MULLER GLOBAL

Site Sensitivity Verification Report:

New Feed Mill and Ancillary work on

PTN 15 of PTN 1 of Farm Bultfontyn

Impact on Civil Aviation Installations

Prepared by

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1. Report Summary

The proposed development will be for the establishment of a Feed Mill, Agricultural Recreation Area, Solar Farm and Sheep Feedlot on Portion 15 of Portion 1 of the Farm Bultfontyn, Inxuba Yethemba Local Municipality, Eastern Cape Province. The site is rated as a "High" sensitivity site for the civil aviation theme. This is mainly due to its close proximity to the Middelburg (Cape) Aerodrome (FAMC) at location Ref. Point: S31.547259 ,E25.029453. In accordance with the Government Gazette No. 43110 a specialist assessment was performed in order to ensure the level of impact on civil aviation installations. After an assessment performed by a radio frequency and radar specialist the site was rated as a "Low" sensitivity site for the civil aviation theme. Therefore according to the Government Gazette No. 43110 no further assessment requirements are identified.

Initial Screeningtool result: "High" Sensitivity site related to the impact on civil aviation installations.

Assessed result: "Low" Sensitivity site related to the impact on civil aviation installations.

2. Assessment

After the assessment the Development has been rated as a “Low” sensitivity site for the civil aviation theme because of the following main reasons.

1. The highest planned structure on the development site will fall within the obstacle identification surfaces area and not cause any obstacle problems for the Middelburg (Cape) Aerodrome (FAMC).

2. The site also will cause low radar interference. Radar is a detection system that uses radio waves to determine the range, angle, or velocity of objects. A radar system consists of a transmitter producing electromagnetic radio waves. These electromagnetic radio waves reflect off the object and return to the receiver, giving information about the object's location and speed. Because the Development site is not in line with the approach and departure flight paths and the maximum height of the buildings is low relative to the radar the interference from the proposed development site will be negligible.

3. The proposed development site do not fall in the takeoff and approach flight path of the RF signal lobes as used by precision landing systems for the Middelburg (Cape) Aerodrome (FAMC).

4. A Glint and glare analysis show no "yellow" glare (potential for after-image) for any flight path from threshold to 2 miles. PV glare can be hazardous for pilots, motorists, and other observers. There is also no glare of any kind for Air Traffic Control Tower(s) ("ATCT") at cab height.

5. The site will also have negligible interfere with any ground to air communication, any airport radio direction finding equipment as well as any radio transmitting beacons

3. Site Overview

The proposed development will be for the establishment of a Feed Mill, Agricultural Recreation Area, Solar Farm and Sheep Feedlot on Portion 15 of Portion 1 of the Farm Bultfontyn, Inxuba Yethemba Local Municipality, Eastern Cape Province.

The site marked in light blue in the figures below is 1.5km due north of Middelburg (Cape) Aerodrome (FAMC).

The runways of the Middelburg (Cape) Aerodrome (FAMC) is indicated in green in the figures below.

Indicated in red with inside the development area is the location of the solar plant.

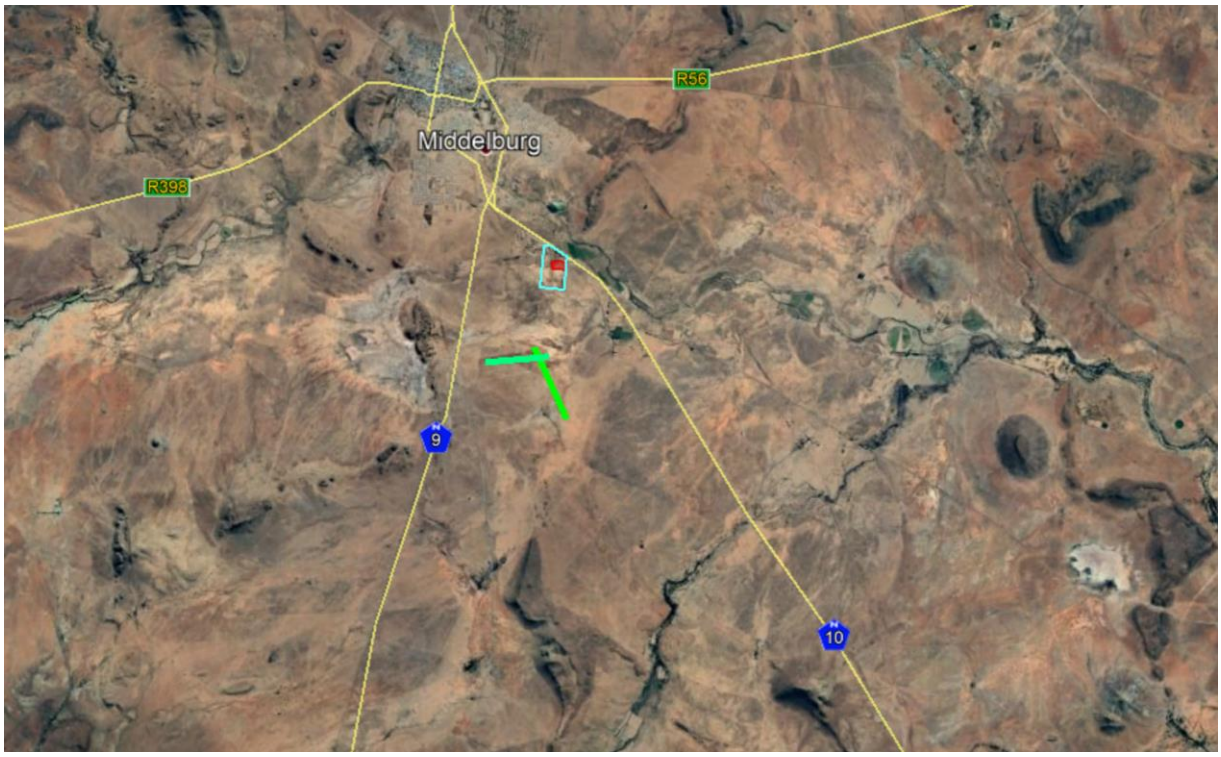


Image 1: Proposed development site in respect to FAMC

Image 2: Proposed development site in respect to FAMC

Image 3: Proposed development site in respect to FAMC

4. Obstacle identification surfaces

The highest planned structure on the development site will fall well below the obstacle identification surfaces area and not cause any obstacle complications for the Middelburg (Cape) Aerodrome (FAMC).

The proposed development site is 1.5km due north of Middelburg (Cape) Aerodrome (FAMC) and falls within the Inner Horizontal Surface with n limitation on the height of the maximum structure on the development site to be below 40meters in height.

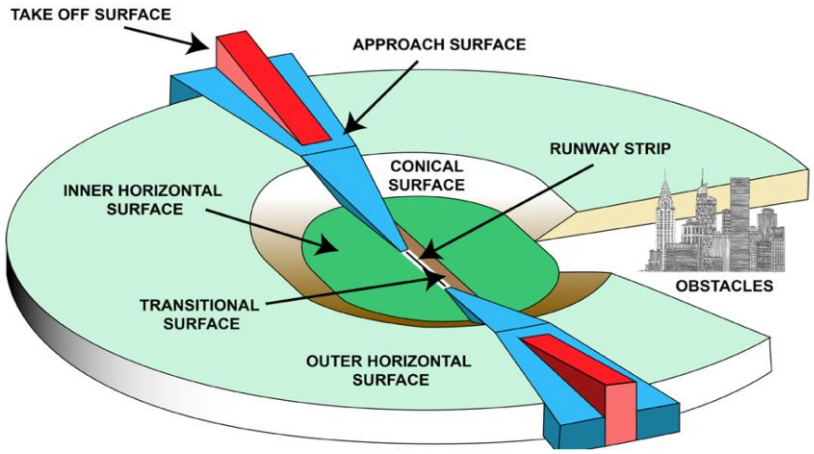


Image 4: Obstacle identification surfaces

5. Radio Frequency propagation modelling

Radio frequency propagation prediction modelling was performed in order to assess the degree of interference from the proposed development site on any type of electromagnetic radio waves transmitting devices that could be deployed at the Middelburg (Cape) Aerodrome (FAMC).

The Middelburg (Cape) Aerodrome (FAMC) runways are indicated by the green lines in the images below and the proposed development site is indicated in light blue.

The following parameters were used to perform the propagation prediction.

Tool	Radio mobile	**Version**	11.6.5
Elevation Data	SRTM DTED Level 1		
Transmitter Height	15 meter	**Transmitter location**	-34.158130 , 22.062086
Transmitter Freq	1 GHz – plot 1 20GHz – plot 2	**Transmitter Power**	25 kW
Receiver height	12 meter	**Plot type**	Omni Directional

The Middelburg (Cape) Aerodrome (FAMC) currently do not have a radar system. For possible future radar installations the proposed development site will have a very low influence on an airport radar. This is due to the height of the development area in regards to the runway level. The area is very flat and the development is more or less on the same level as the runway. This low level together with angle of the radar antenna and the distance from the runway will result in very low interference on the radar. The interference will be so low together with clutter map adjustments that the interference from the proposed development site is negligible.

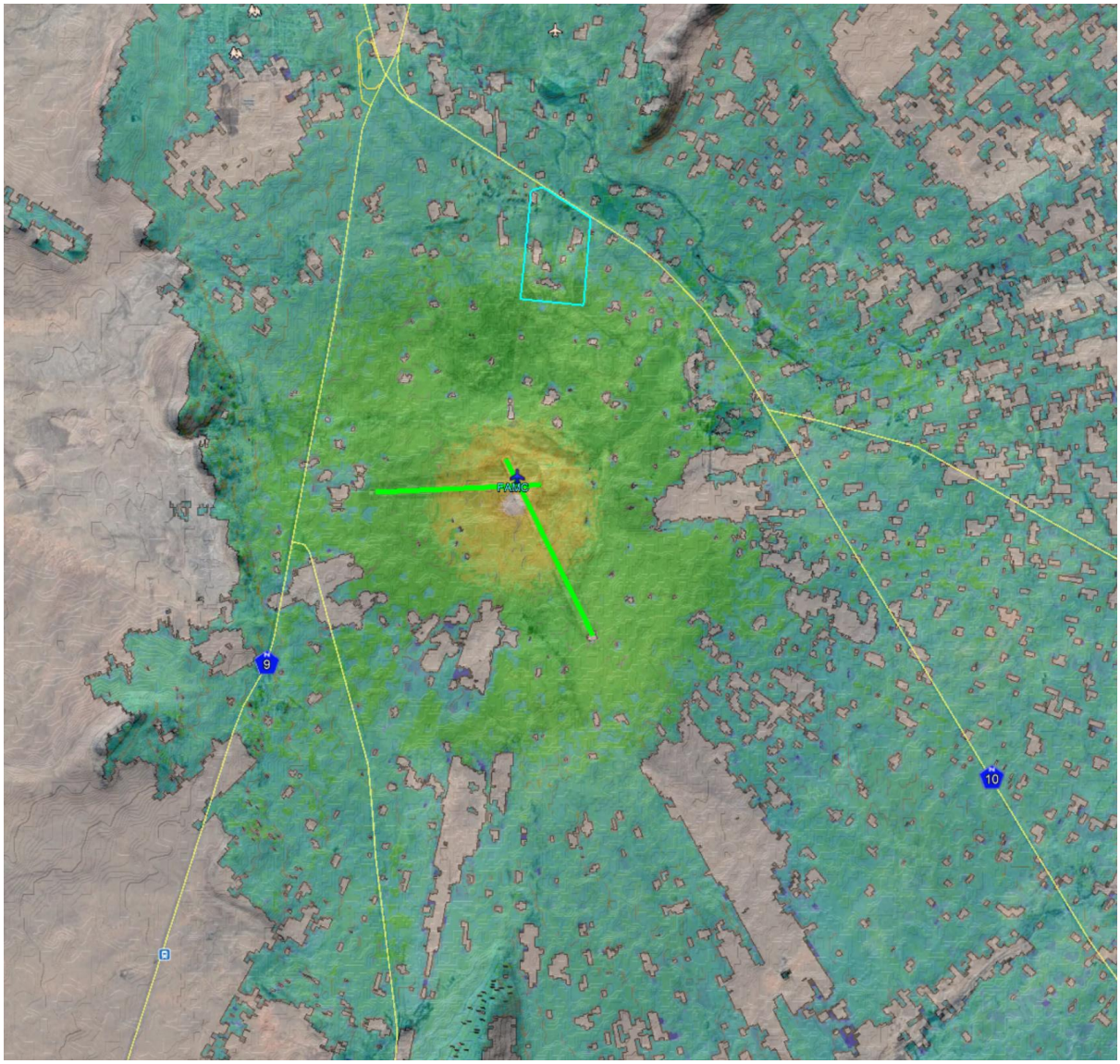


Image 5: RF propagation from FAMC – Plot 2

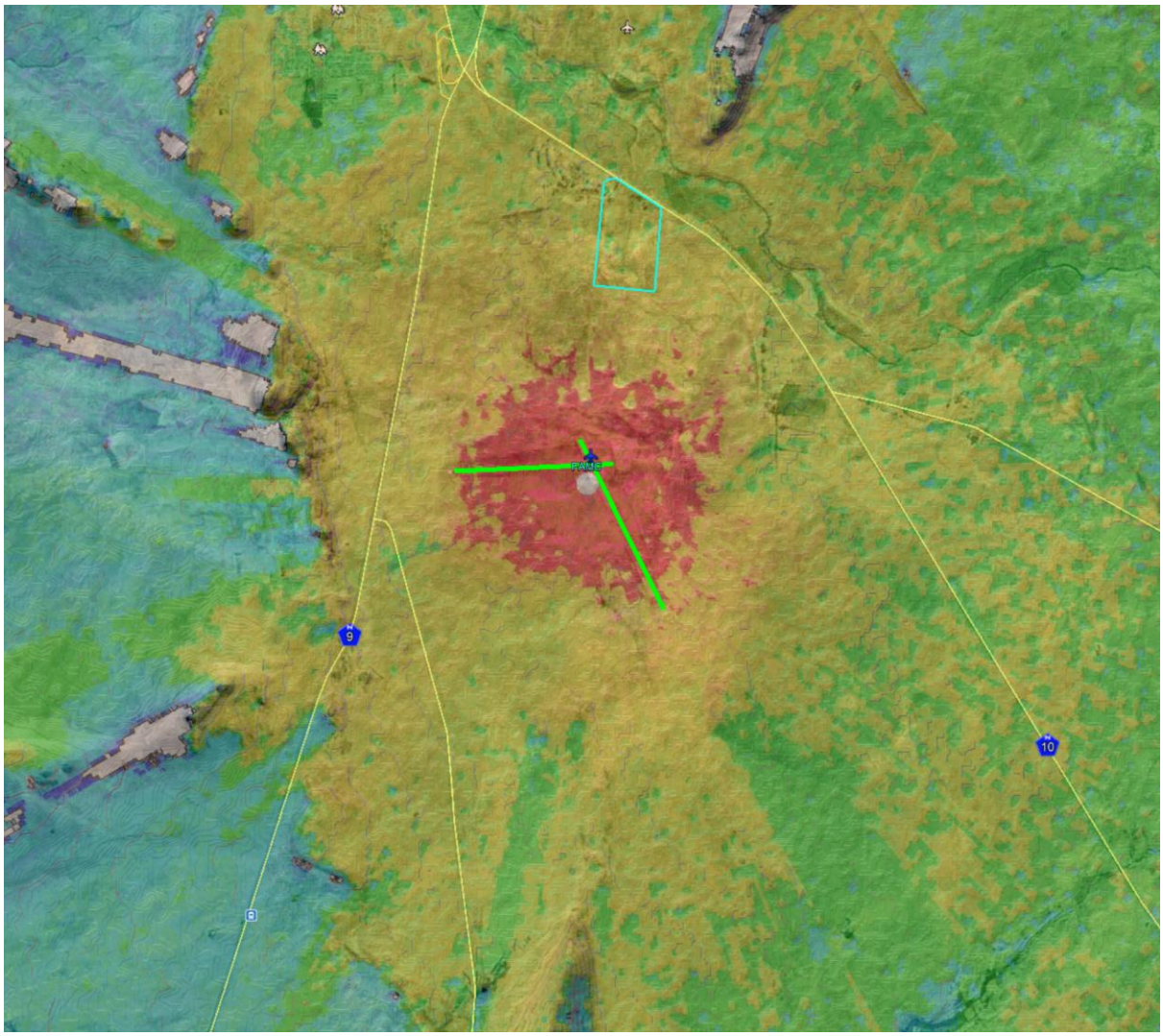


Image 6: RF propagation from FAMC – Plot 1

6. Precision landing systems

The proposed development site do not fall in the takeoff and approach flight path of the RF signal lobes as used by precision landing systems for the Middelburg (Cape) Aerodrome (FAMC). Although there are no precision landing systems currently deployed, it can be seen in the image below that should there be precision landing systems deployed in the future the RF signal focus area of the precision landing systems fall well outside the proposed development.

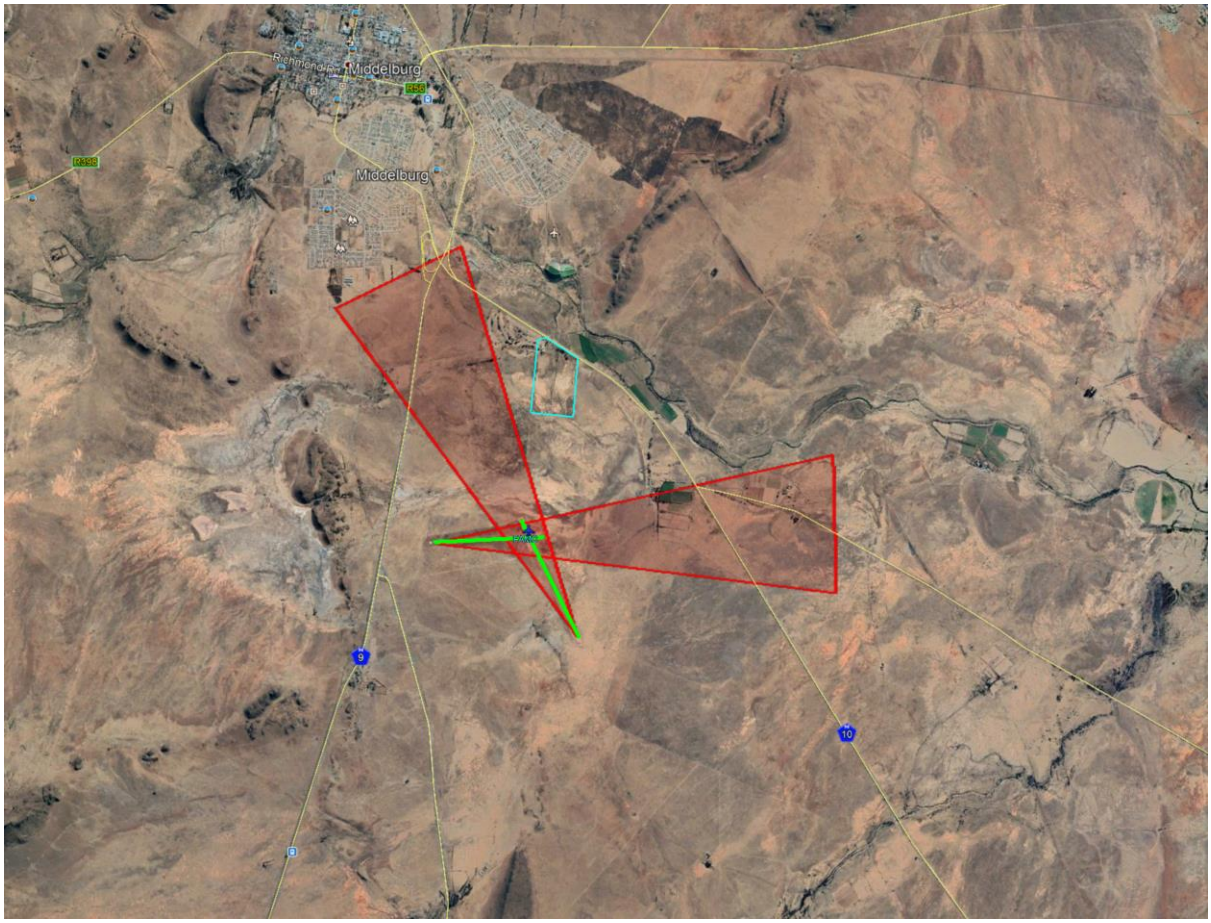


Image 6: RF propagation from FAMC for advance landing systems

7. Glint and Glare

A Glint and glare analysis was performed on the influence of the planned solar plant. The reason for this is that the PV glare can be hazardous for pilots, motorists, and other observers.

The following table summarizes the policy adherence of the glare analysis based on the 2013 U.S. Federal Aviation Administration

Interim Policy 78 FR 63276. This policy requires the following criteria be met for solar energy systems on airport property:

- No "yellow" glare (potential for after-image) for any flight path from threshold to 2 miles
- No glare of any kind for Air Traffic Control Tower(s) ("ATCT") at cab height.
- Default analysis and observer characteristics (see list below)

COMPONENT	STATUS	DESCRIPTION
Analysis parameters	PASS	Analysis time interval and eye characteristics used are acceptable
2-mile flight path(s)	PASS	Flight path receptor(s) do not receive yellow glare
ATCT(s)	PASS	Receptor(s) marked as ATCT do not receive glare

Default glare analysis parameters and observer eye characteristics (for reference only):

- Analysis time interval: 1 minute
- Ocular transmission coefficient: 0.5
- Pupil diameter: 0.002 meters
- Eye focal length: 0.017 meters
- Sun subtended angle: 9.3 milliradians

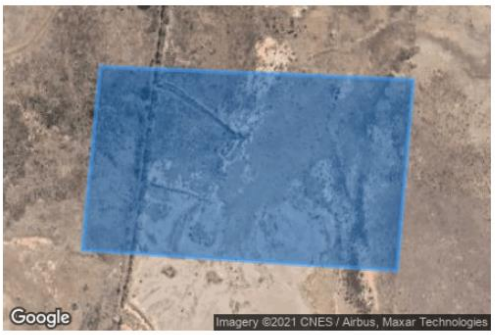
The site configuration details is as below.

Analysis Parameters

DNI: peaks at 1,000.0 W/m^2
Time interval: 1 min
Ocular transmission coefficient: 0.5
Pupil diameter: 0.002 m
Eye focal length: 0.017 m
Sun subtended angle: 9.3 mrad
Site Config ID: 55373.9935

PV Array(s)

Name: PV array 1
Axis tracking: Fixed (no rotation)
Tilt: 30.0°
Orientation: 0.0°
Rated power: -
Panel material: Light textured glass without AR coating
Reflectivity: Vary with sun
Slope error: correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-31.528468	25.035698	1224.88	1.00	1225.88
2	-31.530082	25.035537	1224.64	1.00	1225.64
3	-31.529908	25.032412	1225.91	1.00	1226.91
4	-31.528358	25.032593	1226.65	1.00	1227.65

Flight Path Receptor(s)

Name: East West Runway
Description:
Threshold height: 15 m
Direction: 265.8°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	-31.546633	25.031991	1225.04	15.24	1240.28
Two-mile	-31.544526	25.065867	1213.27	195.69	1408.96

Name: North South Runway
Description:
Threshold height: 15 m
Direction: 158.5°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	-31.547189	25.029416	1225.25	15.24	1240.49
Two-mile	-31.520296	25.016945	1234.56	174.61	1409.17

Discrete Observation Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
1-ATCT	1	-31.547859	25.028506	1226.59	5.00
OP 2	2	-31.559050	25.035802	1229.22	2.00
OP 3	3	-31.547713	25.014945	1240.09	2.00

Map image of 1-ATCT

Route Receptor(s)

Name: Runways
Path type: Two-way
Observer view angle: 50.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-31.547774	25.016027	1240.59	0.00	1240.59
2	-31.546311	25.031304	1225.12	0.00	1225.12
3	-31.558892	25.037484	1229.51	0.00	1229.51

Summary of PV Glare Analysis

PV configuration and total predicted glare

PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced	Data File
	deg	deg	min	min	kWh	
PV array 1	30.0	0.0	5,240	0	-	-

Distinct glare per month

Excludes overlapping glare from PV array for multiple receptors at matching time(s)

PV	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
pv-array-1 (green)	1248	929	3	0	0	0	0	0	0	595	1197	1268
pv-array-1 (yellow)	0	0	0	0	0	0	0	0	0	0	0	0

PV & Receptor Analysis Results

Results for each PV array and receptor

PV array 1 low potential for temporary after-image

Component	Green glare (min)	Yellow glare (min)
FP: East West Runway	0	0
FP: North South Runway	5240	0
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
Route: Runways	0	0

PV array 1 - Receptor (East West Runway)

No glare found

PV array 1 - OP Receptor (1-ATCT)

No glare found

PV array 1 - OP Receptor (OP 2)

No glare found

PV array 1 - OP Receptor (OP 3)

No glare found

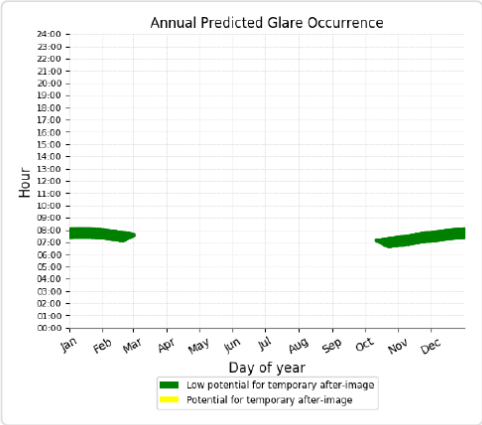
PV array 1 - Route Receptor (Runways)

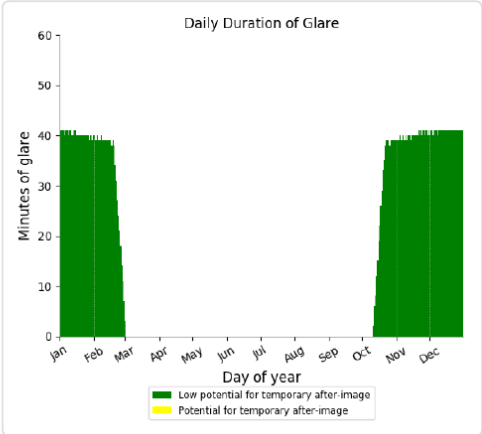
No glare found

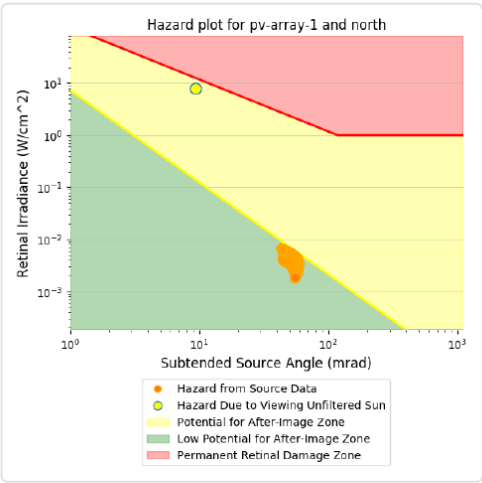
PV array 1 - Receptor (North South Runway)

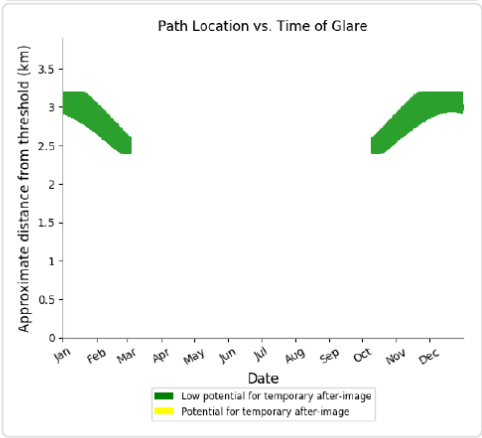
PV array is expected to produce the following glare for observers on this flight path:

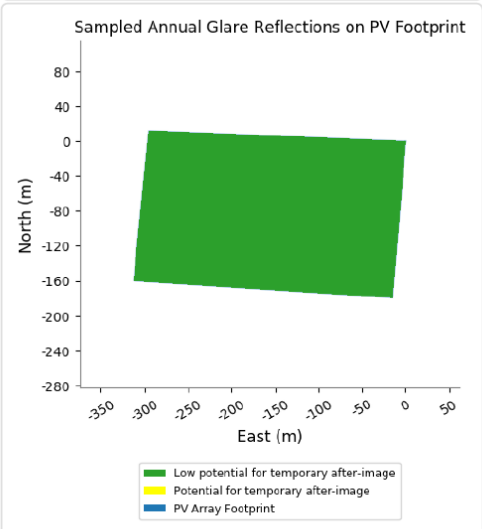
- 5,240 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.

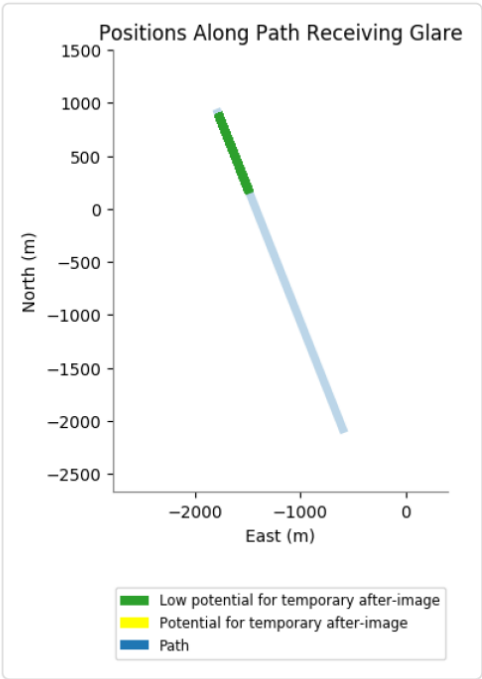












8. Assumptions

Buildings are a maximum height of 25meters high.

A future radar installation will be according to standard radar installations.

A future precision landing system installation will be according to standard new installations.

"Green" glare is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.

"Yellow" glare is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.

Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.

Glare analyses do not account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographic obstructions.

Several calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for large PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare.

The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size.

Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)

Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.

Glare vector plots are simplified representations of analysis data. Actual glare emanations and results may differ.

The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual results and glare occurrence may differ.

Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid based on aggregated research data. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.

9. Assessment Specialist Contact Details and Bio

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Werner Muller completed his B.Eng and M.Eng degrees in Electronic Engineering at the University of Pretoria in 2002 and 2006, respectively. He has been working in the Electronic Warfare area since 2003 with a focus on Communications Intelligence systems and Radar ESM/ELINT systems. Since 2017 he shifted his focus more towards commercial Spectrum Management and Monitoring systems as well as Electronic Surveillance for the security market. He is an expert in the field of Radio Frequency propagation and equipment.