAA standards, based on methodologies as outlined in the SACAA document "Technical Guidance Material for conducting Aeronautical Studies or Risk Assessment', effective January 2022 (Appendix 6.3). This includes the following elements:

- Initiation – Identification of potential impacts and risk issues
- Technical analysis
- Compliance assessment

- Risk Assessment – Estimation, Evaluation and Control
- Action and Monitoring, including Risk Mitigation (as required).

The study also references various standards and recommended practices (SARPS) of the International Civil Aviation Organisation (ICAO) and the Air Traffic and Navigational Services SOC Limited (ATNS).

In summary, the CASS arises because the powerline route is within the trigger distances of the aerodromes listed, for which the Screening Tool has indicated 'high' sensitivity. This relates mainly to potential risks associated with obstacle limitation surfaces, potential interference with communications and navigational equipment and infrastructure.

Executive Summary of Findings

Aeronautical Aspects - Obstacles

The main findings of the study are based on the maximum height of any structures of 45m above natural ground level.

- 5 of the 7 aerodromes identified necessitate the application for obstacle approval for the entire powerline.
- There are aeronautical communication facilities, in the form of VHF forward relay stations at Mokopane (Potgietersrus) and at Ysterberg which are within 35km of the proposed powerline. These are not impacted.
- Cranes, powerlines and other construction equipment will need to be marked and lighted in accordance with ruling SACAA standards, particularly CATS 139.01.30 (Obstacle Restriction and Removal *and* Visual Aids for Denoting Obstacles)

Environmental Aspects

The findings of the CASS are that the sensitivity is low, and that no Civil Aviation Compliance Statement will be required for the purposes of environmental authorisation.

2 Introduction

The proposed project entails the proposed construction of the Borutho-Silimela 400kV powerline and its associated infrastructure. The length of the powerline is approximately 150km. The proposed power line is located between the existing Borutho Substation on farm Gillimberg 861 in Mokopane and runs south to the existing Silimela Substation on farm Loskop Noord 12, near Marble Hall within the Lepelle-Nkumpi, Mogalakwena, Modimolle-Mookgophong and Ephriam Mogale Local Municipalities, Limpopo Province. The towers for the proposed powerline will be between 29m and 40m in height.

The proposed development requires Environmental Authorisation in terms of the National Environmental Management Act (Act 107 of 1998), and NTC Group is the independent Environmental Assessment Practitioner (EAP) appointed to conduct an Environmental Impact Assessment (EIA).

The powerline route passes relatively close to no fewer than 7 aerodromes or airstrips along the route, all of which are noted on the latest (June 2024) SA Civil Aviation Authority (SACAA) register of aerodromes at various different classifications, according to Table 1.

Aerodrome	ICAO Code	Licence Status	Threshold Height amsl (h_t)	Critical OLS height (h_o)	Nearest pylon ngl Height amsl (h_{pg})	Height Limit (h_t+45-h_{pg})	Distance to Powerline (km)	Compliance with CARS 139.01.30	Recommendations
FAQR/R325	2	N	1 066	45	1 113	-2	4,36	N	Obstacle Approval/ Marking CATS 139.01
R081	1	N	1 344	45	1 130	259	12,5	Y	Beyond 8km - Intervening obstacle (terrain)
R237	1	N	1 113	45	1 063	95	13,9	Y	Beyond 8km – No Obstacle Approval Reqd.
R214	1	N	913	45	934	24	3,4	N	Obstacle Approval/ Marking CATS 139.01
FAMI/R216	1	N	913	45	933	25	3,4	N	Obstacle Approval/ Marking CATS 139.01
R170	1	N	967	45	928	84	5,42	N	Obstacle Approval/ Marking CATS 139.01
R304	1	N	899	45	919	25	1,8	N	Obstacle Approval/ Marking CATS 139.01

Table 1: Obstacle Limitation and Clearances based on SACARS 139.01.30 (supersedes ICAO Annex 14)

The Mokopane (Borutho) – Wolwekraal (Silimela) substations have pre-existing environmental approvals from 2011 and no modifications will be done to them in the proposed project. They are therefore excluded from this assessment.

Using the DFFE screening tool, NTC Group has identified the project as having high aviation sensitivity. Accordingly, a specialist Civil Aviation Sensitivity Study (CASS) is required. Should the CASS confirm this sensitivity, further consultation with the SA Civil Aviation Authority (SACAA) may be required, which may trigger additional studies, as a pre-requisite to the CAA issuing a Compliance Statement for purposes of environmental approval.

From an aviation safety viewpoint, the 5 aerodromes (marked in Amber) listed in Table 1 are within the 8km distance that would trigger a future obstacle assessment in terms of SACAA regulations. However, because they are all Code 1 Aerodromes, only one, on available evidence, requires detailed analysis since the powerline route falls outside the obstacle limitation surfaces per ICAO Annex 14 for the aerodrome Code. The analysis however will deal individually with those aerodromes that fall within the 8km radius. 2 other aerodromes fall between 8km and 15km and do not trigger an obstacle assessment.

In the first instance, the scope of the study is to undertake a CASS. While based primarily on the requirements of the DFFE Protocol, the study also references various standards and recommended practices of the International Civil Aviation Organisation (ICAO), the SA Civil Aviation Authority (SACAA) and Air Traffic and Navigational Services SOC Limited (ATNS). These include, inter alia:

- The Civil Aviation Act No. 13 of 2009
- Draft White Paper on Civil Aviation Policy, 2017
- ICAO Annex 14, Volume 1: Aerodrome Design and Operations (see Appendix 6.4 & 6.5)

- SA Civil Aviation Regulations (CARS): Part 139 – Aerodromes and Heliports
- SA Civil Aviation Technical Standards (CATS): SACATS 139.01.30 (26^{th} Amendment) – Obstacle Limitations and Markings Outside Aerodromes or Heliports (Appendix 6.2)
- Associated provisions of SACATS 139.02.2 – Aerodrome Design Requirements
- ATNS Database of civil aviation airspace in South Africa, June 2024.

The limitations and assumptions of this Civil Aviation Sensitivity Study are that:

- This sensitivity study forms part of the DFFE protocol for the purpose of the environmental study. All future Obstacle Approval Applications for purposes of obtaining construction approval are excluded and are to be made once all the environmental authorisations have been obtained.
- Other than to interface with the proposed powerline, no other major works will be conducted on the Borutho and the Silimela Substations which impact on the existing environmental approvals of the sub-stations.

3 Scope and Methodology

While prepared in accordance with industry best practices for environmental Specialist Studies, the study also references applicable CAA guidelines, since there is some overlap. To meet this requirement, GWI Aviation Advisory utilises methodologies as outlined in the SACAA document "Technical Guidance Material for conducting Aeronautical Studies or Risk Assessment" effective January 2022 (Appendix 6.3) and recent amendments (in March 2023) to the Civil Aviation Regulations, which will affect the operational phase of the project.

In essence, the study comprises the following elements:

- Initiation – Identification of potential impacts and risk issues
- Technical analysis
- Compliance assessment
- Risk Assessment – Estimation, Evaluation and Control
- Action and Monitoring, including Risk Mitigation (as required).

3.1 Environmental Triggers

An Environmental Authorisation application is required in terms of the Environmental Impact Assessment Regulations (EIA Regulations, 2014) published in Government Notice (GN) No. 982 of 4 December 2014 (as amended by GN No. 571 of June 2021), based on Chapter 5 of the National Environmental Management Act, 1998 (NEMA, Act No. 108 of 1998).

The EIA Regulations, 2014 provide for control over certain listed activities. These listed activities are detailed in Listing Notice 1 (LN1), Listing Notice 2 (LN2) and Listing Notice 3 (LN3), as amended by GN No. 517 of June 2021. The undertaking of activities specified in the Listing Notices is prohibited until Environmental Authorisation has been obtained from the competent authority.

The Scoping Report to which this study is attached lists in detail the activities triggered for the current EIA process.

3.2 DFFE Protocol of March 2020

A '*Protocol for the specialist assessment and minimum report content requirements for environmental impacts on civil aviation installations'* was gazetted by the DFFE as GN No.320 in the Government Gazette 43110 on 20th March 2020. The Protocol is attached as Appendix 6.9.

In terms of the Protocol, the EAP is required to undertake an initial review of the subject site, utilizing the Screening Tool developed by the DFFE, to assess the potential impact of the proposed development on adjoining civil aviation installations.

The Screening Tool uses distance as an indicator of sensitivity. If the proposed site is:

1. Between 15 and 35km from a civil aviation radar, or
2. Between 15 and 35km from a major civil aviation aerodrome, or
3. Between 8 and 15km of other civil aviation aerodromes

then a sensitivity rating of medium or high is assigned, which triggers a CASS.

In terms of the Protocol:

- ***If the outcome of (the Specialist's) site sensitivity verification justifies a sensitivity of medium or higher, then a Civil Aviation Compliance Statement is required.***
- ***If the outcome of (the Specialist's) site sensitivity verification indicates low sensitivity then there are no further requirements.***

3.3 Initial Assessment

The proposed development was assessed by NTC Group using the Screening Tool and a high sensitivity assigned on account of the proximity of the powerline route to various aerodromes in the area. As recorded in Table 1, up to 7 aerodromes are potentially affected, of which 5 (highlighted in amber) present potentially high risks.

3.4 Specialist Study Elements

The study comprised the following elements:

3.4.1 Obstacle Assessment

Using ICAO Annex 14 and the relevant SACAA CARS/CATS standards, relevant OLS's were reviewed and the risk to these surfaces presented by the proposed development and associated infrastructure assessed.

3.4.2 Airspace Analysis

Using the SACAA Aerodrome Directory and the Aeronautical Information Publication (AIP) information on the potentially affected aerodromes, airspace classification sourced from the Air Traffic and Navigational Services Corporation (ATNS) and available topographical data, the proposed development site was overlaid on the airspace classification map of the environs and risk posed to aircraft operating in the area assessed.

3.4.3 Radar, Navigation and RF Interference Assessment

Using information available from the SACAA and ATNS, the location of civil aviation radar and other navigational equipment and infrastructure within the guideline distances (per the US FAA) from the proposed development were determined and the risk posed to the operation of these installations assessed.

3.4.4 Other Potential Impacts

The likelihood was assessed of any construction materials presenting glint and glare or other risks, both during the construction and operational stages of the project.

Based on the above studies, the risk status of the development was determined.

4 Specialist Study Outputs

4.1 Obstacle Limitation Surfaces - Principles

ICAO requires the determination of various obstacle limitation surfaces (OLS's), which vary according to the aerodrome reference code (ARC) of a specific aerodrome. Figure 1 illustrates. Essentially, an OLS is an imaginary surface in the air beyond which an object may not penetrate unless otherwise motivated through a detailed Aeronautical Study. OLS's vary in size, slope, and extent according to the ICAO ARC of the affected aerodrome, which is typically based on runway length and width, referenced to standard atmospheric conditions at sea level. Figure 2 illustrates. Appendix 6.9 contains further details of the ICAO Annex 14 standards applicable to various ARC's under different infrastructural and operational conditions.

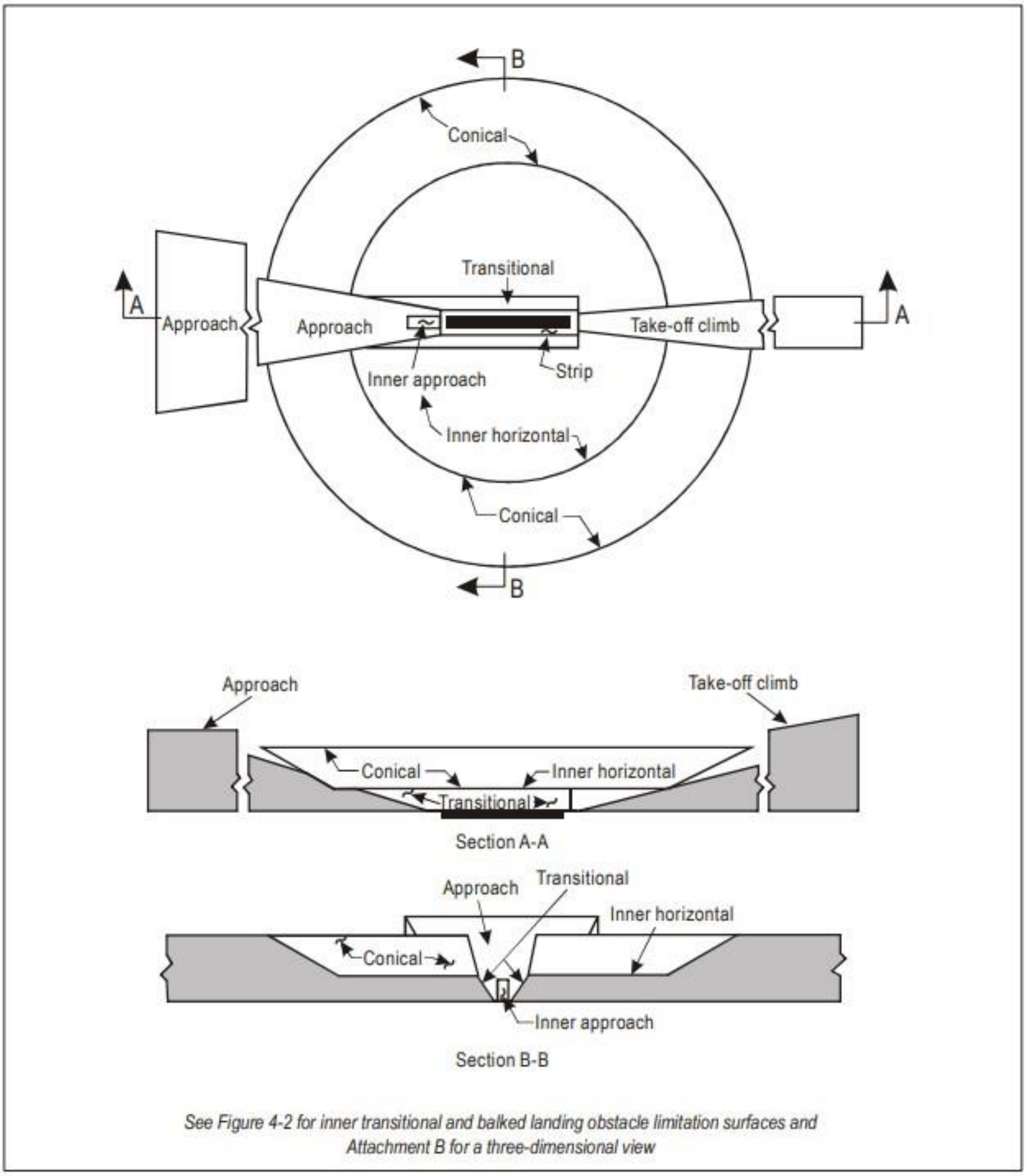

Figure 1: ICAO Obstacle Limitation Surfaces

Table 1-1. Aerodrome reference code
(see 1.6.2 to 1.6.4)

Code element 1	
Code number	Aeroplane reference field length
1	Less than 800 m
2	800 m up to but not including 1 200 m
3	1 200 m up to but not including 1 800 m
4	1 800 m and over
Code element 2	
Code letter	Wingspan
A	Up to but not including 15 m
B	15 m up to but not including 24 m
C	24 m up to but not including 36 m
D	36 m up to but not including 52 m
E	52 m up to but not including 65 m
F	65 m up to but not including 80 m

Note 1.— Guidance on planning for aeroplanes with wingspans greater than 80 m is given in the Aerodrome Design Manual *(Doc 9157), Parts 1 and 2.*

Note 2.— Procedures on conducting an aerodrome compatibility study to accommodate aeroplanes with folding wing tips spanning two code letters are given in the PANS-Aerodromes (Doc 9981). Further guidance can be found in the manufacturer's manual on aircraft characteristics for airport planning.

Figure 2: ICAO Aerodrome Reference Codes (ARC)

4.2 Location of Affected Aerodromes

The general location of the affected aerodromes is illustrated in Figure 3, with Figures 4,5 and 6 reflecting other relevant data of aerodromes within an 8km radius of the powerline route(s) insofar as this might affect navigational infrastructure and airspace in the vicinity.

Figure 3: Regional Location of Proposed Route relative to Potentially Affected Aerodromes

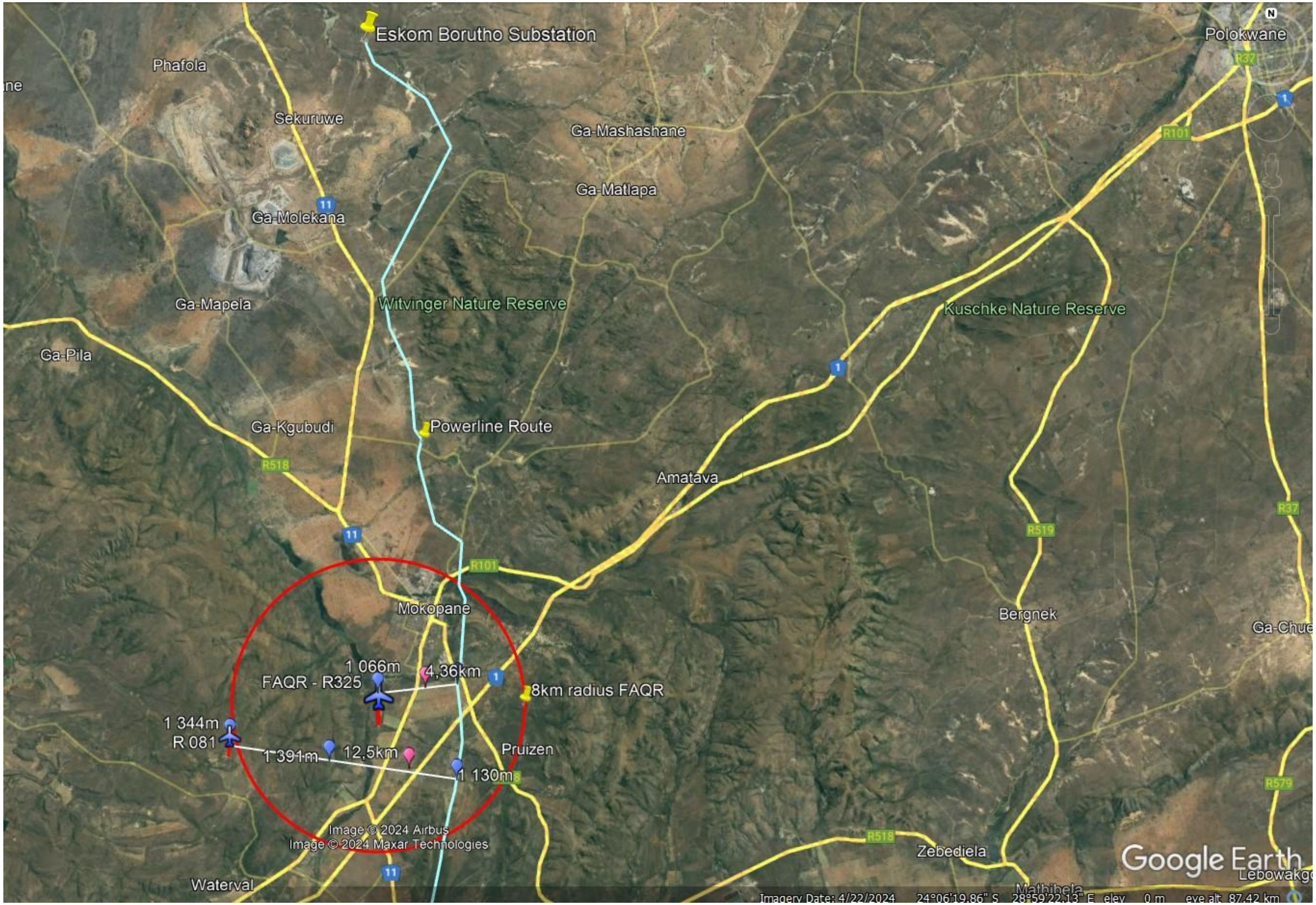

Figure 4: Location of R325/ FAQR – Potgietersrus/ Mokopane and R081/Shikwaru Lodge aerodromes

Figure 5: Location of FAMI/ R216 – Marble Hall aerodrome

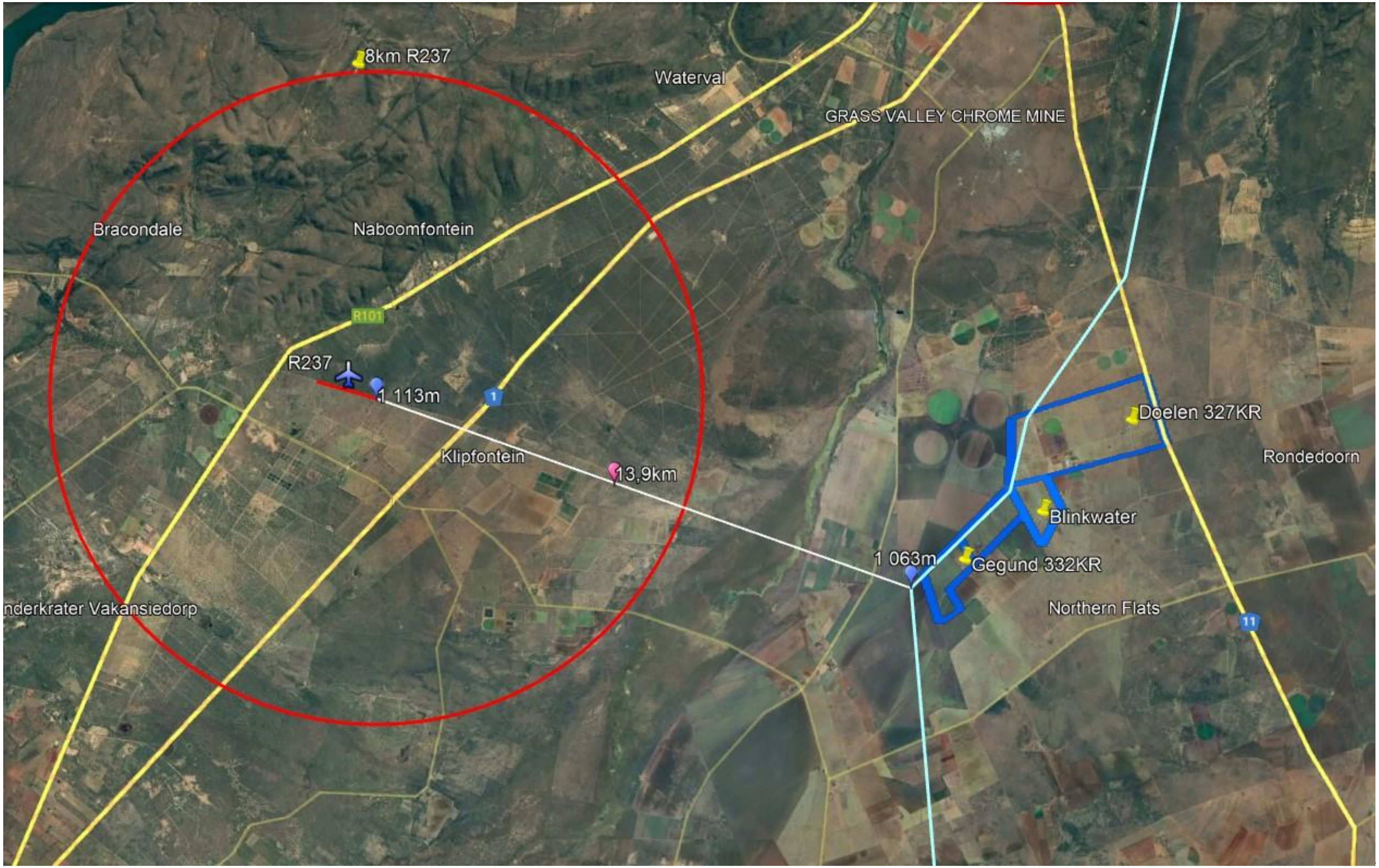

Figure 6: Location of R237/Labola Eco aerodrome

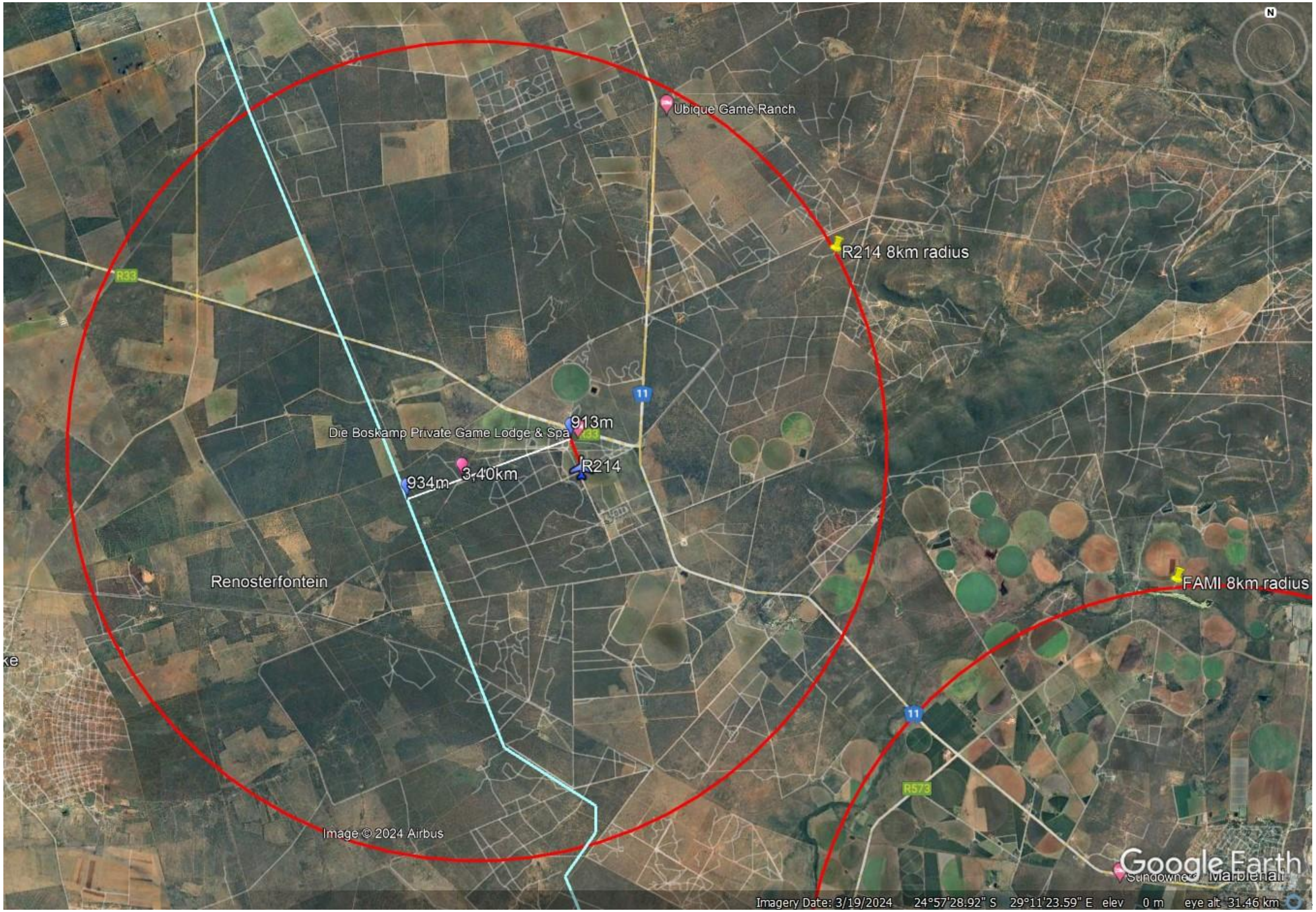

Figure 7: Location of R214/Die Boskamp aerodrome

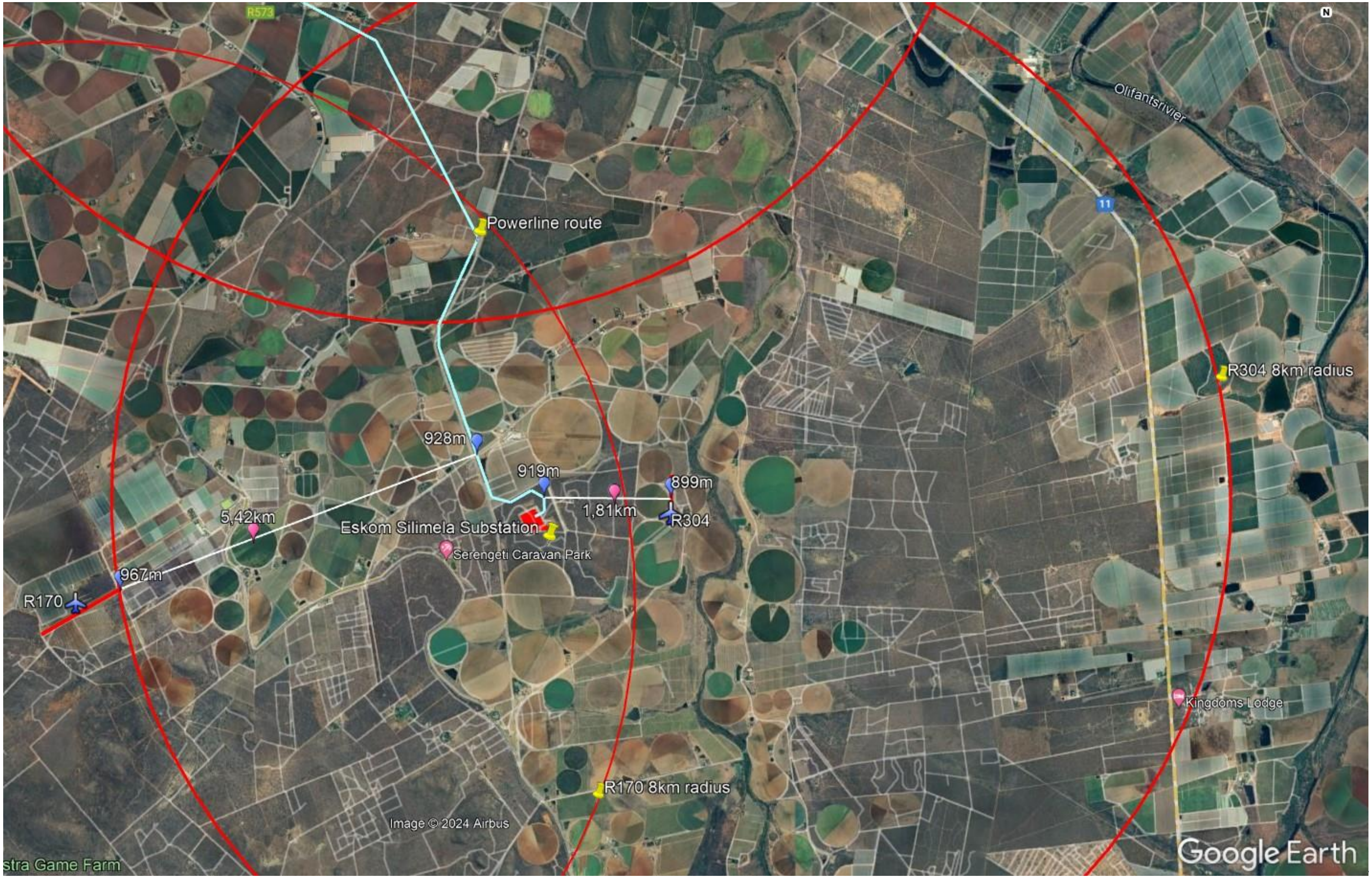

Figure 8: Location of R170/Tebogo and R304/TKB aerodromes

4.3 Affected Aerodromes

Table 1 lists the aerodromes that fall within the 8km trigger distance, which warrant individual attention for an obstacle assessment viewpoint.

In all cases, the affected runways are non-instrument runways, for which ICAO standards require the determination of Obstacle Limitation Surfaces (OLS's) as follows:

Non-instrument runways

4.2.1 The following obstacle limitation surfaces shall be established for a non-instrument runway:

— conical surface;
— inner horizontal surface;
— approach surface; and
— transitional surfaces.

Figure 9: ICAO OLS's for Non-Instrument runways

Available AIP/AIC data and navigational infrastructure status for all the aerodromes is included in Appendix 6.4. The proposed powerline intersects the departure/approach paths to the runways in some of the aerodromes as per Table 2 below:

Aerodrome	ICAO Code	Licence Status	Runway Orientation	Threshold Height amsl (h_t)	Distance to Powerline (km)	Approach/Climb out over powerline	Slope (%)	Altitude over powerline (mamsl)	Clearance over 45m pylon	Risk	Comment
FAQR/R325	2	N	18/36	1 066	4,36	N	N/A	N/A	N/A	Low	Obstacle Approval /Marking CATS 139.01
R081	1	N	00/18	1 344	12,5	N	N/A	N/A	N/A	Low	Obstacle Approval /Marking CATS 139.01
R237	1	N	11/29	1 113	13,9	Y	5	1 808	700	Low	Obstacle Approval /Marking CATS 139.01
R214	1	N	16/34	913	3,4	N	N/A	N/A	N/A	Low	Obstacle Approval /Marking CATS 139.01
FAMI/R216	1	N	06/24	913	3,4	Y	5	1 083	105	Low	Obstacle Approval /Marking CATS 139.01
R170	1	N	06/24	967	5,42	Y	5	1 238	265	Low	Obstacle Approval /Marking CATS 139.01
R304	1	N	00/18	899	1,8	N	N/A	N/A	N/A	Low	Obstacle Approval /Marking CATS 139.01

Table 2: Assessment of Approach/Departure Risk over Powerline

4.3.1 FAMI/ R216 Aerodrome

The runway 06/24 is 1000m long with a width of 10m and is classified in terms of ICAO Annex 14 Ch 4.2 as Code 1B (Reference elevation of 913m amsl).

The proposed powerline is located 3.4km southwest of the threshold of the runway 06/24 at its nearest point (Figure 5).

While there are two potentially influential ICAO OLS's, being the inner horizontal and the conical surface, the requirements imposed by the SACAA in terms of Part 139.01.30, which deals with the approval of obstacles above 45m high within 8km of aerodromes, supersedes the ICAO OLS's, since the powerline is 3,4km away and therefore beyond the ICAO Code 1 OLS. The governing OLS is thus the 8km limit imposed by the SACAA in terms of CARS Part 139.01.30, which imposes a height limitation of 45m above the aerodrome reference altitude.

The nearest proposed pylon is below the obstacle limitation of 45m by 25m (see Table 1). However, the powerline crosses the extended centreline of the runway, with a clearance (at a 5% slope), of 105m (see Table 2), which constitutes low risk. However, an obstacle application will be required for this aerodrome in due course.

4.3.2 FAQR/ Potgietersrus (Mokopane)/ R325 Aerodrome

The runway 18/36 is 1800m long with a width of 18m and is classified in terms of ICAO Annex 14 Ch 4.2 as Code 2.

The proposed powerline is located 4.36km east of RWY18/36 at its nearest point (Figure 4).

While there are two potentially influential ICAO OLS's, being the inner horizontal and the conical surface, the requirements imposed by the SACAA in terms of Part 139.01.30, which deals with the approval of obstacles above 45m high within 8km of aerodromes, supersedes the ICAO OLS's, since the sites are over 2km away and therefore beyond the ICAO Code 2B OLS's. The governing OLS is thus the 8km limit imposed by the SACAA in terms of CARS Part 139.01.30, which imposes a height limitation of 45m above the aerodrome reference altitude.

The nearest proposed pylon exceeds the obstacle limitation of 45m by 2m (see Table 1). On this basis, an obstacle application will be required in due course, even though the powerline does not cross the departure/approach paths of aircraft.

4.3.3 R170/ Tebogo

The unmarked runway runs in a southwest to northeasterly direction and is approximately 1230m long with an approximate width of 18m (GE measurement) and is classified in terms of ICAO Annex 14 Ch 4.2 as Code 1. No further official information is published on this aerodrome

The proposed project is located 5.42km northeast of the runway at its nearest point (Figure 8).

While there are two potentially influential ICAO OLS's, being the inner horizontal and the conical surface, the requirements imposed by the SACAA in terms of Part 139.01.30, which deals with the approval of obstacles above 45m high within 8km of aerodromes, supersedes the ICAO OLS's, since the sites is 5,42km away and therefore beyond the ICAO Code OLS's. The governing OLS is thus the 8km limit imposed by the SACAA in terms of CARS Part 139.01.30, which imposes a height limitation of 45m above the aerodrome reference altitude.

The nearest proposed pylon is below the obstacle limitation of 45m by 84m (see Table 1). Moreover, the powerline does not cross the extended centreline of the runway. Therefore, an obstacle application is **not** required for this aerodrome. However, an obstacle application may be necessitated by the other aerodromes that are affected.

4.3.4 R214/ Die Boskamp

The runway 17/35 is 825m long and classified in terms of ICAO Annex 14 Ch 4.2 as Code 1 (Reference Field length of <800m and runway width of 25m).

The proposed powerline is located 3.4km of the west of the RWY18/35 at its nearest point from the aerodrome (Figure 7).

While there are two potentially influential ICAO OLS's, being the inner horizontal and the conical surface, the requirements imposed by the SACAA in terms of Part 139.01.30, which deals with the approval of obstacles above 45m high within 8km of aerodromes, supersedes the ICAO OLS's, since the site is 3,4km away and therefore beyond the ICAO Code 1 OLS's. The governing OLS is thus the 8km limit imposed by the SACAA in terms of CARS Part 139.01.30, which imposes a height limitation of 45m above the aerodrome reference altitude.

The nearest proposed pylon is below the obstacle limitation of 45m by 24m (see Table 1). However, the powerline crosses the extended centreline of the runway, with a clearance (at a 5% slope) of 1238m (see Table 2), which constitutes a low-risk situation. However, an obstacle application will still be required for this aerodrome.

4.3.5 R304/ TKB

The runway 18/36 is 680m long and classified in terms of ICAO Annex 14 Ch 4.2 as Code 1 (Reference Field length of <800m and runway width of 30m).

The proposed powerline is located only 1.87km of the west of the RWY18/35 at its nearest point, the Borutho Substation is more than 35km away from the aerodrome, while the Similela Substation is 1.8km from the aerodrome (Figure 8).

There are two potentially influential ICAO OLS's, being the inner horizontal and the conical surface, but the requirements imposed by the SACAA in terms of Part 139.01.30, which deals with the approval of obstacles above 45m high within 8km of aerodromes, supersedes the ICAO OLS's, since the site is 1,87km away and therefore beyond the ICAO Code 1 OLS's. The governing OLS is thus the 8km limit imposed by the SACAA in terms of CARS Part 139.01.30, which imposes a height limitation of 45m above the aerodrome reference altitude.

The nearest proposed pylon is below the obstacle limitation of 45m by 25m (see Table 1), which represents a low-risk scenario. Moreover, the powerline does not cross the extended centreline of the runway. However, an obstacle application will still be required on account of the 1,87km proximity to the aerodrome and the other aerodromes that are affected.

4.3.6 Existing Obstacles

These are noted in Appendix 6.4

4.4 Risk Assessment - Obstacles

Appendix 6.3 contains SACAA guidelines for assessment of risk, based on (a) the severity of risk associated with an event and (b) the likely consequence. In this case, the most severe event would be the consequence of an aircraft impacting an obstacle on the site or being affected by debris resulting from on-site activities, or the unlikely event of a major explosion. The approach is thus based on a 'with the development' versus a 'without the development' scenario. Based on Table 2, with the exception of the aerodromes noted, the risk is thus assessed as '2A', indicating that minor mitigation measures will need to be introduced. These will relate mainly to updating the AIP and Aerodrome Register information of the FAMI (Marble Hall), FAQR (Potgietersrus), R170 (Tebogo), R214 (Die Boskamp) and R304 (TKB) aerodromes and marking of new obstacles in accordance with CATS 139.01, even if this mitigation is more 'operational' than 'environmental'.

RISK PROBABILITY		RISK SEVERITY				
		Catastrophic A	Hazardous B	Major C	Minor D	Negligible E
Frequent	5	5A	5B	5C	5D	5E
Occasional	4	4A	4B	4C	4D	4E
Remote	3	3A	3B	3C	3D	3E
Improbable	2	2A	2B	2C	2D	2E
Extremely Improbable	1	1A	1B	1C	1D	1E

Table 3: Risk Assessment Matrix

Appendix 6.3 outlines the range of risk tolerability, as illustrated in Table 5. In this case, the risk tolerability is deemed 'tolerable', indicating that some risk mitigation will be required from the developer in terms of CATS 139.30, relating to both the development activities and the marking of obstacles.

In the case of aircraft operating near the affected aerodromes the standard operating procedures (PANS/OPS) laid down in the CARS (including Parts 91 and 135) provide for risk mitigation in the event of aircraft failure or other unexpected events, supplemented by the CATS relevant to operating of aircraft close to sites where fuel is stored, or other risk events are likely to occur. This scenario, however, is only likely after the commissioning of the facility.

TOLERABILITY LEVEL	ASSESSED RISK INDEX	SUGGESTED CRITERIA
Intolerable	5A, 5B, 5C, 4A, 4B, 3A	Unacceptable in the existing circumstances
Tolerable	5D, 5E, 4C, 4D, 4E, 3B, 3C, 3D, 2A, 2B, 2C	Acceptable based on risk mitigation – may require a Management decision
Acceptable	3E, 2D, 2E, 1A, 1B, 1C, 1D, 1E	Acceptable

Table 4: Risk Tolerability Matrix

4.5 Airspace Analysis, Radar and Communications Assessment

Figures 10 and 11 illustrate the classification of airspace and navigational arrangements in the vicinity of the project sites and Appendices 6.4 to 6.10 contain details of various operational and navigational protocols and standards applicable to aircraft operating in the vicinity of the affected airports.

Some Key observations are:

- There are no civilian radar facilities within 35km of the proposed powerline.
- There are no aeronautical navigational facilities within 35km of the proposed powerline.
- There are aeronautical communication facilities, in the form of VHF forward relay stations at Mokopane (Potgietersrus) and at Ysterberg which are within 35km of the proposed powerline.

The following paragraphs detail some of the significant issues identified:

4.5.1 Rules of the Air – IFR

IFR Flights departing from the any of the affected airfields that are outside of controlled airspace must conduct the first portion of flight as VFR within the blue zone indicated in Figure 11 and later change to IFR once clear of the Hoedspruit TMA, therefore complying with Z Flight Rules in terms of Flight Plan Requirements.

IFR flights arriving at the affected airfields that are outside of controlled airspace will have conducted the first portion of the flight under IFR rules and will have to change to VFR Rules at the conclusion of an Instrument Approach at the nearest facility, thereby circling to land, or proceeding the last portion of the flight as VFR, therefore complying with Y Flight Rules in terms of Flight Plan Requirements.

Therefore, in all instances, the VFR Rules of the Air are always applicable in the proximity of the affected airfields, and within 8km of the project site.

4.5.2 Rules of the Air – VFR

The applicable protocol for aircraft operating under VFR conditions is ENR 1.1-1 General Rules (Appendix 6.8) particularly insofar as minimum safe operating altitude (MSA) is concerned, which is relevant to this study.

> ***"…no aircraft… shall be flown over built-up areas or over an open-air assembly of persons at a height less than 1000 feet above the highest obstacle, within a radius of 2000 feet from the aircraft;…"***

This rule ensures that any planned structures will not be a hazard to aircraft overflying the area in compliance with this rule.

Attention is also to ENR 1.1-1 General Rules, Minimum Heights, 2) b)

> ***… an aircraft shall at night, in IMC, or when operated in accordance with IFR, be flown (b) at a height of at least 2000ft above the highest terrain or obstacle located within five nautical miles of the aircraft in flight where the height of such terrain or obstacle exceeds 5000Ft above sea level. Provided that within areas determined by the Director the minimum height may be reduced to 1000 feet above the highest terrain or obstacle located within 5 nautical miles of the aircraft in flight, and provided furthermore that the aircraft is flown in accordance with such procedure as the Director may determine…"***

The impact of this rule is that no overflying aircraft may be flown below 305m (1000Ft) above the height of the highest structure **at night**.

With the lowest possible altitude being at 1000ft above ground level the proposed powerline is not a hazard to aviation.

Moreover, the SACAA has issued a warning to low-flying aircraft with respect to the danger of Powerlines as per AIC 21.8 (Appendix 6.7). For this warning to be effective, it is recommended that the powerlines are marked as per regulations and are published on aeronautical maps.

4.5.3 Radio Frequency Interference

Known aeronautical communication infrastructure within 35km of the powerline are VHF forward relay stations (FRS) at Mokopane (Potgietersrus) and at Ysterberg. Each of the FRS is located at the top of the highest hill within its location.

SACAA CAR Part 171.03.3, PROTECTION OF RADIO SITES states that:

"(ix) VHF / UHF Receivers / Transmitters

Ground level safeguarding of circle radius 91 metres centred on the base of the main aerial tower (or equivalent structure). Additionally, from an elevation of 9 metres on this circle, a 2% (1:50) slope out to a radius of 610 metres."

The proposed powerline follows low growth through the mountains for the entire 150km and therefore does not infringe the abovementioned standard.

Communication at each substation makes use of microwave frequency *(1GHz to 1000GHz)* which is a form of electromagnetic radiation with wavelengths different to VHF radio frequency band *(30MHz to 300MHz).* Therefore, the development is unlikely to cause Radio Frequency Interruption (RFI) and therefore, *no further* assessment is required. In addition, the further the distance from a powerline, the less the magnetic field caused by it as per the following diagram:

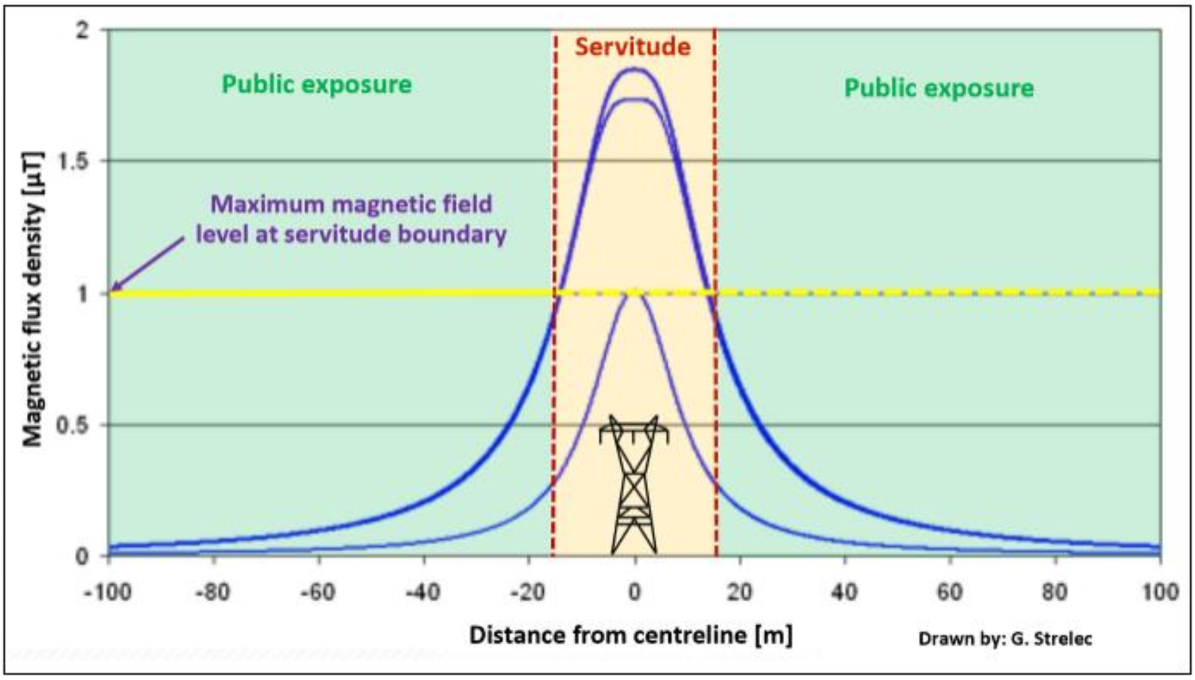

Figure 10: Electric field profile at ground level for typical 132kV line designs

(Source: ESKOM Fact Sheet, May 2022. *https://www.eskom.co.za/wp-content/uploads/2022/06/TD-0001-Electric-and-magnetic-fields-of-power-lines-Rev-1.pdf* ***)***

The following diagram shows how a 400kV transmission line has a higher nett effect than the 132kV illustrated above. However, the impact is the same horizontally and a few metres higher, vertically, although still rated below that of ordinary household appliances.

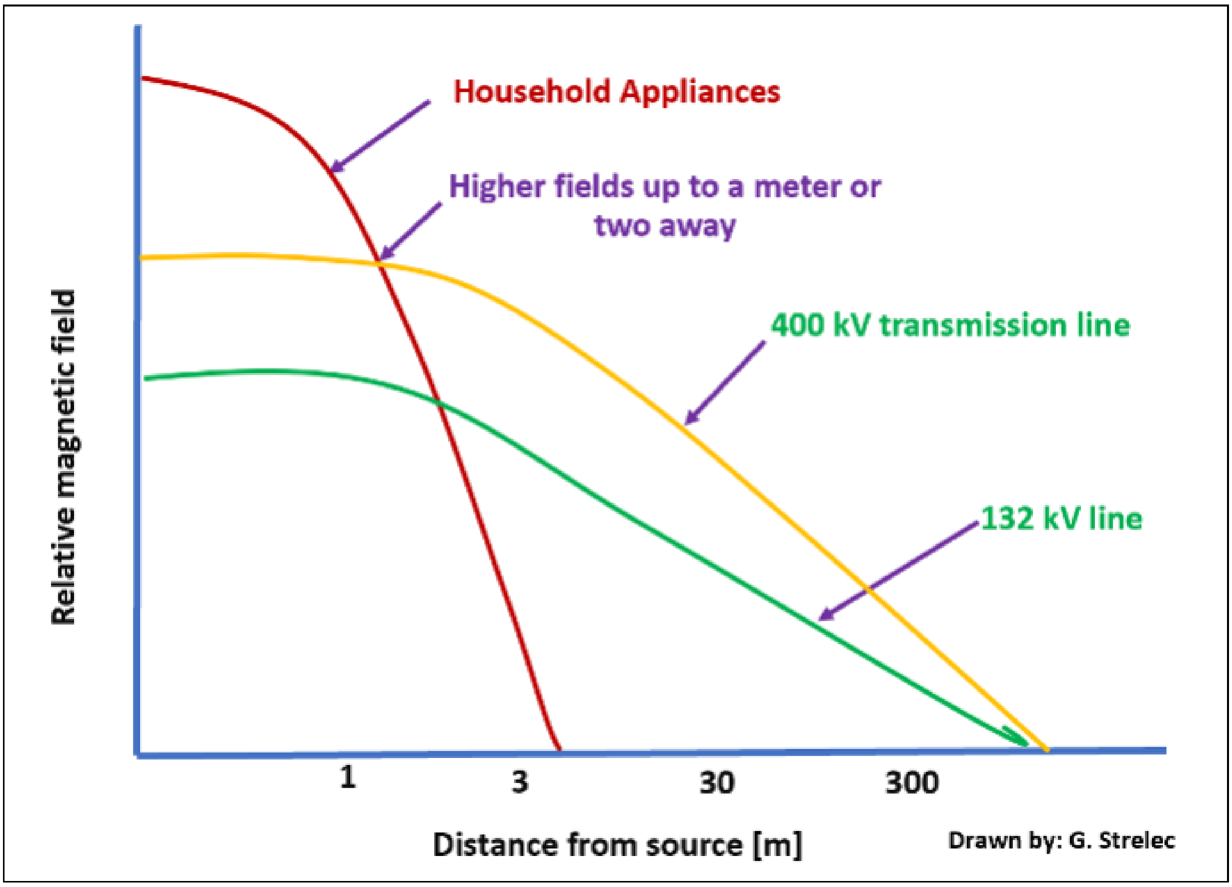

Figure 11: Relative magnetic fields associated with household appliances and overhead lines

(Source: ESKOM Fact Sheet, May 2022. https://www.eskom.co.za/wp-content/uploads/2022/06/TD-0001-Electric-and-magnetic-fields-of-power-lines-Rev-1.pdf)

Moreover, the intended servitude area for the powerline is at a maximum of 90m. With both the FRS maintaining the integrity of their protection areas and not overlapping with the servitude there is no evidence indicating that the powerline will have any electromagnetic interference nor become a physical obstruction with adverse effects on the technical integrity of the Potgietersrus and Ysterberg FRS.

4.5.4 Applicable Aeronautical Publications

There are no NOTAMs (Notices to Airmen).

4.6 Risk Assessment – Navigation and Radio Frequency Interruption

The powerline is not within 35km of any aeronautical navigation facilities. Moreover, the development is unlikely to cause Radio Frequency Interruption (RFI) within the VHF Spectrum.

Overall, based on the foregoing discussion, risk was assessed as 1E.

RISK PROBABILITY		RISK SEVERITY				
		Catastrophic A	Hazardous B	Major C	Minor D	Negligible E
Frequent	5	5A	5B	5C	5D	5E
Occasional	4	4A	4B	4C	4D	4E
Remote	3	3A	3B	3C	3D	3E
Improbable	2	2A	2B	2C	2D	2E
Extremely Improbable	1	1A	1B	1C	1D	1E

Table 5: Risk Assessment Matrix

Similarly, using the Appendix 6.3 guidelines, the risk tolerability has been assessed as ‘Acceptable’.

TOLERABILITY LEVEL	ASSESSED RISK INDEX	SUGGESTED CRITERIA
Intolerable	5A, 5B, 5C, 4A, 4B, 3A	Unacceptable in the existing circumstances
Tolerable	5D, 5E, 4C, 4D, 4E, 3B, 3C, 3D, 2A, 2B, 2C	Acceptable based on risk mitigation – may require a Management decision
Acceptable	3E, 2D, 2E, 1A, 1B, 1C, 1D, 1E	Acceptable

Table 6:Risk Tolerability Matrix

4.7 Other Potential Impacts – Glint and Glare

3km is regarded by the SACAA as the distance within which ‘glint and glare’ issues might become problematic for facilities where highly reflective materials are likely to be used. A detailed glint and glare assessment would only be required if significant components of the facility (solar panels, glazing and roof materials, for example) are of a reflective nature and likely to cause ‘glint’ issues to aircraft on approach. However, the proposed structures do not comprise of solar panels, glazing and roof materials.

5 Recommendations

The analysis contained in this Aeronautical Study has determined:

1. The proposed development is compliant with all relevant ICAO Annex 14 and SACAA (CARS and CATS) standards in respect of obstacle limitation surfaces and can therefore be supported for purposes of environmental approval.

2. The proposed development will not materially impact civilian radar, navigation or communications infrastructure in the environs, nor present any material additional risks to operations at the aerodromes identified as potentially affected, currently or in the future.

3. CAA Obstacle Approval processes per CA139.27 will need to be complied with in due course, and amended aerodrome operating procedures will need to be implemented.

4. There are no cumulative effects arising from the implementation of the powerline from an aviation safety and Aeronautical perspective.

On this basis, the recommendation of this CASS is that the sensitivity status of the proposed development be amended to ‘low’.

6 Appendices

6.1 Glossary of Terms

The definitions listed below apply to this document. Definitions have been taken from Wikipedia, where applicable.

TERM	ACRONYM	DEFINITION
Aeronautical Flight Information Systems	AFIS	Wind, weather and other operational information available to aircraft operators at airfields that do not have fully-fledged control tower facilities
Aircraft Classification Number	ACN	An indication of runway strength requirements of aircraft, which must not exceed the corresponding Pavement Classification Number (PCN) of the airfield
Aeronautical Information Publication	AIP	A document published and regularly updated by the SA Civil Aviation Authority containing key details and parameters of licensed aerodromes, in accordance with the SA Civil Aviation Regulations.
Aeronautical Information Circular	AIC	A document 'for information only' issued by the SA Civil Aviation Authority containing basic details of aerodromes (usually) registered with the SACAA, but not licensed.
Air Traffic Control	ATC	A system of ground-based services that manage the safe and efficient movement of aircraft within controlled airspace and on the ground at airports. The primary objectives of air traffic control are to prevent collisions between aircraft, provide safe and orderly flow of air traffic, and ensure efficient utilization of airspace and airport resources.
Air Traffic and Navigational Services SOC Limited	ATNS	A State-owned Enterprise formed in 1993, responsible for overall air traffic and airspace management in South Africa.
Airfield Ground Lighting	AGL	Lighting systems on runway, taxiways and apron.
Above Mean Sea Level	AMSL	The vertical measurement of an aircraft's altitude or the elevation of a location with reference to the average sea level. It serves as a standard reference point for altitude calculations, providing a consistent baseline for navigation and airspace management.
Civil Aviation Regulations	CARS	A national aviation authority or civil aviation authority is a government statutory authority in each country that maintains an aircraft register and oversees the approval and regulation of civil aviation.
Civil Aviation Technical Standards	CATS	A set of technical standards and industry best practices, to be read in conjunction with the CARS.
Distance Measuring Equipment	DME	Electronic distance measuring capability of VHF radio antennae.
Flexible Use of Airspace	FUA	A policy of the SACAA in terms of which airspace is not unnecessarily restricted, allowing more effective use as long as safety standards are not compromised.
Forward Relay Station	FRS	The Forward Relay Stations (FRS) are remotely controlled radio stations housing transmitter/receiver combinations which are controlled by the ATC at the main air traffic control centres.
General Aviation	GA	Private, recreational, pilot training and non-scheduled commercial air services
Global Navigational Satellite System	GNSS	Satellite based aircraft navigational systems relying on GPS technology
Integrated Development Plan	IDP	An Integrated Development Plan is a plan for an area that gives an overall framework for development. It aims to co-ordinate the work of local and other spheres of government in a coherent plan to improve the quality of life for all the people living in an area.
International Civil Aviation Organisation	ICAO	The International Civil Aviation Organization is a specialized agency of the United Nations. It changes the principles and techniques of international air

TERM	ACRONYM	DEFINITION
		navigation and fosters the planning and development of international air transport to ensure safe and orderly growth.
International Air Transport Association	IATA	The International Air Transport Association is a trade association of the world's airlines. Consisting of 290 airlines, primarily major carriers, representing 117 countries, the IATA's member airlines account for carrying approximately 82% of total available seat miles air traffic.
Instrument Flight Rules	IFR	Rules and regulations to govern flight under conditions in which flight by outside visual reference is not safe. IFR flight depends upon flying by reference to instruments in the flight deck, and navigation is accomplished by reference to electronic signals.
Instrument Landing System	ILS	The ILS provides both vertical and lateral guidance information for pilots to allow safe landings to touchdown. The ILS sends information to instruments in the cockpit so that the pilot can maintain a predetermined flight path to the runway in low visibility.
Instrument Meteorological Conditions	IMC	Weather conditions under which visual operation of aircraft is not possible due to industry visibility limits not being met, which require aircraft to be operated using instrument procedures.
Level of Service	LOS	Level of service to passengers as defined in IATA reference documents
Obstacle Clearance Altitude	OCA	The lowest altitude or the lowest height above the elevation of the relevant runway threshold or the aerodrome elevation as applicable, used in establishing compliance with appropriate obstacle clearance criteria.
Obstacle Limitation Surfaces	OLS	A set of imaginary planes or surfaces above the ground that sets limits beyond which ground-based objects may not penetrate, to preserve the operational safety of aircraft, as laid down in ICAO reference material, particularly Annex 14.
Passengers	PAX	Number of passengers
Performance Based Navigation	PBN	ICAO recommended policy to improve air traffic management through increased reliance on satellite-based navigation systems and thereby reduce aircraft-based carbon footprint through reduction in approach and 'hold' times of arriving aircraft.
South African Civil Aviation Authority	SACAA	The South African Civil Aviation Authority is the South African national aviation authority, overseeing civil aviation and governing investigations of aviation accidents and incidents.
Safety Health and Environment	SHE	Safety Health and Environment
Service Level Agreement	SLA	A service-level agreement (SLA) is a commitment between a service provider and a client. The most common component of an SLA is that the services should be provided to the customer as agreed upon in the contract.
Request for Information	RFI	A request for information is a common business process whose purpose is to collect written information about the capabilities of various suppliers. Normally it follows a format that can be used for comparative purposes. An RFI is primarily used to gather information to help make a decision on what steps to take next.
Request for Proposal	RFP	A request for proposal is a document that solicits proposal, often made through a bidding process, by an agency or company interested in procurement of a commodity, service, or valuable asset, to potential suppliers to submit business proposals.
Remote Navigation	RNAV	Satellite based navigation systems similar to GNSS
Runway	RWY	According to the International Civil Aviation Organization, a runway is a "defined rectangular area on a land airport prepared for the landing and take-off of aircraft".
Standards and Recommended Practices	SARPS	A set of industry norms as published by ICAO and other recognised industry bodies, which determine best-practice processes and procedures as distinguished from strict regulatory requirements.
Threshold	THD	The defined end of a runway, marked in accordance with ICAO SARPS.

TERM	ACRONYM	DEFINITION
Visual Flight Rules	VFR	Visual flight rules are a set of regulations under which a pilot operates an aircraft in weather conditions generally clear enough to allow the pilot to see where the aircraft is going.
Very high frequency Omnidirectional Range Station	VOR	A type of short-range radio navigation system for aircraft, enabling aircraft with a receiving unit to determine its position and stay on course by receiving radio signals transmitted by a network of fixed ground radio beacons.
Visual Meteorological Conditions	VMC	Meteorological conditions under which visual sight distances (per SACAA rules) allow flight operations to proceed under VFR, without the necessity to resort to instrument procedures.
Work Breakdown Structure	WBS	A work-breakdown structure in project management and systems engineering, is a deliverable-oriented breakdown of a project into smaller components. A work breakdown structure is a key project deliverable that organizes the team's work into manageable sections.

6.2 26th Amendment – CATS 139.01.30

139.01.30

(1) A holder of an aerodrome licence shall monitor a concerned aerodrome and its surroundings to assess permanent or temporary obstacle limitation and penetration surfaces, to establish if any obstacle has an impact on the safety of aircraft operations at such aerodrome.

(2) If an assessment referred to in subregulation (1) identifies any obstacle that negatively impacts on aircraft safety, a holder of an aerodrome licence shall take appropriate action to mitigate the risk and restrict or remove such obstacle.

(3) A holder of an aerodrome licence shall not erect or allow to be erected, without the prior approval of the Director, a building, structure, or object which projects above a slope of 1 in 20 and which is within 3 000 m measured from the nearest point on a boundary of such aerodrome or heliport.

(4) An object, whether temporary or permanent, which projects above the obstacle limitation surfaces within a radius of 8 km as measured from an aerodrome reference point shall be marked as prescribed in Document SA-CATS 139.

(5) An object, whether temporary or permanent, which projects above the obstacle limitation surfaces beyond a radius of 8 km and constitutes a potential hazard to aircraft, shall be marked as prescribed in Document SA-CATS 139.

(6) A holder of an aerodrome licence shall not erect or allow to be erected, without the prior approval of the Director, a building or object which constitutes an obstruction or potential hazard to an aircraft operating in a navigable airspace in the vicinity of an aerodrome, or navigation aid, or which will adversely affect the performance of a radio navigation or ILS.

(7) A holder of an aerodrome licence shall not erect or allow to be erected, without the prior approval of the Director, an object higher than 45 m above the

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mean level of a landing area or within 8 km measured from the nearest point on a boundary of an aerodrome.

(8) A holder of an aerodrome licence shall not erect or allow to be erected, without the prior approval of the Director a building, structure, or object which projects above a slope of 1 in 20 and which is within 3 000 m measured from the nearest point on a boundary of an aerodrome or heliport.

(9) A holder of an aerodrome licence shall not erect or allow to be erected, without the prior approval of the Director, a building, structure or other object which will project above the obstacle limitation surfaces of an aerodrome or heliport.

(10) A person or authority involved in land development, shall not compromise air safety by authorising or developing any land or erecting a building or obstacle on such land.";

(d) the insertion in Subpart 2 in the arrangements of regulations of the following Subpart:

"SUBPART 2: LICENSING AND OPERATION OF AERODROMES

139.02.1 Requirements for licence

139.02.2 Application for licence or amendment thereof

139.02.3 Processing of application for licence or amendment thereof

139.02.4 Adjudication of application for licence or amendment thereof

139.02.5 **[[Issuing]** Issuance of licence

139.02.6 Period of validity

139.02.7 Transferability

139.02.8 Renewal of licence

139.02.9 Licence of intent

139.02.10 Aerodrome design requirements

6.3 SACAA Technical Guidance Material: Aeronautical Studies

SOUTH AFRICAN CIVIL AVIATION AUTHORITY

TECHNICAL GUIDANCE MATERIAL

for Conducting Aeronautical Studies or Risk Assessment Advisory Circular

SUBJECT: **GUIDANCE ON CODUCTING AERONAUTICAL STUDIES OR RISK ASSESSMENT**

EFFECTIVE DATE: **11 JANUARY 2022**

APPLICABILITY

An Aeronautical study or risk assessment may be carried out when aerodrome standards cannot be met as a result of development. Such a study is most frequently undertaken during the planning of a new airport or during the certification of an existing aerodrome.

PURPOSE

An aeronautical study is conducted to assess the impact of deviations from the aerodrome standards specified in Volume Ito Annex 14 to the Convention on International Civil Aviation, SACAR 139 and Part 11, to present alternative means of ensuring the safety of aircraft operations, to estimate the effectiveness of each alternative and to recommend procedures to compensate for the deviation.

1. REFERENCE:

i. ICAO Annex 14 – Volume 1
ii. ICAO Doc 9774 -Manual on Certification of Aerodromes
iii. ICAO Doc 9734 - Safety Oversight Manual
iv. ICAO Doc 9859 -Safety Management Manual
v. Civil Aviation Regulation Part 11- Subpart 4 Procedure for granting of Exemptions and Recognition of Alternative means of Compliance
vi. Civil Aviation Regulation Part 139 -Aerodromes and Heliports
vii. Civil Aviation Regulation Part 140 -Safety Management

2. TERMS AND ABBREVIATIONS:

TERM	DEFINITION
Risk mitigation	The process of incorporating defences or preventive controls to lower the severity and/or likelihood of a hazard's projected consequence.
Safety risk -	The predicted probability and severity of the consequences or outcomes of a hazard.

ABBREVIATION	DESCRIPTION

TGM: Conducting aeronautical studies or risk assessment	New: 11 January 2022	Page 1 of 8

ATS	Air Traffic Services
CAR	Civil Aviation Regulation
DCA	Director of Civil Aviation
GA	General Aviation
ICAO	International Civil Aviation Authority
SACAA	South African Civil Aviation Authority
SACAR	South African Civil Aviation Regulation
M: ADO	Manager: Aerodrome Operations
E: AI	Executive: Aviation Infrastructure
SM: ADFA	Senior Manager: Aerodromes and Facilities

3. TECHNICAL ANALYSIS

3.1 Technical analysis will provide justification for a deviation on the grounds that an equivalent level of safety can be attained by other means. It is generally applicable in situations where the cost of correcting a problem that violates a standard is excessive but where the unsafe effects of the problem can be overcome by some procedural means which offers both practical and reasonable solutions.

3.2 In conducting a technical analysis, inspectors will draw upon their practical experience and specialised knowledge or consult other specialists in relevant areas.

3.3 When considering alternative procedures in the deviation approval process, it is essential to bear in mind the safety objective of the CAR 139 and the applicable standards so that the intent of the regulations is not circumvented.

4. APPROVAL OF DEVIATIONS

4.1 In some instances, the only reasonable means of providing an equivalent level of safety is to adopt suitable procedures and to require, as a condition of certification, that cautionary advice be published in the appropriate AIS publications.

4.2 The determination to require caution will be primarily dependent on two considerations:

4.2.1 A pilot's need to be made aware of potentially hazardous conditions; and

4.2.2 The responsibility of the DCA to publish deviations from standards that would otherwise be assumed under certificate status.

5. AERONAUTICAL STUDY

5.1 An aeronautical study is a tool used to review aerodrome and airspace processes and procedures to ensure that safety criteria in place are appropriate. The study can be undertaken in a variety of ways using various analytical methods appropriate to the aeronautical study requirements. An aeronautical study should include the use of:

5.1.1 current state review (baseline position)

5.1.2 quantifiable data analysis

5.1.3 stakeholder interviews

5.1.4 safety/risk matrix

5.2 In general, an aeronautical study should be viewed as providing an overarching document giving a holistic view of an aerodrome's operational environment e.g., the macro perspective as compared to a safety case study which is a task specific document e.g., the micro view.

5.3 An aeronautical study may contain many elements; however, risk assessment, risk mitigation and risk elimination are key components.

5.4 An aeronautical study can be undertaken at any time. It is constructed to consider all relevant factors, including traffic volume, mix and distribution, weather, aerodrome role, aerodrome and airspace configuration, surface activity and the efficiency requirements of operators using the service. The scope of studies can range from minor adjustments to aerodrome configuration, e.g., from the widening of a taxiway to a complete review of aerodrome airspace with the introduction of a new runway.

5.5 The scope of an aeronautical study usually reflects one of three situations:

5.5.1 the existing operation, e.g., the aerodrome, airspace or ATS (or sometimes just a particular part of the operation);

5.5.2 a change to the existing operation;

5.5.3 a new operation.

5.6 Where the aeronautical study is used to consider a change to existing operations or a new operation, it may not initially be possible to provide all the safety assessment and evidence required. An aeronautical study can identify and evaluate aerodrome service options, including service increases or decreases or the introduction or termination of services (such as the introduction of a rapid exit taxiway or removal of a grass runway).

5.7 The goal of risk management in an aeronautical study is to identify risks and take appropriate action to minimise risk as much as is reasonably practicable. Decisions made in respect of risks must balance the technical aspects of risk with the social and moral considerations that often accompany such issues.

5.8 These decisions may have significant impact on an aerodrome's operation and for an effective outcome there should be a level of consensus as to their acceptability among the key stakeholders.

5.9 Aerodrome operators should also undertake aeronautical studies when the aerodrome operating environment changes. These changes are normally precipitated by a trigger event such as a change, or a proposed change in; airspace design, aircraft operations, aerodrome infrastructure or the provision of an air traffic service.

5.10 It is the aeronautical study process that determines the site-specific need for services, and identifies and recommends a course of action, or presents options for decision makers to act upon. In all cases the aeronautical study should document and demonstrate the site-specific need and rationale for the level of service, procedure design or operational requirements.

6. TRIGGER FACTORS

6.1 The aeronautical study is a tool for the aerodrome management to use as part of its operations and strategic planning and is an integral part of the aerodrome's Safety Management Systems.

6.2 One of the purposes of the aeronautical study is to determine levels of operational safety, service or procedures that should apply at a particular location. The decision to undertake this type of study may be triggered by any one or more of a wide range of factors.

6.3 These may include changes to:

6.3.1 The number of movements;

6.3.2 the peak traffic periods;

6.3.3 the ratio of IFR to VFR traffic;

6.3.4 the type of operations - scheduled, General Aviation (GA), training, etc.;

6.3.5 the types, and variety of types, of aircraft using the aerodrome (jet, turboprop, rotary, etc.);

6.3.6 aerodrome layout;

6.3.7 aerodrome management structure;

6.3.8 runway or taxiway and associated manoeuvring areas;

6.3.9 operations of a neighbouring aerodrome or adjacent airspace.

6.4 Feedback about any changes should be sought from aviation stakeholders including pilots, individuals, and other representative groups as part of the study.

6.5 An aeronautical study may be initiated by an aerodrome operator, or another interested party, such as an air traffic service provider or air operators.

7. THE CONCEPT OF RISK

7.1 Risk Management is a key area in an aeronautical study. ICAO Doc 9859: Safety Management Manual defines risk as following:

7.1.1 **Risk mitigation** - The process of incorporating defences or preventive controls to lower the severity and/or likelihood of a hazard's projected consequence.

7.1.2 **Safety risk** - The predicted probability and **severity** of the consequences or outcomes of a hazard.

8. SAFETY RISK

Safety risk management is also a key component of safety management system and aeronautical study. The term safety risk management is meant to differentiate this function from the management of financial risk, legal risk, economic risk and so forth. This section presents the fundamentals of safety risk and includes the following topics:

A. Definition of Safety Risk;
B. Safety Risk Probability;
C. Safety Risk Severity;
D. Safety Risk Tolerability; and
E. Safety Risk Management.

8.1 Definition of Safety risk:
Safety risk is the projected likelihood and severity of the consequence or outcome from an existing hazard or situation. While the outcome may be an accident, an "intermediate unsafe event/consequence" may be identified as "the most credible outcome".

8.2 Safety Risk Probability: (How likely is it that it will occur?)
The process of controlling safety risks starts by assessing the probability that the consequences of hazards will materialize during aviation activities performed by the organization. Safety risk probability is defined as the likelihood or frequency that a safety consequence or outcome might occur. The determination of likelihood can be aided by questions such as:

8.2.1 Is there a history of occurrences similar to the one under consideration, or is this an isolated occurrence?
8.2.2 What other equipment or components of the same type might have similar defects?
8.2.3 How many personnel are following, or are subject to, the procedures in question?
8.2.4 What percentage of the time is the suspect equipment or the questionable procedure in use?
8.2.5 To what extent are there organizational, managerial or regulatory implications that might reflect larger threats to public safety?

Any factors underlying these questions will help in assessing the likelihood that a hazard may exist, taking into consideration all potentially valid scenarios. The determination of likelihood can then be used to assist in determining safety risk probability. The table below presents a typical safety risk probability table, in this case, a five-point table. The table includes five categories to denote the probability related to an unsafe event or condition, the description of each category, and an assignment of a value to each category.

LIKELIHOOD	MEANING	VALUE
Frequent	Likely to occur many times (has occurred frequently)	5
Occasional	Likely to occur sometimes (has occurred frequently)	4
Remote	Unlikely to occur, but possible (has occurred rarely)	3
Improbable	Very unlikely to occur (not known to have occurred)	2
Extremely Improbable	Almost inconceivable that the event will occur	1

Table1: Safety Risk Probability

8.3 Safety Risk Severity

Once the probability assessment has been completed, the next step is to assess the safety risk severity, taking into account the potential consequences related to the hazard. Safety risk severity is defined as the extent of harm that might reasonably occur as a consequence or outcome of the identified hazard. The severity assessment can be based upon:

8.3.1 **Fatalities/injury:** - How many lives may be lost (employees, passengers, bystanders, and the general public)?

8.3.2 **Damage:** - What is the likely extent of aircraft, property or equipment damage?

The severity assessment should consider all possible consequences related to an unsafe condition or object, taking into account the worst foreseeable situation. Table 2 presents a typical safety risk severity table. It includes five categories to denote the level of severity, the description of each category, and the assignment of a value to each category. As with the safety risk probability table, this table is an example only.

SEVERITY	MEANING	VALUE
CATASTROPHIC	• Equipment destroyed • Multiple deaths	A
HAZARDOUS	• A large reduction in safety margins, physical distress or a workload such that the operators cannot be relied upon to perform their task accurately or completely. • Serious injury • Major equipment damage	B
MAJOR	• A significant reduction in safety margins, a reduction in the ability of the operators to cope with adverse operating conditions as a result of increase in workload, or as a result of conditions impairing their efficiency. • Serious incident • Injury to persons	C
MINOR	• Nuisance • Operating limitations • Use of emergency procedures • Minor incident	D
NEGLIGIBLE	• Little consequences	E

Table 2: Safety Risk Severity

8.4 Risk assessment

Risks are the potential adverse consequences of a hazard and are assessed in terms of their severity and probability. Thus, for each hazard resulting from the non-compliance, one can now describe the risk by placing the combination of severity and probability in the Risk assessment matrix table shown below. If the risk comes out as medium or above, risk reduction measures must be identified.

RISK PROBABILITY		RISK SEVERITY				
		Catastrophic A	Hazardous B	Major C	Minor D	Negligible E
Frequent	5	5A	5B	5C	5D	5E
Occasional	4	4A	4B	4C	4D	4E
Remote	3	3A	3B	3C	3D	3E
Improbable	2	2A	2B	2C	2D	2E
Extremely improbable	1	1A	1B	1C	1D	1E

Table 3: Risk Assessment Matrix Table

As can be seen from the risk classification matrix, risk reduction measures can aim towards either reducing the likelihood of an occurrence or reducing the probability of an occurrence.

The first priority should always be to seek measures that will reduce the likelihood of an occurrence {i.e. accident prevention). When contemplating mitigating measures, it is always necessary to look to the intent of the requirement that is not (fully) complied with.

8.5 Risk mitigation strategies may include:
8.5.1 revision of the system design;
8.5.2 modification of operational procedures;
8.5.3 changes to staffing arrangements;
8.5.4 training of personnel to deal with the hazard;
8.5.5 development of emergency and/or contingency arrangements and plans;
8.5.6 ultimately, ceasing operation.

8.6 Safety Risk Tolerability

The safety risk probability and severity assessment process can be used to derive a safety risk index. The index created through the methodology described above consists of an alphanumeric designator, indicating the combined results of the probability and severity assessments. The respective severity/probability combinations are presented in the safety risk assessment matrix in table 3.

The third step in the process is to determine safety risk tolerability. First, it is necessary to obtain the indices in the safety risk assessment matrix. For example, consider a situation where a safety risk probability has been assessed as occasional (4), and safety risk severity has been assessed as hazardous (B). The composite of probability and severity (48) is the safety risk index of the consequence.

The index obtained from the safety risk assessment matrix must then be exported to a safety risk tolerability matrix (Table 4) that describes the tolerability criteria for the particular organization. Using the example above, the criterion for safety risk assessed as 48 falls in the "unacceptable under the existing circumstances" category. In this case, the safety risk index of the consequence is unacceptable.

8.6.1 The organization must therefore:

a) Take measures to reduce the organization's exposure to the particular risk, i.e., reduce the likelihood component of the risk index;
b) Take measures to reduce the severity of consequences related to the hazard, i.e., reduce the severity component of the risk index; or
c) Cancel the operation if mitigation is not possible.

TOLERABILITY DESCRIPTION	ASSESSED RISK INDEX	SUGGESTED CRITERIA
Intolerable	5A, 5B, 5C 4A, 4B, 3A	Unacceptable in the existing circumstances.
Tolerable	5D, 5E, 4C, 4D, 4E, 3B, 3C, 3D, 2A, 2B, 2C	Acceptable based on risk mitigation. It may require Management decision.
Acceptable	3E, 2D, 2E, 1B, 1C, 1D, 1E	Acceptable

Table 4: Safety Risk Tolerability Matrix

8.7 Example of an Aeronautical Study Methodology

A generic model of an Aeronautical Study methodology consists of initiation, preliminary analysis, risk estimation, risk evaluation, risk control and action or monitoring.

8.7.1 **STEP 1:** Initiation

This step consists of defining the opportunity or problem and the associated risk issues; setting up the risk management team; and beginning to identify potential users who may be affected by any change.

8.7.2 **STEP 2:** Preliminary Analysis

The second step consists of defining the basic dimensions of the risk problem and undertaking an initial identification, analysis and evaluation of potential risks. This preliminary evaluation will help determine:

a) whether a situation exists that requires immediate action;
b) whether the matter requires further study prior to any action being taken; or,
c) whether the analysis should be ended as the risk problem is determined not to be an issue.

8.7.3 **STEP 3 and 4:** Risk Estimation

These steps estimate the degree of risk. Step 3 estimates the severity of the consequences and step 4 estimates the probability of their occurrence.

8.7.4 **STEP 5:** Risk Evaluation

The benefits and operational costs of the activity are integrated into the analysis and the risk is evaluated in terms of the safety implications of the activity and of the needs, issues, and concerns of affected users.

8.7.5 **STEP 6**: Risk Control

This step identifies feasible risk controls and mitigations which will act to reduce either the probability of the event or the consequence of the event should it occur.

8.7.6 **STEP 7:** Action or Monitoring

This step entails implementing the chosen risk control options, evaluating the effectiveness of the risk management decision process, and implementing an on-going monitoring program.

9. Acceptance by the SACAA

The Aeronautical Study and Risk assessment results need to be submitted to SACAA for the granting of exemptions.

DEVELOPED BY:		
	VICTRESS MASHAVA	11 JANUARY 2021
SIGNATURE OF M: ADO	NAME IN BLOCK LETTERS	DATE
REVIEWED & VALIDATED BY:		
	NELSON NKABITI	11 JANUARY 2021
SIGNATURE OF SM: ADFA	NAME IN BLOCK LETTERS	DATE
APPROVED BY:		
	GAWIE BESTBIER	11 JANUARY 2021
SIGNATURE OF E: AI	NAME IN BLOCK LETTERS	DATE

END

6.4 SACAA Classification Data of Affected Aerodromes

6.4.1 FAMI/ R216 – Marble Hall

Aerodrome Name: FAMI

Registration Number: R 216

Runway Heading: 06/24

Alternative Runway: Nil

Coordinates (WGS 84): S24° 59′ 20″ E029° 16′ 59″

Elevation: 2980 ft

Length / Width: 06/24 1000 m x 10 m

Surface type: 06/24 Asphalt

Frequency: 124.80

Obstacles to clear: Yes depending runway in use

Windsock: Yes

Landing suggestion: Any

Take off suggestion: Any

Buildings/Hangars: Yes

Night flying: Nil

IMPORTANT / DANGER:
Rwy 24 obstacles about 200 m from threshold. Buildings. Prior Permission Required.

Contact Details: Giovan Emile Smit Cell: 073 024 2506
E-mail: giovanemile@yahoo.com

6.4.2 R325/ FAQR – Potgietersrus/ Mokopane

Aerodrome Name: Potgietersrus Vliegveld Mokopane (FAQR)

Registration Number: R 325

Runway Heading: 18/36

Alternative Runway: Nil

Coordinates (WGS 84): S24° 13′ 46″ E028° 59′ 02″

Elevation: 3500 feet

Length / Width: 18/36 1800 m x 18 m

Surface type: 18/36 Asphalt

Frequency: 124.8

Obstacles to clear: Mountains to the West

Windsock: Yes, in the middle of the runway to the East

Landing suggestion: Wind mostly favours 36

Take off suggestion: Wind mostly favours 36

Buildings/Hangars: Hangars to the East

Night flying: Nil

IMPORTANT / DANGER:
Prior permission required. Right hand circuit runway 36. Mountains to the East.

Contact Details: Cell: 082 852 5961 E-mail:
nico@limpopoflightschool.co.za

6.4.3 R170/ Tebogo

Aerodrome Name: Tebogo

Registration Number: R 170

Type of aircraft for which the aerodrome is planned: Nil

Coordinates (WGS 84): S25° 05′ 54″ E029° 13′ 58″

Obstacles to clear: Nil

Contact Details: Cell: 082 388 1338 E-mail: andre@tysocon.co.za

6.4.4 R214/ Die Boskamp

Aerodrome Name: Die Boskamp

Registration Number: R 214

Runway Bearings: 17/35

Coordinates (WGS 84): S 24° 53' 33.3" E 029° 09' 31.5"

Altitude: 3082 ft

Length / Width: 825m x 25m

Surface type: Gravel

Radio Frequency: 124.8

Obstacles to clear : Nil

Windsock: Yes

Night flying: Nil

Landing suggestion: Nil

Take off suggestion: Nil

Buildings /Hangars: Nil

Important/ Remarks: 2 cement blocks , one for parking and on threshold 35 for power checks

Contact Details: Giovan Emile Smit

Contact number: 073 424 2465/ 073 024 2506

E-mail: giovanemile@yahoo.com

6.4.5 R304/ TKB

Aerodrome Name: TKB

Registration Number: R 304

Runway Heading: 004/184

Alternative Runway: Nil

Coordinates (WGS 84): S25° 05′ 03″ E029° 19′ 01″

Elevation: 2926 feet

Length / Width: 004/184 680 m x 30 m

Surface type: 004/184 Gravel

Frequency: 124.8

Obstacles to clear: On approach runway 184 about 150 m on the approach power lines treshold

Windsock: Yes

Landing suggestion: 004

Take off suggestion: 184

Buildings/Hangars: Nil

Night flying: TBA

IMPORTANT / DANGER:
Prior permission to land required.

Contact Details: Cell: 073 024 2506 E-mail: giovanemile@yahoo.com

6.4. Obstacles – Operational Mitigation

SOUTH AFRICAN CIVIL AVIATION AUTHORITY	**REPUBLIC OF SOUTH AFRICA** CIVIL AVIATION AUTHORITY **AERONAUTICAL INFORMATION CIRCULAR**	*CAA Private Bag x73 Halfway House 1685*
Tel: (011) 545-1000 Fax: (011) 545-1465 E-Mail: mail@caa.co.za		***AIC Series B*** *008/2021 07 OCT 2021*

OPERATIONS OF AIRCRAFT

SAFETY

OBSTACLES OF SIGNIFICANCE TO AIR NAVIGATION

☛ *Indicates changes*

☛ *This AIC replaces AIC 006/2016 dated 21 JUL 2016*

1. *It is impossible for the CAA to provide a complete list of radio masts, microwave towers, wind turbines and other high structures, which are continually being erected over the country.*

2. ☛ *Pilots are cautioned that these structures constitute a potential danger to aircraft, especially during low level operations in reduced visibility or in marginal weather conditions. Pilots are also cautioned that supported masts have anchor cables, which might not always be marked. Extreme caution should be exercised during low flying.*

3. *Where practicable, structures higher than 45m (148 feet) AGL are conspicuously marked by day and night markings, but it must be noted that some might not be marked accordingly.*

4. *Details of known structures which constitute a potential hazard to aviation are published on the CAA's website:*

   a) *The obstacle dataset is available on www.caa.co.za > Information for the Industry > Obstacles.*

   b) ☛ *The obstacle dataset is updated in accordance with the AIRAC publication dates.*

   c) *Special requests for obstacle data can be directed to the GIS Section of the PANS-OPS office (gis@caa.co.za).*

5. ☛ *Pilot attention is drawn to the following criteria used for the charting of obstacles:*

   a) *Only structures higher than 60m (197 feet) AGL are shown on aeronautical charts. This is due to the large number of structures below 60m (197 feet), which makes publication impractical.*

6. ☛ *Details regarding known significant structures, or temporary structures such as cranes and Monitoring mast, which constitute potential hazards to aviation, will be published by NOTAM for the first 30 days, where the NOTAM will self-cancel after 30 days of publication and the information shall be incorporated into the Obstacle Dataset as per 4(a).*

6.5. Danger of Powerlines to Overflying Aircraft

<table>
<tr><td></td><td rowspan="2">REPUBLIC OF SOUTH AFRICA

CIVIL AVIATION AUTHORITY

AERONAUTICAL INFORMATION CIRCULAR</td><td>CAA
Private Bag x 08
Waterkloof
0145</td></tr>
<tr><td>Tel: (012) 346-5566
Fax: (012) 345-6059
E-Mail: mail@caa.co.za</td><td>AIC
21·8
01-08-15</td></tr>
</table>

OPERATION OF AIRCRAFT

SAFETY

<u>DANGER OF POWERLINES TO LOW-FLYING AIRCRAFT</u>

Λ Indicates changes.

Λ1. This AIC replaces AIC 21·8 dated 94-01-15.

2. The attention of all pilots is again drawn to the inherent danger to lowflying aircraft of overhead powerlines which have been erected over wide areas of the Republic. This danger is particularly great in the case of powerlines which span valleys and gorges or which cross the crests of hills. These powerlines often blend with trees etc. in the background and are therefore very difficult to observe.

3. Regulation 91.06.32 of the Civil Aviation Regulations 1997 relating to minimum heights requires aircraft to be flown at a height of not less than 500 feet above the ground or water unless the flight can be made without hazard or nuisance to persons or property on the ground or water. It is therefore the duty of every pilot to make sure that he is aware of the location of these hazards. Low level operations should therefore be avoided as far as possible.

4. An endeavour is being made to have the location of all powerlines shown on aeronautical maps as and when these maps are reprinted.

COMMISSIONER FOR CIVIL AVIATION

6.6. Rules of the Air

ENR 1 GENERAL RULES AND PROCEDURES
ENR 1.1 GENERAL RULES

The air traffic and procedures applicable to air traffic in the Republic of South Africa conform with Annexes 2 and 11 to the Convention of International Civil Aviation and to the Procedures for Air Navigation Services - Rules of the Air and Air Traffic Services, and the Regional Supplementary Procedures applicable to the AFI Region except in the cases listed in GEN 1.7.

All differences have been registered with the International Civil Aviation Organisation.

1 Minimum Heights

1) Except when necessary for taking off or landing, or except with prior written approval of the Director, no aircraft -
   a) shall be flown over built-up areas or over an open-air assembly of persons at a height less than 1 000 feet above the highest obstacle, within a radius of 2000 feet from the aircraft;
   b) when flown elsewhere than specified in paragraph (a), shall be flown at a height less than 500 feet above the ground or water, unless the flight can be made without hazard or nuisance to persons or property on the ground or water; and
   c) shall circle over or do repeated overflights over an open-air assembly of persons at a height less than 3 000 feet above the surface.
2) Except when necessary for take-off or landing, or with the express permission of the Director, an aircraft shall at night, in IMC, or when operated in accordance with IFR, be flown
   a) at a height of at least 1 000 feet above the highest terrain or obstacle where the height of such terrain or obstacle does not exceed 5 000 feet above sea level within five nautical miles of the aircraft in flight; or
   b) at a height of at least 2 000 feet above the highest terrain or obstacle located within five nautical miles of the aircraft in flight where the height of such terrain or obstacle exceeds 5 000 feet above sea level: Provided that within areas determined by the Director the minimum height may be reduced to 1000 feet above the highest terrain or obstacle located within 5 nautical miles of the aircraft in flight, and provided furthermore that the aircraft is flown in accordance with such procedures as the Director may determine.

2 Dropping objects, spraying or dusting

Except in an emergency or unless granted special permission by the Director, no article shall be dropped from an aircraft in flight other than-

a) fine sand or clean water used as ballast; or
b) chemical substances for the purpose of spraying or dusting.

6.7. FAA Guidelines on EM Interference

For proposed projects off, but close to airport property, the methodology considers three key questions:

Does the project height penetrate airspace?

The FAA has certain criteria to determine this, but in the SA scenario we substitute ICAO Annex 14 and any additional provisions of the SACAA Regulations (CATS 139.30), where these are more onerous. This would typically involve a desktop analysis of the aerodrome or airfields closest to the project site – in this case only FAWB. Airfields further than 8km away are generally not affected, unless approach or departure corridors pass directly over the site and there are precision navigation approaches in play, where aircraft have very 'flat' approach paths of 2,0%. (There might be military considerations here, too, but these in fact are excluded from the provisions of the DFFE Protocol).

Is the Project Design/Orientation likely to cause reflectivity concerns?

For solar PV projects consideration is given to 'glint' and 'glare' issues that might cause 'flash blindness' arising from both specular and diffused reflections. This is important for solar PV projects, but for the other proposed facilities it may be necessary to consider any potential effects of construction materials (roof) and other potentially reflective components.

Depending on the proposed site layout, a geometric analysis based on the changing azimuth and bearing of the sun through the year, at key times during the day where air traffic is likely to be impacted, is sufficient for this purpose.

Is the Project likely to Interfere with Communications Systems, Operations and/or Flight Standards/Procedures?

The DFFE Protocol for environmental civil aviation studies refers specifically to 'radar'; however the FAA precedent document also looks at potential interference on all types of communications equipment, which is prudent. Thus, consideration is given to, inter alia:

Location of radar facilities

Location of Control Tower(s)

Location of (remaining) ground based NDB's (since these are being phased out)

Location of VOR/DME installations that could be affected by the potential of the project (or key components thereof) to generate EM radiation that could perhaps affect these. Based on FAA guidelines, these distances are generally quite small, and are not usually a cause for concern.

Finally, as part of the 'operational' aspect, a review would be undertaken of existing flight corridors, RNAV and VFR routes, approaches in the area and published airport/airfield procedures, circuits, etc., to assess the potential of the proposed project to negatively impact on any of these at a material risk level i.e. more severe than 'low'. If so – and only in such case – would the matter need to be escalated to the SACAA for further analysis or review, in terms of the DFFE Protocol.

6.8. Eskom Publication on EMF Risk

Electric and magnetic fields of power lines

May 2022

1. Introduction to power line electric and magnetic fields

Electric and magnetic fields are phenomena inherent to the generation and consumption of electricity. Electric power is supplied as an alternating current at a frequency of 50 Hertz (Hz or "cycles per second").

Power system frequency is substantially lower than most other common electromagnetic fields; for example, 5G cellular communication systems operate at 5 GHz (billion Hertz or 1 000 000 000 Hz). Electromagnetic Fields (EMFs) that emanate from power lines are of an Extremely Low Frequency (ELF). The energy associated with the field is proportional to the frequency, and therefore the energy linked to 50 Hz power fields is very low, relative to almost all other EMFs.

Electric and magnetic fields exist in the vicinity of overhead power lines and are related to the voltage and current on the line, respectively.

An electric field is defined as a voltage gradient (measured in Volts per metre or V/m), and electric fields are proportional to the amount of electrical charge on an object, or the voltage potential applied to an object, such as a power line conductor. Electric fields decrease with the square of the increase in distance from the source ($1/r^2$), i.e., at double the distance, the field drops to 25%. Therefore, the field reduces rapidly with increasing distance from the line.

Magnetic fields or 'magnetic flux density' are produced by the current flowing (i.e., the movement of electric charge) through a conductor (measured in Tesla, T). The current on an electrical system varies depending on the number and rating of the devices supplied by the system. This is referred to as the 'load' on the system. As the load changes, the magnetic fields will change in unison. Magnetic fields also decrease with the square of the increase in distance from the source (e.g., power line conductor).

In the case of power lines, fields at ground level are of interest as this is where there could be human exposure. The fields at ground level are influenced by the conductor configuration on the power line structure and conductor height above ground. As the voltage increases, the structure height tends to increase to maintain safety clearances to objects under the line, and this partially negates the increase in electric field levels at the ground.

All power lines have a certain area of space to either side of the line called the servitude which is allocated for maintenance (Figure 1 and Figure 3). Strictly, this area is not allowed to be developed or inhabited which would interfere with access to the line as well as result in some potential hazards. The levels for public exposure therefore apply to the boundary of the servitude. Workers inside the servitude may be exposed to short-term higher occupational levels.

Interestingly, migratory birds use the earth's magnetic field to navigate. The earth's magnetic field is static unlike the field from power lines and varies between 30 µT (micro-Tesla) for most temperate and tropical areas to over 60 µT near to the poles. These birds appear to be completely unperturbed and even

1

oblivious to the high electric and magnetic field levels encountered when perching directly on conductors or near power lines.

2.1 Electric fields

The overall electric field due to a power line is the resultant of three-phase voltages that vary continuously and are displaced by 120° (i.e., out of "sync:). This means that the fields from the individual phases cancel one another to a large extent. If the three conductors were brought very close together, there would be a zero net field.

The electric field 'falls off' to the square of the distance from the line. The partial cancellation, as well as the rapid reduction with distance result in very low field levels - a mere few 10s of metres from the power line (Figure 1). Figure 1 represents the field associated with different 132 kV lines which are the most common high-voltage (HV) lines in South Africa, whilst most visible lines are medium voltage (MV).

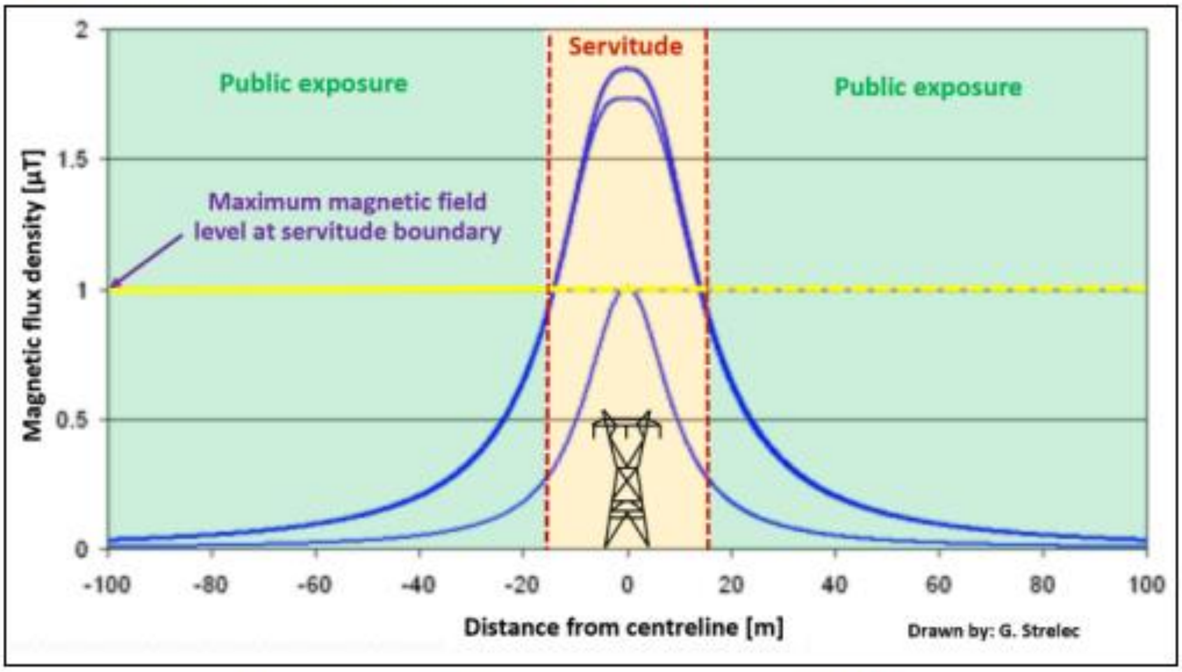

Figure 1: Electric field profile at ground level for typical 132kV line designs

Electric fields are readily attenuated 'partly shielded) by conductive and even partially conductive ordinary objects or structures e.g., buildings, trees, etc. Figure 2 illustrates the significant electric field attenuation due to normal trees in the path between the source of EMF and measurement position.

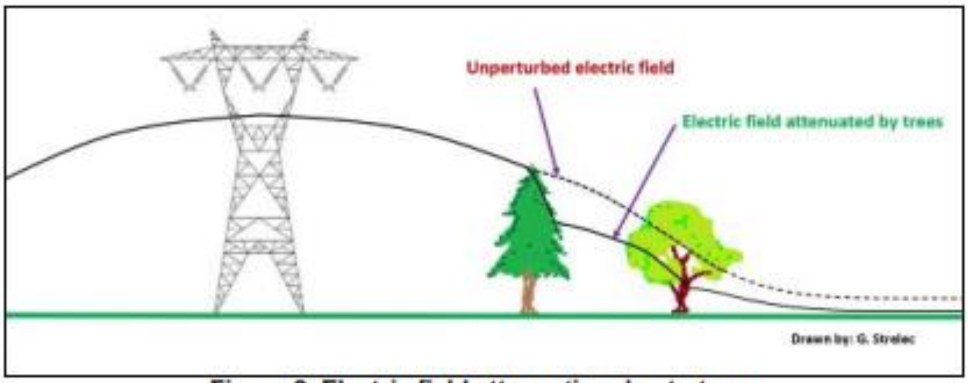

Figure 2. Electric field attenuation due to trees

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2.2 Magnetic fields

In South Africa, the most common high-voltage power lines are operated at a nominal voltage of 132 kV and the magnetic fields associated with lines of this voltage level rarely exceed 2 μT. Most overhead lines are medium voltage and are operated at voltages up to 22 kV.

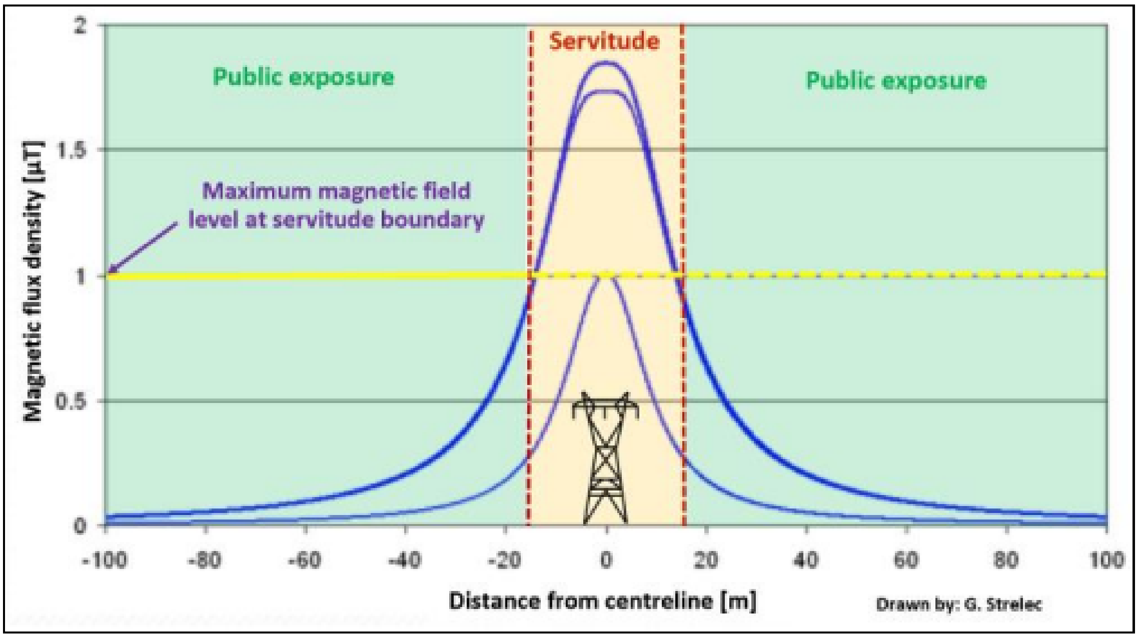

Figure 3. Magnetic field profile at ground level for typical 132kV line designs

Unlike electric fields that are readily attenuated by ordinary materials, magnetic field shielding requires 'ferro-magnetic' metals that have high magnetic permeability, typically iron (steel), and alloys of iron with cobalt or nickel.

2. Health concerns related to power line EMFs

Concerns originated several decades ago about a possible link between health effects and power lines. Until now (2022), there has been no scientific study to indicate anything other than a weak statistical link. In general, controlled laboratory studies do not support the findings of early controversial research on populations near to power lines. Furthermore, no biological mechanism for any adverse health impact has been identified, which can be attributed to the extremely low frequency electromagnetic field exposure from power lines. EMF certainly does not damage DNA (genome), or disrupt any cellular metabolic processes that could result in adverse health effects.

Referring to EMF as "radiation" can be misleading. Radiation is commonly used to describe the potent energy given off by radioactive materials such as uranium. These materials are unstable and emit nuclear radiation in the form of gamma rays, alpha and beta particles, that have extremely high energies and are acutely hazardous to all life and damaging to most materials. This is contrary to EMF, in general, and especially to extremely low frequency electromagnetic fields. Shielding for nuclear radiation requires thick layers of high-density material like lead.

Occasionally, concerns are expressed about possible health effects related to power lines, particularly Electromagnetic Fields (EMFs). These concerns are unduly potentiated by extensive non-scientific and non-peer-reviewed misinformation published on the internet and in social media.

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3. Electric and magnetic fields due to household appliances

Electric and magnetic fields are also generated by ordinary electrical household appliances. Close to these appliances, the fields can be higher than those due to power lines. The relative magnetic field exposure from common kitchen appliances is higher than the field when directly under a power line (Figure 4). Although the voltages and currents of power lines may be much higher, the distances between household sources and exposed people are comparatively tiny.

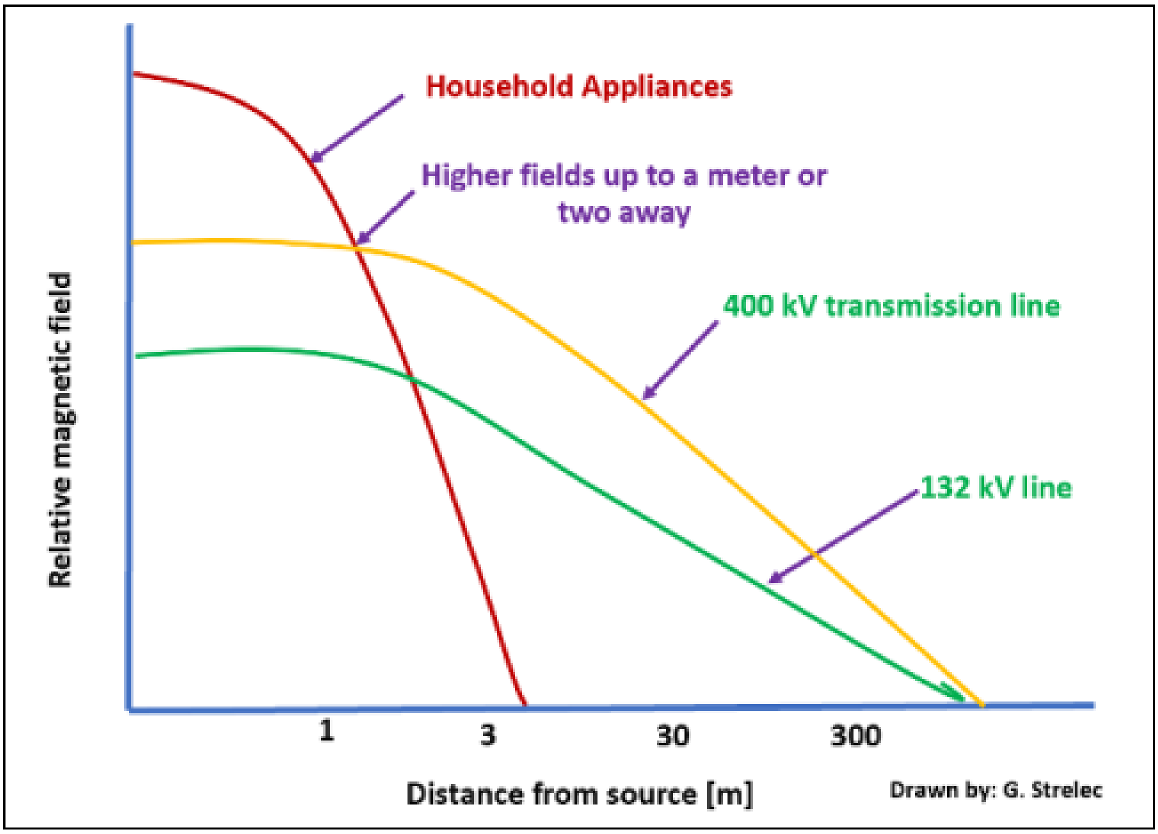

Figure 4: Relative magnetic fields associated with household appliances and overhead lines

EMF exposure in the home is higher in the "near field" (within a metre or two) from ordinary appliances. It is not feasible to design and manufacture specially shielded appliances and household wiring to reduce these fields.

All humans in modern environments are exposed to EMF, as it is an inherent property of electricity. Whilst a shielded connection to the consumer to reduce the electric field is technically possible, the electric field is omni-present due to the presence of voltage in all electrical devices and wiring, even if no power is consumed.

4. Exposure guidelines for EMFs

For more than two decades, the focus of the scientific community has shifted away from Extremely Low Frequency (ELF) Electromagnetic Field (EMF) exposure from power lines as no consistent or compelling evidence could be found. Recent medical research is focussed exclusively on high frequency exposure

4

from mobile telecommunication systems. There are no recent publications related to the health effects of power frequency EMFs associated with power lines.

Despite the lack of definitive effects or mechanisms, international bodies agreed to take a conservative approach and extensive research was conducted over several decades by experts from various scientific disciplines, including medical and engineering. Ultimately, precautionary guidelines for exposure limits were proposed in the late 1990s by the International Council on Non-Ionising Radiation Protection (ICNIRP). Subsequently, these guidelines were adopted by the World Health Organisation (WHO) and all other health and power utility related international organisations, most of which published these recommendations during the 2000s in their own documentation. The South African Department of Heath endorses the ICNIRP/WHO guidelines. Eskom has also adopted the ICNIRP values and applies these recommendations to all infrastructure, including power lines, underground cables, and substations.

The ICNIRP guidelines and the international consensus (WHO etc.) was reaffirmed in the late 2000s, and the position remains unchanged until the present, in 2022. This information is reviewed, and any potential developments are continuously monitored by Eskom.

It must be emphasised that these guidelines are in the absence of any demonstrable scientific justification. Although some biological effects, such as nerve stimulation, have been demonstrated at levels that are many times higher than these guideline values, no adverse health effects such as changes in living tissue, have been discovered at all. Furthermore, the typical levels from almost all power lines are very low, or even negligible compared to the ICNIRP values.

The human nervous system is electrical in nature. Nerve impulses are transmitted as miniscule electrical pulses. The biological effects related to EMF exposure, such as nerve stimulation, are caused by the currents that are induced inside the body tissues. However, such currents have not been shown to cause any harm to living cells. At extremely high levels, these currents can cause very mild heating effects. As the body is not a very good conductor (resistivity of body tissue ranges between about 10 Ω.m and 50 Ω.m) these effects are mild. In good conductors, such as metals, these "induction effects" can be pronounced, as these materials are characterised by resistivities that are around 1 billion (1 000 000 000) times lower than body tissue. The induced currents are proportional to the frequency of the EMF, so heating is not considered at 50 and 60 Hz, and only at higher frequencies.

Consequently, the basic restriction set by ICNIRP is based on induced fields in human body tissues for power frequencies and for higher frequencies, on induced currents that may result in heating. There are two categories:

- Occupational - levels for people who may be temporarily exposed to slightly higher levels than the public due to the nature of their work;
- Public – levels for members of the public who may be continuously exposed due to the proximity of electrical infrastructure.

The Basic Restriction, based on current density, is 10 mA/m^2 (milli-Amperes per area) for occupational exposure and 2 mA/m^2 for continuous public exposure. This body current is impractical to measure, leading to guidelines being based instead on induced field levels in typical human body tissue. The electric and magnetic field exposure guidelines set by the ICNIRP are shown in Table 1.

Table 1. Power frequency (in SA, 50 Hz) electric and magnetic field exposure guidelines (ICNIRP)

Exposure classification	**Electric Field** [kV/m]	**Magnetic Field** [μT)]
Occupational	10	500
Public	5	100

It is emphasised that the ICNIRP values are guidelines and are merely precautionary levels recommended in the absence of conclusive scientific evidence. The ICNIRP values are not South African engineering standards and much less enforced by law (statutory).

The International Council on Large Electric Systems (CIGRE) is the organisation that regulates the international standards for power plant infrastructure, including power lines. CIGRE makes the following statement regarding EMF exposure: "It is CIGRE's view that there is no scientific justification for measures to reduce exposure to EMF through changes in the technology and management of existing high-voltage power systems. Nevertheless, considering the existence of public concern and some scientific uncertainties, CIGRE will continue to monitor the issue and to update its view in the light of any new developments."

Despite this, Eskom strives to meet these guidelines for all existing and new infrastructure.

Table 2 provides typical electric field values associated with overhead power lines. This is characteristic of Eskom lines as well as any typical power lines from other international utilities that design to similar overall principles and the same international standards. These values have also been confirmed by numerous site measurements conducted on Eskom lines over several decades and concur with values readily available from other transmission and distribution companies from, amongst others, the USA, Europe, and UK National Grid.

Table 2: Representative electric field levels from power lines for different voltage levels

Nominal Voltage [kV]	**Max. E-Field (kV/m)**	**E-Field at Servitude Boundary [kV/m]** **Guideline: 5 kV/m**	**Servitude Width [m]**
765	7	**2.5** (50%)	40.0
400	4.7	**1.5** (30%)	23.5
275	3	**0.5** (10%)	23.5
132	1.3	**0.5** (10%)	15.5
88	0.8	**0.3** (6%)	15.5

The levels at the servitude boundary are considerably lower than the maximum ICNIRP guideline of 5kV/m for continuous public exposure. The percentage of the guideline value for various power line voltages are in brackets after the typical electric field value.

Eskom operates a few 765kV transmission lines, which is one of the highest voltages in the world. The 765kV voltage level represents a miniscule proportion of the Eskom overhead lines. The field levels at the servitude boundary are only half of the guideline value. Moreover, the 765kV lines only exist in rural countryside and human exposure is extremely limited and will only be transient in nature.

It is far more likely that a small percentage of the population may be exposed to high-voltage power lines energised at 132 kV. The 132kV lines are associated with electric field levels between about 5% and 10% (Figure 1) of the ICNIRP value. Although these are representative levels, in many cases, the fields on power lines are even lower than these values, especially for newer lines which have more compact designs that result in increased mutual cancellation of the fields between the conductors. It is worth to note that the field levels are still below the guideline, even directly below any transmission line (except perhaps for some 765kV designs), whilst the guidelines categorically apply to the servitude boundary.
Table 3 provides representative magnetic field values associated with overhead power lines. Since the magnetic field is related to current, the field levels are not related to the voltage of the line (Table 3), and 765kV lines, for example, usually have lower magnetic field levels than 400kV lines.

Table 3. Representative magnetic fields due to power lines of different voltages

Nominal Voltage [kV]	Current [A]	Maximum magnetic field [μT]	Magnetic field at servitude boundary [μT] Guideline: 100 μT	Servitude width [m]
765	560	6.0	1.5 (1.5%)	40.0
400	650	10.5	2.5 (2.5%)	23.5
275	350	6.0	1.0 (1.0%)	23.5
132	150	4.0	1.0 (1.0%)	15.5
88	60	1.4	0.2 (0.2%)	15.5

The ICNIRP guideline level for continuous public exposure is 100 μT. Normal 132kV designs seldom exceed 1 μT (Figure 2) at the servitude boundary, which is only 1% of the guideline value.

5. Eskom management of EMF exposure

Eskom has been managing concerns related to EMF since 1988. Furthermore, Eskom established a National Forum in 1990 to report on international research findings and recommend methods on how to deal with the topic of EMF concerns in South Africa.

Policies on EMF have been formulated to practicably cover all the various areas of infrastructure, including power lines and substations. Building of structures beneath powerlines is a major issue in South Africa. This encroaching of servitudes by communities not only impacts utilities who need to maintain the lines, but also increases the risk for the people living under power lines. They are exposed to danger if there is an "earth-fault" (short-circuit) on the line, within the servitudes. Eskom continuously educates communities about the dangers of building structures under powerlines, and also shares the information with municipalities across the country.

Eskom continues to monitor developments in international research and to share information with all stakeholders and the public.

Did you know?

The International Agency for Research on Cancer (IARC), which is part of the World Health Organization (WHO), classifies cancer which is internationally recognised. The four categories and examples are provided in Figure 5 below.

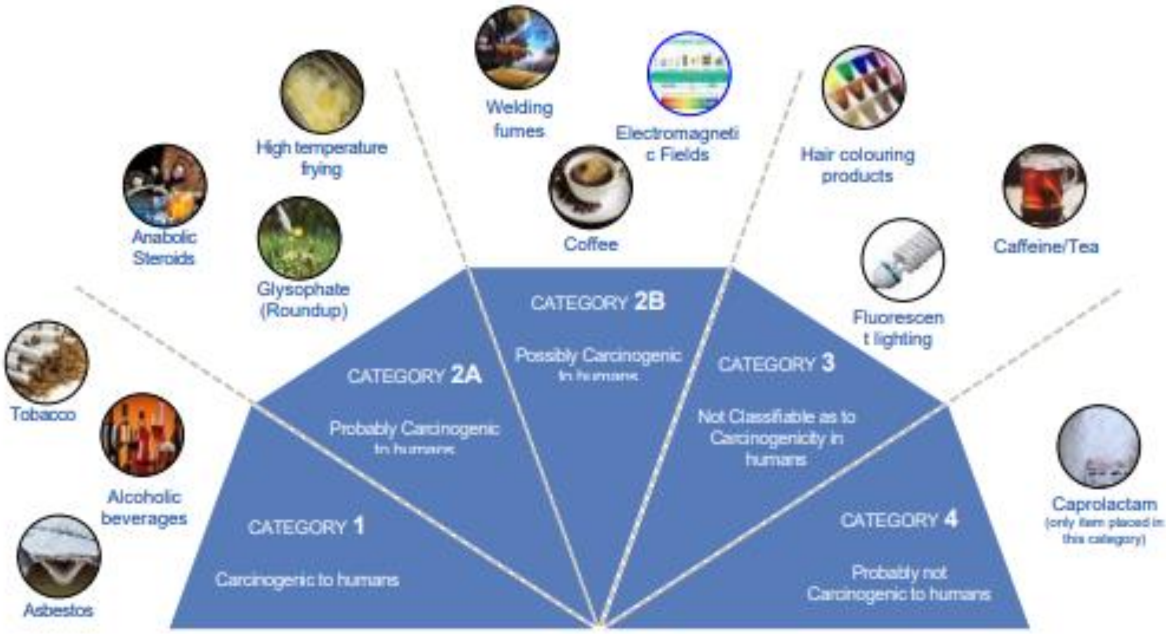

Figure 5: Carcinogenic categories and examples of agent classifications

6.9. ICAO Standards and Recommended Practices (SARPS)

All infrastructure proposals and developments will be implemented in accordance with standards and recommended practices of the International Civil Aviation Organisation (ICAO) and the SA Civil Aviation Authority (SACAA), as contained in the Civil Aviation Regulations (CARS), as well as relevant SANS standards, planning policies and by-laws in place in the Limpopo Province and relevant Municipal Districts.

Annex 14	Airport Planning
Annex 10	Aeronautical communications
Annex 17	Security
Doc 8991	Manual on Air Traffic Forecasting
Doc 8261	Airport Economics Manual

Table 6-1: Typical ICAO Annexes

Other stakeholders in the civil aviation space may need be consulted including the SACAA and ATNS.

Airport Reference Code

Airport geometrics are determined in accordance with International Standards and Recommended practices (SARPS). These standards are included in the following documents (as updated by ICAO from time to time):

- ICAO, Annex 14 "International Standards and Recommended Practices for Airports";
- ICAO, Airport Design Manual part 1: Runways;
- ICAO, Airport Design Manual part 2: Taxiways, Aprons and Holding Bays;
- ICAO, Airport Design Manual part 3: Pavements;
- ICAO, Airport Design Manual part 4: Visual Aids;
- ICAO, Airport Design manual part 5: Electrical Systems;
- ICAO, Airport Design Manual part 6: Frangibility;
- ICAO, Airport Services Manual, part 1: Rescue and Fire Fighting;
- ICAO, Airport Services Manual, part 3: Bird Control and Reduction;
- ICAO, Airport Services Manual, part 6: Control of Obstacles;

ICAO Annex 14 assigns an Airport Reference Code (Code number and letter), which is a simple method for matching the characteristics of airport facilities to those of aircraft intended to operate at the airport. The code number is used to classify the runway length, referenced to sea level under 'standard' atmospheric conditions; the code letter is used to classify the main part of the airside layout, based mainly on aircraft wingspan, although more recent editions also use landing gear geometry as a reference.

CODE ELEMENT 1		CODE ELEMENT 2	
Code number	**Aeroplane Reference Field Length**	**Code Letter**	**Wing span**
1	Less than 800	**A**	Up to but not including 15m
2	800m up to but not including 1200m	**B**	15m up to but not including 24m
3	1200m up to but not including 1800m	**C**	24m up to but not including 36m
4	1800m and over	**D**	36m up to but not including 52m
		E	52m up to but not including 65m
		F	65m up to but not including 80m

Table 2: ICAO Annex 14: Table 4-1

Table 4-1. Dimensions and slopes of obstacle limitation surfaces — Approach runways

APPROACH RUNWAYS

	RUNWAY CLASSIFICATION									
	Non-instrument Code number				Non-precision approach Code number			Precision approach category I Code number		Precision approach category II or III Code number
Surface and dimensions[a]	1	2	3	4	1,2	3	4	1,2	3,4	3,4
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
CONICAL										
Slope	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Height	35 m	55 m	75 m	100 m	60 m	75 m	100 m	60 m	100 m	100 m
INNER HORIZONTAL										
Height	45 m	45 m	45 m	45 m	45 m	45 m	45 m	45 m	45 m	45 m
Radius	2 000 m	2 500 m	4 000 m	4 000 m	3 500 m	4 000 m	4 000 m	3 500 m	4 000 m	4 000 m
INNER APPROACH										
Width	—	—	—	—	—	—	—	90 m	120 m[e]	120 m[e]
Distance from threshold	—	—	—	—	—	—	—	60 m	60 m	60 m
Length	—	—	—	—	—	—	—	900 m	900 m	900 m
Slope								2.5%	2%	2%
APPROACH										
Length of inner edge	60 m	80 m	150 m	150 m	140 m	280 m	280 m	140 m	280 m	280 m
Distance from threshold	30 m	60 m	60 m	60 m	60 m	60 m	60 m	60 m	60 m	60 m
Divergence (each side)	10%	10%	10%	10%	15%	15%	15%	15%	15%	15%
First section										
Length	1 600 m	2 500 m	3 000 m	3 000 m	2 500 m	3 000 m	3 000 m	3 000 m	3 000 m	3 000 m
Slope	5%	4%	3.33%	2.5%	3.33%	2%	2%	2.5%	2%	2%
Second section										
Length	—	—	—	—	—	3 600 m[b]	3 600 m[b]	12 000 m	3 600 m[b]	3 600 m[b]
Slope	—	—	—	—	—	2.5%	2.5%	3%	2.5%	2.5%
Horizontal section										
Length	—	—	—	—	—	8 400 m[b]	8 400 m[b]	—	8 400 m[b]	8 400 m[b]
Total length	—	—	—	—	—	15 000 m	15 000 m	15 000 m	15 000 m	15 000 m
TRANSITIONAL										
Slope	20%	20%	14.3%	14.3%	20%	14.3%	14.3%	14.3%	14.3%	14.3%
INNER TRANSITIONAL										
Slope	—	—	—	—	—	—	—	40%	33.3%	33.3%
BALKED LANDING SURFACE										
Length of inner edge	—	—	—	—	—	—	—	90 m	120 m[e]	120 m[e]
Distance from threshold	—	—	—	—	—	—	—	c	1 800 m[d]	1 800 m[d]
Divergence (each side)	—	—	—	—	—	—	—	10%	10%	10%
Slope	—	—	—	—	—	—	—	4%	3.33%	3.33%

a. All dimensions are measured horizontally unless specified otherwise.
b. Variable length (see 4.2.9 or 4.2.17).
c. Distance to the end of strip.
d. Or end of runway whichever is less.
e. Where the code letter is F (Table 1-1), the width is increased to 140 m except for those aerodromes that accommodate a code letter F aeroplane equipped with digital avionics that provide steering commands to maintain an established track during the go-around manoeuvre.

Note.— See Circulars 301 and 345, and Chapter 4 of the PANS-Aerodromes, Part I (Doc 9981) for further information.

Table 4-2. Dimensions and slopes of obstacle limitation surfaces

RUNWAYS MEANT FOR TAKE-OFF

Surface and dimensions[a] (1)	Code number 1 (2)	2 (3)	3 or 4 (4)
TAKE-OFF CLIMB			
Length of inner edge	60 m	80 m	180 m
Distance from runway end[b]	30 m	60 m	60 m
Divergence (each side)	10%	10%	12.5%
Final width	380 m	580 m	1 200 m 1 800 m[c]
Length	1 600 m	2 500 m	15 000 m
Slope	5%	4%	2%[d]

a. All dimensions are measured horizontally unless specified otherwise.
b. The take-off climb surface starts at the end of the clearway if the clearway length exceeds the specified distance.
c. 1 800 m when the intended track includes changes of heading greater than 15° for operations conducted in IMC, VMC by night.
d. See 4.2.24 and 4.2.26.

Table 3: ICAO Annex 14 Table 4-2

6.10. DFFE Protocol 320

Published in Government Notice **No. 320** GOVERNMENT GAZETTE **43110** 20 MARCH 2020

GAZETTED FOR IMPLEMENTATION

CIVIL AVIATION

PROTOCOL FOR THE SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS FOR ENVIRONMENTAL IMPACTS ON CIVIL AVIATION INSTALLATIONS

1. SCOPE

This protocol provides the criteria for the specialist assessment and minimum report content requirements for impacts on civil aviation installations for activities requiring environmental authorisation. This protocol replaces the requirements of Appendix 6 of the Environmental Impact Assessment Regulations[1].

The assessment and reporting requirements of this protocol are associated with the level of sensitivity identified by the national web based environmental screening tool (screening tool).

The screening tool can be accessed at: https://screening.environment.gov.za/screeningtool.

2. SITE SENSITIVITY VERIFICATION AND MINIMUM REPORT CONTENT REQUIREMENTS

Prior to commencing with a specialist assessment, the current use of the land and the potential environmental sensitivity of the site under consideration as identified by the screening tool must be confirmed by undertaking a **site sensitivity verification**.

2.1. The site sensitivity verification must be undertaken by an environmental assessment practitioner or specialist with expertise in radar.

2.2. The site sensitivity verification must be undertaken through the use of:
(a) a desk top analysis, using satellite imagery;
(b) a preliminary on-site inspection; and
(c) any other available and relevant information.

2.3. The outcome of the site sensitivity verification must be recorded in the form of a report that:
(a) confirms or disputes the current use of the land and environmental sensitivity as identified by the screening tool, such as new developments or infrastructure etc.;
(b) contains a motivation and evidence (e.g. photographs) of either the verified or different use of the land and environmental sensitivity; and
(c) is submitted together with the relevant assessment report prepared in accordance with the requirements of the Environmental Impact Assessment Regulations.

3. SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS

TABLE 1: ASSESSMENT AND REPORTING OF IMPACTS ON CIVIL AVIATION INSTALLATIONS
1. General Information 1.1. An applicant intending to undertake an activity identified in the scope of this protocol for which a specialist assessment has been identified on the screening tool: 1.1.1. on a site identified as being of:

	1.1.1.1. "very high", "high" or "medium" sensitivity for civil aviation, must submit a **Civil Aviation Compliance Statement**; or 1.1.1.2. "low" sensitivity, no further assessment requirements are identified. 1.1.2. on a site where the information gathered from the site sensitivity verification differs from the designation of "very high", "high" or "medium" sensitivity on the screening tool and it is found to be of a "low" sensitivity, no further assessment requirements are identified; 1.1.3. similarly, on a site where the information gathered from the initial site sensitivity verification differs from the designation of "low" sensitivity on the screening tool and it is found to be of a "very high", "high" or "medium" sensitivity, a **Civil Aviation Compliance Statement** must be submitted; and 1.1.4. If any part of the proposed development footprint falls within an area of "very high", "high" or "medium" sensitivity, the assessment and reporting requirements prescribed for the "very high", "high" and "medium" sensitivity apply to the entire footprint. In the context of this protocol, development footprint means the area on which the proposed development will take place and includes any area that will be disturbed.
VERY HIGH SENSITIVITY RATING - high likelihood for significant negative impacts on the civil aviation installation that cannot be mitigated. In-depth assessment of the potential impacts are likely to be required before development can be considered in these areas. **HIGH SENSITIVITY RATING** – potential for negative impacts on the civil aviation installation that can potentially be mitigated. Further assessment may be required to investigate potential impacts and mitigation measures. **MEDIUM SENSITIVITY RATING** - low potential for negative impacts on the civil aviation installation, and if there are impacts there is a high likelihood of mitigation. Further assessment of the potential impacts may not be required.	**2. Civil Aviation Compliance Statement** 2.1. The compliance statement must be prepared by an environmental assessment practitioner or a specialist with expertise in radar. 2.2. The compliance statement must: 2.2.1. be applicable to the preferred site and the proposed development footprint; 2.2.2. confirm the sensitivity rating for the site; and 2.2.3. indicate whether or not the proposed development will have an unacceptable impact on civil aviation installations. 2.3. The compliance statement must contain, as a minimum, the following information: 2.3.1. contact details of the environmental assessment practitioner or the specialist, their relevant qualifications and expertise in preparing the statement, and a curriculum vitae; 2.3.2. a signed statement of independence by the environmental assessment practitioner or specialist; 2.3.3. a map showing the proposed development footprint (including supporting infrastructure) overlaid on the civil aviation sensitivity map generated by the screening tool; 2.3.4. a comment, in writing, from the South African Civil Aviation Authority (SACAA), which may include inputs from the Obstacle Evaluation Committee (OEC), if appropriate, confirming no unacceptable impact on civil aviation installations; and 2.3.5. should the comment from the SACAA indicate the need for further assessment, a copy of the assessment report and mitigation measures is to be attached to the compliance statement and incorporated into the Basic Assessment Report or Environmental Impact Assessment Report with mitigation and monitoring measures identified included in the EMPr. The assessment must be in accordance with the requirements stipulated by the SACAA.

	2.4. A signed copy of the compliance statement must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.
LOW SENSITIVITY RATING - No significant impacts on the civil aviation installation are expected in low sensitivity areas. It is unlikely for further assessment and mitigation measures to be required.	No requirement identified.

6.11. Resumes of Key Resources

Mr Basil Karstadt – PrCPM, BTech (SACPCMP). Basil is a professional project and construction manager who has specialized for nearly 30 years in the delivery of infrastructure projects, mainly for Public Sector clients in remote and developing areas. In aviation, from 2013 he led the KZN Provincial Treasury 'Crack Team' that was responsible for Provincial intervention in the municipal airport space and drove the KZN Regional Airport strategy, which ensured appropriate expenditure on upgraded infrastructure at many of KZN's municipal airports.

Mr Jon Heeger – Pr Eng, MBA, BSc (Eng). Formerly a property development manager in the RMB Group and Group Development Manager at ACSA from 1996, Jon has since become widely recognized as a leading 'regional airport' expert, specializing in turnaround strategies for former Municipal and GA airports. He also regularly acts as Guest Lecturer for the University of KZN and is active in the seminar and conference space as a host and moderator on a wide variety of airport development strategies and aviation topics.

Mr Sibusiso Nkabinde – PD (SA), Dip (BA), Air Traffic Control. Sibusiso is a seasoned professional with over 23 years' experience in Air traffic Management, including Aeronautical Information Management, Aerodrome and Approach Air Traffic Control, Air Traffic Control Instruction & Examination, Air Traffic Services Management, Executive Leadership in Aeronautical Search & Rescue, Aerospace Medicine (ATC Ergonomics) and Governance. He is a full Professional Member of the Director's Association of South Africa and has notably represented South Africa in CANSO Task Teams, ICAO meetings, and South Atlantic ATM/CNS forums, focusing on Air Traffic Management System harmonization and interoperability.

Also refer: www.gwi.co.za | www.av-innovate.com

Curriculum Vitae (CV): JBC Heeger

<table>
<tr><td>1</td><td>PROPOSED POSITION FOR THIS PROJECT</td><td colspan="4">Aviation and Airport Specialist</td></tr>
<tr><td>2</td><td>NAME OF PERSON</td><td colspan="4">Heeger, Jon</td></tr>
<tr><td>3</td><td>DATE OF BIRTH</td><td colspan="4">2 May 1955</td></tr>
<tr><td>4</td><td>NATIONALITY</td><td colspan="4">South African</td></tr>
<tr><td>5</td><td>MEMBERSHIP IN PROFESSIONAL SOCIETIES</td><td colspan="4">Member, Engineering Council of South Africa -ECSA No. 820365 (1982 - 2008)</td></tr>
<tr><td>6</td><td>EDUCATION</td><td colspan="4">MBA (Construction Management), University of the Witwatersrand, 1985
GDE (Construction Management), University of the Witwatersrand, 1985
BSc. Civil Engineering, University of the Witwatersrand, 1977
BCom modules (part time): Micro and Transport Economics, UNISA 1978-1980</td></tr>
<tr><td>7</td><td>OTHER TRAINING</td><td colspan="4">ACSA/IATA/ICAO- Internal Training & Development programmes (1994-2000)
Presentor/Attendee at various Aviation Conferences/Seminars (Aviadev, ATNS, BARSA)
Guest Lecturer for Aerotropolis Institute Africa, UKZN (202-2023)</td></tr>
<tr><td rowspan="3">8</td><td rowspan="3">LANGUAGES & DEGREE OF PROFICIENCY</td><td>Language</td><td>Speaking</td><td>Reading</td><td>Writing</td></tr>
<tr><td>English</td><td>Excellent</td><td>Excellent</td><td>Excellent</td></tr>
<tr><td>Afrikaans</td><td>Good</td><td>Excellent</td><td>Good</td></tr>
<tr><td>9</td><td>COUNTRIES OF WORK EXPERIENCE</td><td colspan="4">South Africa, Botswana, Ghana, Mozambique, Nigeria, Liberia, China, Kenya, Brazil and Rwanda.</td></tr>
<tr><td rowspan="5">10</td><td>EMPLOYMENT RECORD</td><td colspan="4"></td></tr>
<tr><td>Independent Expert/Consultant: Airport Planning and development</td><td colspan="2">FROM:
2000</td><td colspan="2">TO:
2022</td></tr>
<tr><td>Airport Planning/Development Division - Airports Company South Africa
Position: Group Manager – Airport developments</td><td colspan="2">FROM:
1996</td><td colspan="2">TO:
1999</td></tr>
<tr><td>RMB Group (now Eris Properties)
Position: General Manager: Developments</td><td colspan="2">FROM:
1984</td><td colspan="2">TO:
1996</td></tr>
<tr><td>SA Transport Services
Position: Civil Engineer – Rail Infrastructure</td><td colspan="2">FROM:
1977</td><td colspan="2">TO:
1983</td></tr>
<tr><td>11</td><td>WORK UNDERTAKEN THAT BEST ILLUSTRATES YOUR CAPABILITY TO HANDLE THIS ASSIGNMENT</td><td colspan="4"></td></tr>
</table>

		2022/3 Airport/Aviation Specialist (ongoing) *Feasibility Study for a possible freight Aerotropolis in Sedibeng Municipality.* Passenger and freight demand assessment and catchment area determination; engagement with airline/charter operators and freight forwarders. Status quo review of existing airport infrastructure and compliance check with ICAO Annex 14, IATA and SACAA SARP's (safety, security, health and safety). Assessment of non-aeronautical revenue opportunities. Surface connectivity assessment and pre-planning for improved access onto Provincial roads system, based on Provincial Master Plans and IDP's. Identification of gaps and opportunities for innovation in airlift development, particularly RPAS (Remote Piloted Aircraft Systems, UAV's or drones) in commercial and law enforcement operations. Reference: Mr Tebogo Mutlaneng, Project Manager, Vaal Aerotropolis Study, Sedibeng District Municipality – **tebogom@sedibeng.gov.za**
		2022/3 Airport/Aviation Specialist (ongoing) *Master and Land-use plan Review and Pre-Feasibility Study for the re-development of Plettenberg Bay Airport, Bitou Local Municipality.* Route analysis and passenger demand assessment; engagement with airline/GA operators. Status quo review of airport infrastructure and compliance check with ICAO Annex 14, IATA and SACAA SARP's (safety, security, health and safety). Diversification strategy for non-aeronautical revenue development. Surface connectivity assessment and pre-planning for new airport entrance and improved access onto Provincial roads system, including e-hailing options. Identification of gaps and opportunities for innovation in airlift development, particularly RPAS (Remote Piloted Aircraft Systems, UAV's or drones) in maritime patrol, commercial and law enforcement operations. Reference: Mr M Memani, Municipal Manager, Bitou Local Municipality – **mmemani@plett.gov.za**
		2022 Airport/Aviation Specialist (ongoing) *Master and Land-use plan Review and Pre-Feasibility Study for the re-development of Margate Airport, Ray Nkonyeni Local Municipality.* Route analysis and freight/passenger demand assessment; engagement with airline/charter operators. Status quo review of airport infrastructure and compliance check with ICAO Annex 14, IATA and SACAA SARP's (safety, security, health and safety). Diversification strategy for non-aeronautical revenue development. Multi-modal connectivity assessment and pre-planning for new airport entrance and improved access onto Provincial road system, including public transport options. Identification of gaps and opportunities for innovation in airlift development, particularly RPAS (Remote Piloted Aircraft Systems, UAV's or drones) in maritime patrol and law enforcement operations. Reference: Ms Volanda van Rensburg, Airport Manager, Margate Airport, Ray Nkonyeni Local Municipality – **yolanda.vanrensburg@rnm.gov.za**
		2022 Aviation Specialist (ongoing) *Benchmarkinig Study and Strategy Development for Airlift as a Catalyst for Tourism Growth and*

		Development in the SADC region. (SADC Ministers Council, Secretariat) Route analysis and passenger surveys, route/frequency assessment with airline/charter operators. Assessment of scheduled and non-scheduled fleet mix and status quo review of airport infrastructure within the SADC region and compliance with ICAO Annex 14, IATA and client service levels standards/policies (security, health and safety). Review of Bilateral Air Service Agreements for International and Regional movements within SADC, identification of gaps and opportunities for innovation in airlift development. Status assessment of the progress of the SAATM initiative through the African Civil Aviation Commission and assessment of the status of the Yammousoukro Protocol. Reference: Dr Salifou Siddo, AFC Agriculture and Finance Consultants GmbH – **salifou.siddo@afci.de**
		2019/2022 Airport Specialist *Redevelopment Options for Springs Airport, Springs (Anglo American, SMEC Engineers)* Passenger surveys, traffic forecasting and route/frequency assessment with airline/charter operators. Assessment and agreement of critical design aircraft, runway and terminal planning to ICAO Annex 14, IATA and client service levels standards/policies (security, health and safety) for three site options; commercial land use options for airport precinct, Airport Master Plan including assessment of growth potential for aeronautical and commercial revenues. Assessment of airspace class and options development for navigational and ATC protocols. Input into EIA and noise footprint; Feasibility Study for integrated airport precinct and site options analysis. Reference: Mr B Strauss (Kumba) – 082 904 9300 **abraham.strauss@angloamerican.com**
		2019/2020: Airport Specialist *Pre-Feasibility Study for Proposed Ghana Airports Company Limited Regional Airport, Takoradi, Ghana.* Airport catchment area determination, traffic forecasting and route/frequency assessment. Engagement with GACL on Airport Master Plan and critical aircraft determination. Data gathering including meteorological/wind, runway length calculations and specification, obstacle limitation surface assessment, assessment of land use options for airport precinct, Airport Master plan including assessment of growth potential for aeronautical and JIT freight revenues. Terminal planning including peak hour assessment. Feasibility Study for integrated airport precinct.
		Airport Specialist and Business Analyst *Revitalization Options for Ulundi Airport, South Africa. Zululand District Municipality. (2017)* Land use options for airport precinct, update of the Airport Master plan including traffic analysis and assessment of growth potential for aeronautical and freight revenues. Feasibility Study for integrated airport precinct. Reference: Ms Thembi Hadebe - 082 902 6029
		Commercial/Airport Specialist

		Precinct Planning of Port Elizabeth and East London Airports, ACSA (2018/2020) Advise on commercial land use options for airport precinct, assessment of current traffic in relation to previous forecasts insofar as this may impact on commercial and cargo potential/growth. Assessment of other exogenous developments that may impact growth at both airports (e.g. Coega and ELIDZ). Reference: Mr L Tilana (ACSA)
		Airport Specialist and Business Analyst *Redevelopment Options for Grand Central Airport, Midrand. Ivora Capital, Old Mutual Properties (2018/9)* Land use options for airport precinct, update of the Airport Master plan including traffic analysis and assessment of growth potential for aeronautical and non-aeronautical revenues. Pre-Feasibility Study for integrated airport precinct and potential for use of drones for fast-moving commodity/freight delivery. Reference: Mr C Duminy - 083 633 6909
		Aviation Specialist *Republic of Kenya National Tourism Strategy (2017)* Analysis of existing route networks and traffic distribution and associated potential for international and domestic traffic/freight. Alignment of tourism priorities with airport and airlift strategies as between Ministry of Tourism, KAA, KCAA and stakeholder airlines including Kenya Airways, Fly540, Kenya Express and many non-scheduled operators. Assessment of likely impact of early adoption of SAATM on traffic within Kenya. Ref: Hon Najib Balala, Cabinet Secretary, Tourism
		Airport Specialist and Business Analyst (SMEC) *Richards Bay Airport Master Plan, South Africa. City of uMhlathuze (Richards Bay). (2009, 2017, 2021)* Site assessment, land use options and Airport Master plan including traffic forecast, critical aircraft determination and assessment of growth potential for aeronautical, freight and non-aeronautical revenues. Pre-Feasibility Study for new airport. Reference: Ms B Strachan – **strachanb@umhlathuze.gov.za**
		Airport Specialist and Business Analyst *Redevelopment Options for PC Pelser AIrport, Klerksdorp. Matlosana Municipality (2011,2017-19)* Land use options for airport precinct, update of the Airport Master plan including traffic analysis and assessment of growth potential for aeronautical and non-aeronautical revenues. Pre-Feasibility Study for integrated airport precinct. Reference: Mr A Khutlhwayo - 062 692 0590
		Aviation/Airport Specialist and Business Analyst *KZN Treasury Crack Team. KZN Treasury. (2012 – 2013).* Airport Master planning including traffic forecasts and assessment of growth potential for aeronautical and non-aeronautical revenues; Pietermaritzburg, Margate, Wonderboom National, Ladysmith, Ulundi and Richards Bay Airports. Reference: Mr F Alberts, ED Director, Wonderboom National Municipality – 082 802 0382
		Airport Specialist and Business Analyst *Proposed New Mkuze Airport. Umhlosinga Development Agency. (2008 to 2013).*

		Feasibility study for the Mkuze Regional Airport as a catalyst for socio-economic upliftment of the Umkhanyakude District, including potential for local airfreight of agricultural produce.
		Business/Aviation Specialist *Maun Airport Expansion. Botswana Civil Aviation Authority. (2005-2010).* Preparation and validation of traffic forecasts, developing a business model, scenario planning and economic cost-benefit analysis for period 2005-2030. Development of new terminal concept designs and detailed landside Master planning including parking areas and non-scheduled operator FBOs
		Consultant Team Leader *Development of new Passenger Terminals and Cargo Facilities at Maputo. Aeroporto du Mozambique. (2007-2012).* Design review and construction supervision consultant for the new Domestic and International Terminals at Maputo International Airport. Review of contractor-produced traffic forecast, design brief and design proposals, level-of-service analysis and value management. Reference: Mr A Tuendue, CEO, ADM
		Summary of other airport assignments pre 2007. (1980-2007). • *Team leader – Kruger Mpumalanga International Airport:* Commercialisation Study Proposal. • *Lead Joint Venture partner - Mafikeng Airport IDZ (NW Provincial Government):* Proposed Minerals Cluster and commercial development. • *Team leader – Ghana Civil Aviation Authority*: Accra and Kumasi International airport Master Plans; air platform and non-aeronautical commercialisation (proposal). • *Joint Venture consultant – Ghana Civil Aviation Authority:* Implementation of parking equipment and systems, Kotoka International Airport, Accra, Ghana. • *Transport Economist/Business Analyst – World Bank - Monrovia, Liberia:* Assessment of emergency works required at Roberts International Airport. Validation of traffic forecast, development of business model, scenario planning and economic cost-benefit analysis. • *Team Leader – Department of Civil Aviation, Gaborone, Botswana:* Design review and development of alternate designs for new passenger terminal, including development and validation of traffic forecasts and preparation of facilities/ architectural design brief. • *Aviation Specialist – Bi Courtney Consortium, Lagos, Nigeria: Preparation of Master Plan proposals for expansion of domestic terminal* ***As Client Development Team Leader*** • *International Terminal Retail Project – ORTIA Johannesburg (1997)* • *Design Team Leader – Domestic terminal ORTIA (1997)* • *4 300 bay Multi-storey parkade, ORTIA (1996)* • *Chairman, Airport Steering Committee, La Mercy Airport (1997)* • *General Aviation Centre, East London (1998)*

		• *Terminal upgrades, East London & Port Elizabeth (1998)* • *Refrigerated cargo facility, Cape Town (1997)* • *Precious Commodities handling facility, JIA (1997)* • *In-flight catering facility, Cape Town (1997)*

CERTIFICATION
I, the undersigned, certify that to the best of my knowledge and belief, this CV correctly describes myself, my qualifications, and my experience. I understand that any wilful misstatement described herein may lead to my disqualification or dismissal, if engaged.

[Signature of staff member or authorized representative of the staff]

Date: 02/08/2024
Day/Month/Year

Full name of authorized representative: JONATHAN BARRY CLIVE HEEGER

1	PROPOSED POSITION FOR THIS PROJECT	*Air Traffic Management Specialist*			
2	NAME OF PERSON	*Nkabinde, Sibusiso*			
3	DATE OF BIRTH	*1 July 1981*			
4	NATIONALITY	*South African*			
5	MEMBERSHIP IN PROFESSIONAL SOCIETIES	*Professional Member, Director's Association of South Africa. No 2303/18. 2023 to current*			
6	EDUCATION	*MBA, University of Witwatersrand, 2020 - current* *Diploma (Business Administration), Management College of South Africa, 2014* *Cert (Executive Management), University of La Verne, 2022*			
7	OTHER TRAINING	*Introduction to Safety Management Systems for ATNS Operational Personnel, 2021* *Approach Control (Procedural and Radar) Rating, SACAA, 2012* *Performance Based Navigation, IATA, 2008* *Managing the Safety Oversight Function, IATA 2008* *Approach Control (Procedural) Rating, SACAA, 2007* *Aerodrome Control Rating, SACAA, 2004* *PBN Implementation, ICAO, 2013* *Presenter/Attendee at various Aviation Conferences/Seminars/Committees (ATNS, ACSA, SACAA, CANSO, ICAO, AFRAA, SASAR, OPSCOM, CARCOM)* *Guest Lecturer on ATC Ergonomics in Aerospace Medicine, SACAA (2018 - current)*			
8	LANGUAGES & DEGREE OF PROFICIENCY	Language	Speaking	Reading	Writing
		English	*Excellent*	*Excellent*	*Excellent*
		Afrikaans	*Fair*	*Fair*	*Fair*
		Zulu	*Good*	*Good*	*Fair*
9	COUNTRIES OF WORK EXPERIENCE	South Africa			

<table>
<tr><td>10</td><td>EMPLOYMENT RECORD</td><td colspan="2"></td></tr>
<tr><td></td><td>Manager: Air Traffic Services – OR Tambo International Airport, ATNS</td><td>FROM:
2016</td><td>TO:
2023</td></tr>
<tr><td></td><td>Head: Aeronautical Search and Rescue, South African Search and Rescue Organization (DoT)</td><td>FROM:
2016</td><td>TO:
2019</td></tr>
<tr><td></td><td>Manager Air Traffic Services – King Shaka International Airport, ATNS</td><td>FROM:
2012</td><td>TO:
2016</td></tr>
<tr><td></td><td>Air Traffic Controller, ATNS</td><td>FROM:
2005</td><td>TO:
2012</td></tr>
<tr><td>11</td><td>WORK UNDERTAKEN THAT BEST ILLUSTRATES YOUR CAPABILITY TO HANDLE THIS ASSIGNMENT</td><td colspan="2"></td></tr>
<tr><td></td><td></td><td colspan="2">2020/3 Project Manager

Air Traffic Management Operational Performance Dashboard at OR Tambo Air traffic Services Unit.

Dashboard Development: Lead the design, development, and implementation of an Air Traffic Management Operational Performance Dashboard for OR Tambo Air Traffic Services Unit. Collaborate with stakeholders to define key performance indicators (KPIs) and metrics for operational, safety, and administrative aspects of air traffic services.
Data Integration: Integrate data from various sources to create a unified and real-time view of operational performance. Ensure seamless integration of metrics related to safety, efficiency, and administrative processes for comprehensive reporting.
Metrics Analysis: Analyse performance metrics to identify trends, areas for improvement, and opportunities for optimization. Provide actionable insights to enhance operational efficiency, safety protocols, and administrative procedures.
Management Reporting: Develop regular and ad-hoc reports for management, presenting key findings and performance metrics. Collaborate with leadership to communicate complex data in a clear and concise manner.
Quality Assurance: Implement quality assurance processes to validate data accuracy and reliability within the Operational Performance Dashboard. Conduct regular audits to ensure the integrity of the performance metrics.
Stakeholder Collaboration: Collaborate with air traffic controllers, safety officers, and administrative staff to gather relevant data and insights. Engage with management to understand their reporting needs and provide tailored solutions.

Reference: Josia Manyakoana, COO - ATNS
josiam@atns.co.za</td></tr>
<tr><td></td><td></td><td colspan="2">2012/233 Manager: Air Traffic Services

Air Traffic Service Unit Approval of Obstacles in Controlled Airspace

Obstacle Assessment: assessment of each obstacle applied for in terms of its height, location, and potential impact on air traffic operations, considering factors such as the obstacle's proximity to flight paths, airports, and navigation aids.
Safety Standards and Regulations: Ensuring that the proposed obstacles comply with safety standards</td></tr>
</table>

		and regulations set by the aviation authorities including adherence to height restrictions, lighting requirements, and other safety measures aimed at preventing collisions. Risk Mitigation Strategies: Development and implementation of ATM strategies to mitigate risks posed by any existing obstacles. Documentation and Approval Process: Documenting the obstacle assessment process, including details of each obstacle, the corresponding risk assessment, and any mitigation strategies employed. Monitoring and Compliance: Following approvals, ensuring that implemented measures are consistently maintained, including the identification of any changes in the airspace environment that impacts on the Obstacle limitations. Communication with Air Traffic Controllers: Communicating obstacles to air traffic controllers, ensuring that they have up-to-date information about the controlled airspace. Reference: Josia Manyakoana, COO - ATNS **josiam@atns.co.za**
		2005/12 Air Traffic Controller *Aerodrome, Approach Procedural and Approach Radar Air Traffic Control.*

CERTIFICATION

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Date: 02/08/2024

[Signature of staff member or authorized representative of the staff]

Day/Month/Year

Full name of authorized representative: SIBUSISO WELCOME NKABINDE

6.12. Statement of Independence

DECLARATION BY THE SPECIALIST

I, Jonathan Barry Clive Heeger declare that –

- I act as the independent specialist in this application;
- I am aware of the procedures and requirements for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the National Environmental Management Act (NEMA), 1998, as amended, when applying for environmental authorisation which were promulgated in Government Notice No. 320 of 20 March 2020 (i.e. "the Protocols") and in Government Notice No. 1150 of 30 October 2020.
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing –
  - any decision to be taken with respect to the application by the competent authority; and;
  - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 48 and is punishable in terms of section 24F of the NEMA Act.

Signature of the Specialist

GWI Aviation Advisory

Name of Company:

02 Aug 2024

Date

I, Sibusiso Welcome Nkabinde declare that –

- I act as the independent specialist in this application;
- I am aware of the procedures and requirements for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the National Environmental Management Act (NEMA), 1998, as amended, when applying for environmental authorisation which were promulgated in Government Notice No. 320 of 20 March 2020 (i.e. “the Protocols”) and in Government Notice No. 1150 of 30 October 2020.
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing –
    - any decision to be taken with respect to the application by the competent authority; and;
    - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 48 and is punishable in terms of section 24F of the NEMA Act.

Signature of the Specialist

GWI Aviation Advisory

Name of Company:

02 Aug 2024

Date