

Windpark Oberegg AI

# Beurteilung des Einflusses des Windparks Oberegg AI auf die CNS-Anlagen von Skyguide.

Version/lang.	1 D
status	Released
date of issue	2023-02-15
contact/unit	Fries Matthias / TNP
owner/unit	Fries Matthias / TNP
nickname	
pages	8
classification	Internal
for action	
for information	Catherine Hunziker TNP, Laurent Favéy OPIA, Reto Pauli OMSW
annexes	none
abstract	

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# 1 Einführung

## 1.1 Zweck

Dieses Dokument beinhaltet eine Beurteilung der zu erwartenden Störeinträge des Windparks Oberegg AI auf die CNS-Anlagen von Skyguide. Nicht betrachtet werden, IFP, CNS-Anlagen der Schweizer Luftwaffe oder von angrenzenden Flugsicherungsdienstleistern.

## 1.2 Beschreibung des Windparks

Abbildung 1 zeigt den Standort des Windparks Oberegg AI.

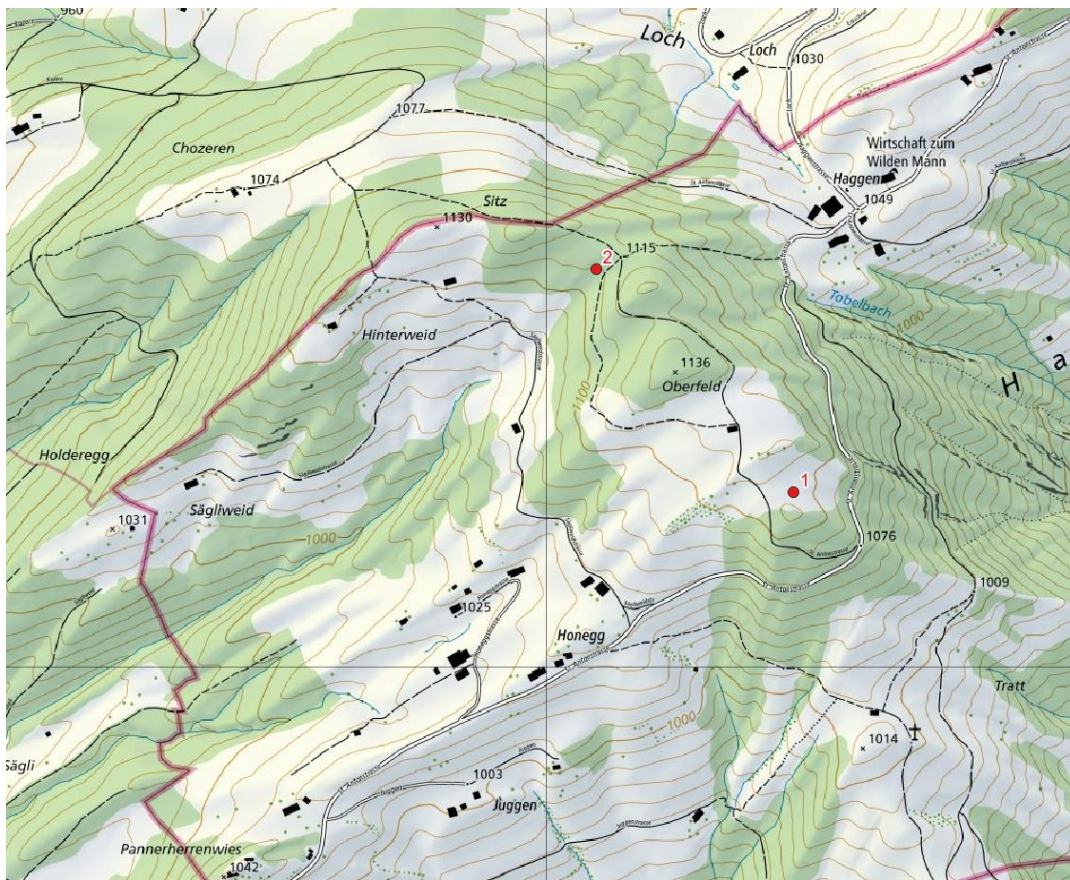


Abbildung 1: Standort des Windparks Oberegg AI

Die detaillierten Angaben zum Windpark befinden sich in Tabelle 1.

(Geplantes) Modell	Leistung (MW)	Koordinate E (LV95) - Ostwert	Koordinate N (LV95) - Nordwert	Terrainhöhe (m.ü.M)	Max. Gesamthöhe (m)	Max. Nabenhöhe (m)	Rotordurchmesser (m)
e-138 EP3 E3	4.26	2 757 344	1 252 243	1109	200	131	138
e-138 EP3 E3	4.26	2 757 070	1 252 554	1110	200	131	138

Tabelle 1: Detailangaben zum Windpark Oberegg AI (aus Formular B)

## 2 Analyse

### 2.1 Zusammenfassung

Der Windpark Oberegg AI befindet sich innerhalb der Schutzzone des Primärradars Holberg (HL2P) sowie des Funkpeilers (VHF Direction Finder VDF) des Flughafens St. Gallen Altenrhein.

Eine Störung des Primärradars HL2P kann ausgeschlossen werden, da keine Sichtverbindung besteht. Die Störung des Funkpeilers Altenrhein wird als akzeptabel bewertet.

Skyguide spricht in Bezug auf seine CNS-Systeme eine positive Stellungnahme für den Windpark Oberegg AI aus.

### 2.2 Betroffene Systeme

Der Windpark Oberegg AI befindet sich innerhalb der Schutzzone des Primärradars Holberg (HL2P) sowie des Funkpeilers (VHF Direction Finder VDF) des Flughafens St. Gallen Altenrhein.

### 2.3 Primärradar Holberg HL2P

Es besteht keine Radarsichtbarkeit bis zu einer Höhe von 300 Metern über Grund (vergleiche Abbildung 2). Folglich kann ein Einfluss ausgeschlossen werden.

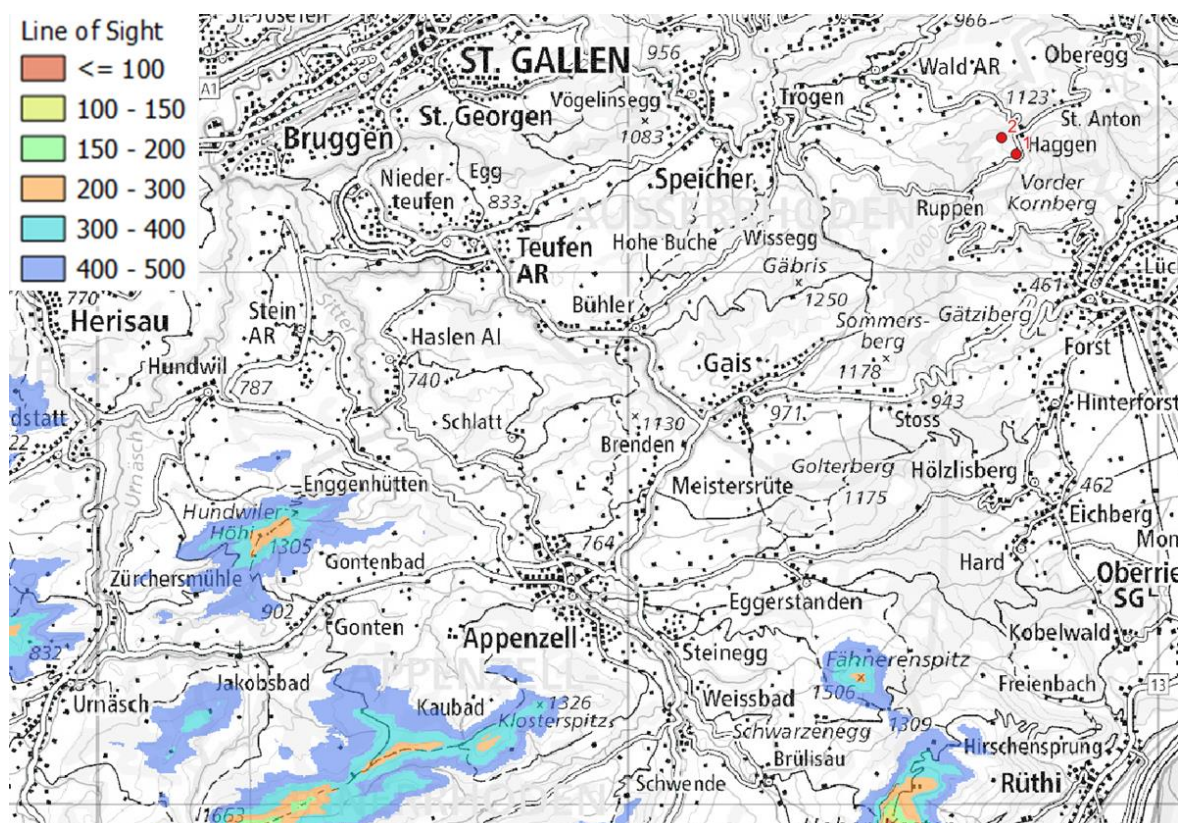


Abbildung 2: Analyse der Signalsichtbarkeit des Primärradars Holberg HL2P im Gebiet des Windparks Oberegg AI.

## 2.4 Funkpeiler Flughafen St. Gallen Altenrhein (VDF Altenrhein)

Die Windenergieanlagen befinden sich an der Grenze der Schutzzone in einer Distanz von 9.7 km zum Funkpeiler. Der Einfluss wird als akzeptabel bewertet.

# 3 Gültigkeitsdauer dieser Stellungnahme

**Die Gültigkeitsdauer dieser Stellungnahme beträgt fünf Jahre ab Ausstellungsdatum.**

Bei Anpassungen bleibt die Stellungnahme gültig sofern die Toleranzen von 20m (vertikal, in der Höhe) und 50m (lateral, am Fusspunkt) nicht überschritten werden. Ansonsten muss das Projekt neu geprüft werden.

Wenn ein Projekt aufgrund einer Einsprache im Rahmen der Nutzungsplanung und/oder der Baubewilligung blockiert wird und die Projektleitung bei Skyguide einen Antrag stellt, wird die Frist für die Dauer des Verfahrens ausgesetzt.

Um diese Unterbrechung der Frist zu gewährleisten, muss die Projektleitung Skyguide informieren, sobald sie Kenntnis davon erhält, dass ein solches Verfahren eingeleitet oder beendet wurde (rechtskräftiger Entscheid eines zuständigen Gerichts oder die Genehmigung der Nutzungsplanung / Erteilung der Baugenehmigung).

Die Belege für das betreffende Verfahren sind unverzüglich mit dem Antrag auf Unterbrechung der Frist einzureichen.

Darüber hinaus kann Skyguide auf Antrag der Projektleitung nach einer Neubeurteilung die Stellungnahme um weitere fünf Jahre verlängern. In solchen Fällen sind die Kosten der Neubeurteilung von der Projektleitung zu tragen.

Während der Gültigkeitsdauer dieser Stellungnahme verpflichtet sich Skyguide, den Windpark bei periodischen Überprüfungen bzw. der Weiterentwicklung von Instrumentenflugverfahren und CNS-Systemen zu berücksichtigen.

Skyguide informiert die Projektleitung während der Gültigkeit über neue Auswirkungen, die sich aus der Einführung neuer Kriterien oder Technologien ergeben können.

## 4 Bibliographie

- [1] European Guidance Material on Managing Building Restricted Areas, Third Edition, 2015 (ICAO EUR DOC 015), ICAO, 2015.
- [2] EUROCONTROL, «Guidelines How to Assess the Potential Impact of Wind Turbines - EUROCONTROL-GUID-130,» 2014.
- [3] Bundesamt für Landestopographie, *Swiss Map 50. Landeskarte der Schweiz 1:200'000*.
- [4] ICAO Annex 10 - Aeronautical Telecommunications - Volume I - Radio Navigational Aids, 7th Edition, ICAO, 2018.
- [5] ICAO Annex 10 - Aeronautical Telecommunications - Volume IV- Surveillance Radar and Collision Avoidance Systems, 5th Edition, ICAO, 2014.
- [6] ICAO, Procedures for Air Navigation Services (PANS) - Aircraft Operations - Volume II Construction of Visual & Instrument Flight Procedures (Doc 8168), 7th Edition, ICAO, 2020.

## History of Changes

Changes and Reviews				
Version	Status	Date of issue	Author	Details
1.0	Released	15. 2. 2023	M. Fries	



title	Wind Turbine Assessment - Oberegg
subject	<b>Impact analysis on Instrument Flight Procedures for LSAS, LSHG, LSHN, LSNF, LSNG, LSXO, LSXU, LSZH, LSZR and LSZS</b>
version	2.0
issue date	2023-01-16
contact	Laurent Favey
status	Released
pages	18

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## 1 Obstacle Overview

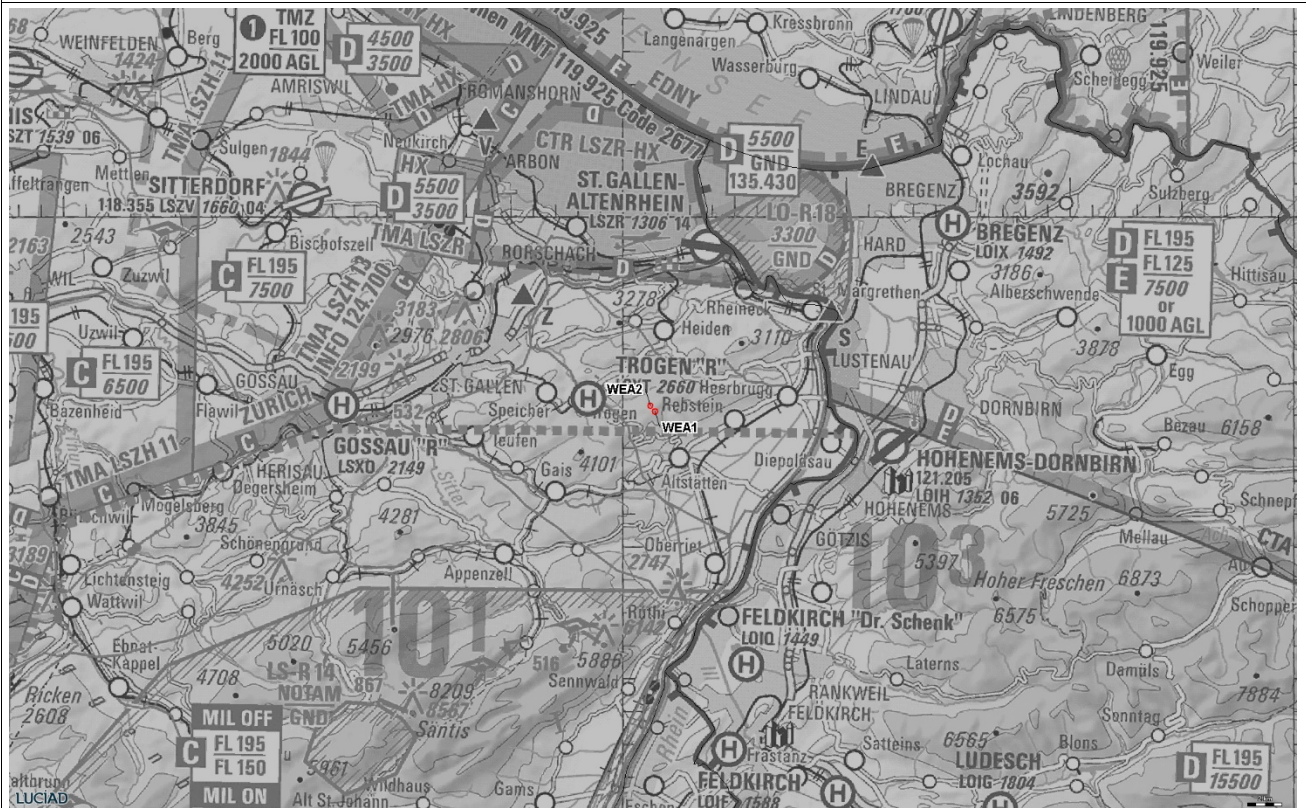


Figure 1 Overview of Oberegg wind farm project on ICAO chart

## 2 Summary

ICAO Location Indicator

LSAS, LSHG, LSHN, LSNF, LSNG, LSXO, LSXU, LSZH, LSZR and LSZS

Workspace

[T-P-652-2022 Oberegg.lws](#)

**3 Wind Turbines location and elevation**

Name	X [m]	Y [m]	Z [m]	Wind turbine height [m]	Vertical tolerance <sup>1</sup> [m]	Total height [m]	Lateral tolerance [m]
WEA1	2757344	1252243	1109	200	2	1311	50
WEA2	2757070	1252554	1110	200	2	1312	50

**Pictures**

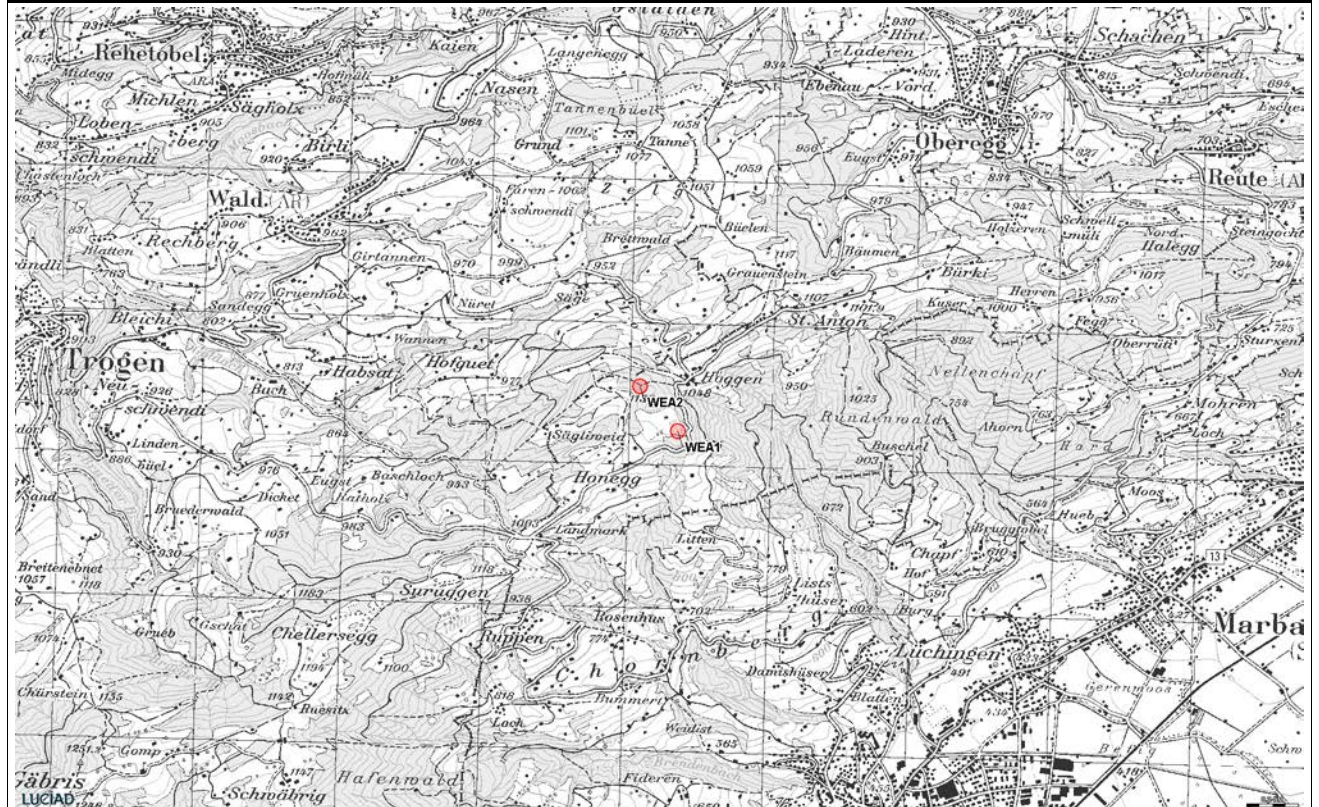
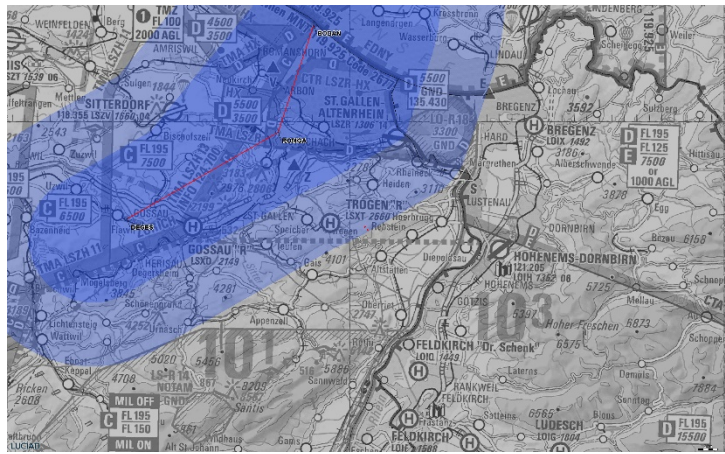


Figure 2 Oberegg wind farm project: location of wind turbines

Notes
<sup>1</sup> DHM error

<b>4 Environment</b>		
Temperature	Horizontal reference system	Vertical reference system
<b>ISA + 15° C</b>	<b>LV95</b>	<b>LN02</b>
Notes		

5 Impact on IFP											
Name	AWY	LFN	SID	STAR	APCH	HLDG	Circling	ASMA	MSA	Possible mitigation	Notification
WEA1	No	No	No	No	No	No	No	No	Yes	Yes	Conditional
WEA2	No	No	No	No	No	No	No	No	Yes	Yes	Conditional
Notes	NIL										

5.1 ATS routes				
IFP name		Remarks		
N871				
Z1		ATS Route Z1 (segment ROMGA-BODAN) is considered for this study, as it is the closest one to the obstacles.		
Z2				
Z6				
Top of obstacle altitude [m]	Minimum Obstacle Clearance (MOC) [m]	Minimum Overflight Altitude	Minimum Altitude considered	Effective Obstacle Clearance
1312 (WEA2)	27	1339 m ≈ 4393 ft	1494 m ≈ 4900 ft	181 m ≈ 594 ft
Picture				
				
Figure 3 Protection area of ATS route Z1				
Conclusion				
Although obstacles are located inside the PANS-OPS protection area of the considered procedures, Minimum Obstacle Clearance Altitude (MOCA) is granted; therefore, there is no PANS-OPS impact to be reported on ATS Routes.				
Notes	Some obstacles as WEA2 are located in secondary protection area. Therefore, MOC is smaller than 300 m.			

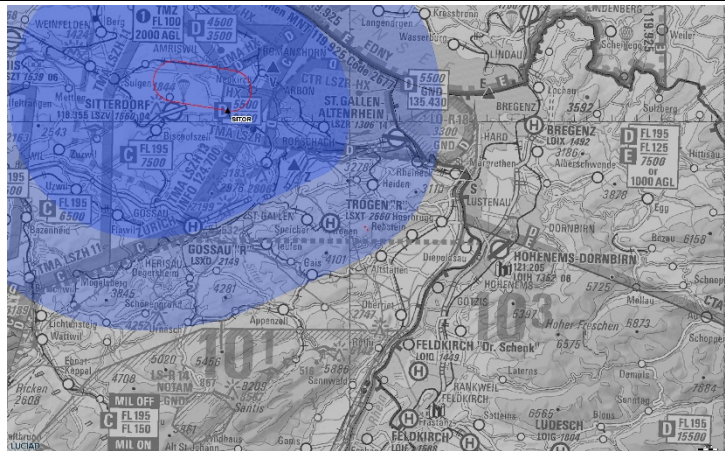
5.2 Low Flight Network (LFN)	
IFP name	Remarks
None	NIL
Conclusion	
No LFN Routes are potentially impacted by Oberegg wind farm project.	
Notes	NIL

5.3 SID	
IFP name	Remarks
None	NIL
Conclusion	
No SIDs are potentially impacted by Oberegg wind farm project.	
Notes	NIL



5.4 STAR	
IFP name	Remarks
None	NIL
Conclusion	
No STARs are potentially impacted by Oberegg wind farm project.	
Notes	NIL

5.5 Approach	
IFP name	Remarks
None	NIL
Conclusion	
No approaches are potentially impacted by Oberegg wind farm project.	
Notes	NIL

5.6 Holdings				
IFP name		Remarks		
LSZR HLDG SITOR		LSZR HLDG SITOR is considered for this study, as it is the closest one to the obstacles.		
Top of obstacle altitude [m]	Minimum Obstacle Clearance (MOC) [m]	Minimum Overflight Altitude	Minimum Altitude considered	Effective Obstacle Clearance
1312 (WEA2)	90	1402 m ≈ 4600 ft	1524 m ≈ 5000 ft	212 m ≈ 696 ft
Picture				
				
<p>Figure 4 Protection area of holding LSZR HLDG SITOR</p>				
Conclusion				
<p>Although obstacles are located inside the PANS-OPS protection area of the considered procedures, Minimum Obstacle Clearance (MOC) is granted; therefore, there is no PANS-OPS impact to be reported on LSZR holdings.</p>				
Notes	<p>Some obstacles as WEA2 are located in secondary protection area. Therefore, MOC is smaller than 300 m.</p>			

5.7 Circling	
IFP name	Remarks
None	NIL
Conclusion	
No circling is potentially impacted by Oberegg wind farm project.	
Notes	NIL

5.8 ATC Surveillance Minimum Altitudes (ASMA)				
IFP name		Remarks		
LSZH ASMA -6°C and -20°C				
LSZR-ARFA ASMA -19°C		LSZR-ARFA ASMA -19°C (sector 5500 ft) is considered for this study, as it is the closest one to the obstacles.		
LSZS-DELTA ASMA -25°C				
Top of obstacle altitude [m]	Minimum Obstacle Clearance (MOC) [m]	Minimum Overflight Altitude	Minimum Altitude considered	Effective Obstacle Clearance
1312 (WEA2)	461	1773 m ≈ 5817 ft	1829 m ≈ 6000 ft	516 m ≈ 1693 ft

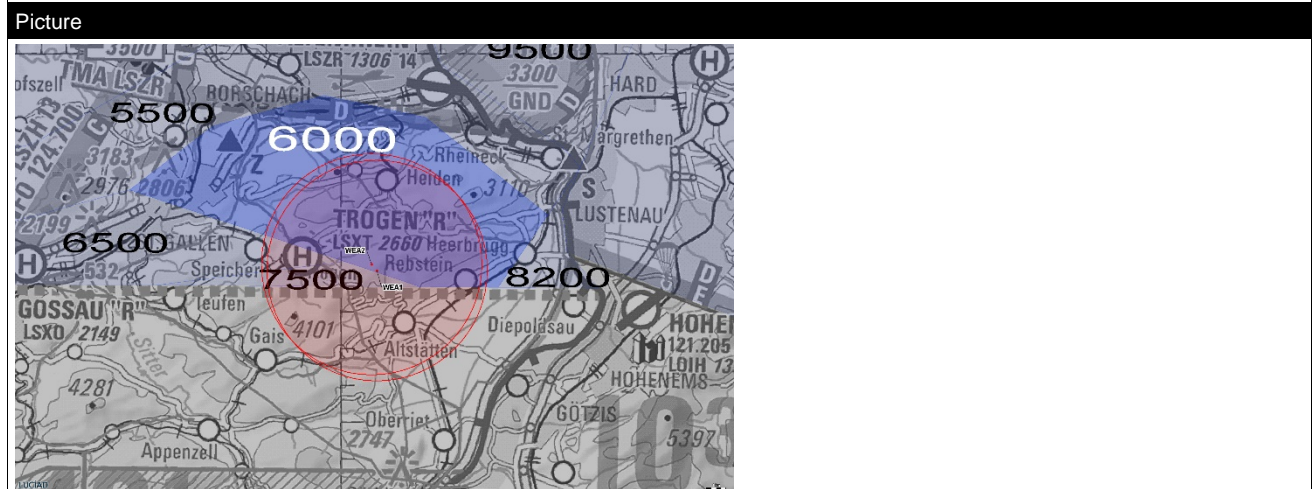


Figure 5 ATC Surveillance Minimum Altitudes LSZR-ARFA ASMA -19°C with wind turbines and 3 NM buffer

Conclusion	
Although obstacles are located inside the PANS-OPS protection area of the considered procedures, Minimum Obstacle Clearance (MOC) is granted; therefore, there is no PANS-OPS impact to be reported on LSZH, LSZR-ARFA and LSZS-DELTA ASMA.	
Notes	<p>MOC is corrected by 161 m in order to take the temperature into account.</p> <p>Effective Obstacle Clearance shall be at least 461 m ≈ 1512 ft.</p> <p>Use of 3 NM buffer around obstacles according to IFPDM § 6.1.3 and study "3 NM separation in ARFA" from TD.</p>

5.9 Minimum Sector Altitude (MSA)				
IFP name		Remarks		
LSHG MSA				
LSNF MSA				
LSNG MSA				
LSXO MSA				
LSXU MSA				
LSZR MSA		LSZR MSA is considered for this study, as it is the closest one to the obstacles.		
Top of obstacle altitude [m]	Minimum Obstacle Clearance (MOC) [m]	Minimum Overflight Altitude	Minimum Altitude considered	Effective Obstacle Clearance
1312 (WEA2)	300	1612 m ≈ 5289 ft	1494 m ≈ 4900 ft	181 m ≈ 594 ft
Picture				
Figure 6 LSZR Minimum Sector Altitude (MSA)				
Conclusion				
<p>Both wind turbines (WT) are infringing LSZR MSA.            Several solutions can be proposed:</p> <ul style="list-style-type: none"> <li>Limit the elevation of WT to <b>MAX 1192 m AMSL</b> (top of rotor);</li> <li>Raise LSZR MSA sector 4900 ft by 400 ft to 5300 ft. This would require the approval from all impacted stakeholders.</li> </ul>				
Notes	NIL			

## 6 Final Conclusion

Wind farm project Oberegg is infringing Minimum Obstacle Clearance (MOC) of an instrument flight procedure (IFP), such as:

- LSZR MSA sector 4900 ft.

In order to solve this issue, the following solutions are proposed:

- Limit the elevation of WT infringing the protection area to **MAX 1192 m AMSL** (top of rotor);
- Raise LSZR MSA sector 4900 ft by 400 ft to 5300 ft.

The solution on IFP requires additional studies and a preliminary safety assessment (PSA).

It will require approval from all stakeholders impacted by this solution.

The developer shall come back to Skyguide at least 12 months prior the start of the building work to assess the feasibility of this solution. All work conducted by Skyguide to assess and implement this solution will be charge to the developer.

All other procedures not mentioned in this report are not impacted by Oberegg wind farm project.

Any change to the project of more than 50 m laterally and 0 m vertically will invalidate this assessment.

## 7 Notification

Skyguide IFP can therefore grant a **conditional notification** for WT WEA1 and WEA2.

## 8 Validity

This assessment is valid 5 years from its publication date.

If the project is blocked due to an objection to the zoning plan and/or a building permit and the developer applies to Skyguide, the validity period shall cease to run for the duration of the procedure.

In order to ensure that the time limit is suspended, the developer must inform Skyguide as soon as he becomes aware that such proceedings have been initiated or that they have been terminated (final decision by a competent court or granting of the zoning plan and/or building permit).

The supporting documents relating to these proceedings in question must be provided without delay with the request for suspension.

In addition, Skyguide may, at the request of the developer, extend this statement for a further period of five years following a reassessment. The costs of such a reassessment shall be borne by the developer.

During the period of validity of this notification, Skyguide commits to take the wind farm into account during the periodical reviews or development of instrument flight procedures and CNS systems.

Skyguide will inform during the validity period the developer of any new impacts that may be identified as a result of the implementation of new criteria or technologies.

9 Data and process details					
9.1 Processes, standards and criteria					
Document			Issued by		
Document 8168 Volume II, 7 <sup>th</sup> edition			ICAO		
IFPDM, V 20.0			Skyguide		
IFPDM-MIL, V4.0			Skyguide		
C3.5, V 2.0			Skyguide		
Annex to Wind Turbine Assessment_200304.pdf			Skyguide		
3 NM separation in ARFA - Technical feasibility study			Skyguide		
9.2 Software / Tools / Internet links					
Name		Provider		Version	
AutoCAD Map 3D 2023		Autodesk		26.0.37.2	
Google Earth Pro		Google		7.3.4.8248	
Luciad Map "PANS-OPS"		Luciad NV		1.4.4	
Obstacle Clearance Calculation.xls		Skyguide		13.0	
9.3 Integrated Aeronautical Information Package					
Type / Format	Source	Hor. / Ver. Reference System	Hor. / Ver. Accuracy <sup>1</sup>	Vertical Resolution <sup>2</sup>	Effective Date
AIP / AIXM 5.1	AIM	WGS-84 / LN02	ICAO	ICAO	2022-12-29
9.4 IFP reports					
18021-N871_v1.0.pdf			18021-Z1_v1.0.pdf		
18021-Z2_v1.0.pdf			18021-Z6_v1.0_signed.pdf		
17017-LSZR_HLDG_SITOR_v2.0.pdf			PR LSZR Holding SITOR.docx		
19003-LSZH_MVA&LoD_v1.0.pdf			LSZR ASMA ARFA.docx (dap_6eafdb94-f47d-99bd-3f13-5b9438acd73b.pdf)		
160408_LSZS_MVA_v1.0.pdf					
200330 IFPD Report LSHG MSA V4.0.pdf			210513 IFPD Report LSNG MSA V5.0.pdf		
200330 IFPD Report LSXO MSA V5.0.pdf			19021-LSXU_MSA_v0.2.docm		
LSZR MSA ARP.docx (dap_f17a32b4-c1a8-acc8-f3dc-141c26461cee.pdf)			210520 IFPD Report LSNF MSA V4.0.pdf		

<sup>1</sup> As per ICAO Annex 14 Vol I&II Chapter 2 and Appendix 5, and Annex 11 Chapter 2 and Appendix 5.

<sup>2</sup> As per ICAO Annex 15 Appendix 7.



## 9.5 Abbreviations and Acronyms

The abbreviations and acronyms in this report are according to ICAO Doc. 8400 (Ninth Edition - 2016), except the ones listed below

AD	Aerodrome
AIP	Aeronautical Information Publication
AMDT	Amendment
APCH	Approach procedure
ARP	Aerodrome Reference Point
ASMA	ATC Surveillance Minimum Altitude
ATM	Air Traffic Management
ATS	Air Traffic Services
AWY	Airway
CNS	Communication, Navigation and Surveillance
DER	Departure End of Runway
DME	Distance Measuring Equipment
FAF	Final Approach Fix
FAP	Final Approach Point
FOCA	Federal Office for Civil Aviation
GP	Glide Path
HLDG	Holding procedure
ICAO	International Civil Aviation Organisation
IFP	Instrument Flight Procedure
IFPDM	Skyguide Instrument Flight Procedures Design Manual
ILS	Instrument Landing System
LFN	Low Flight Network
LOC	Localizer
MAA	Military Aviation Authority
MAX	Maximum
MNM	Minimum
MOC	Minimum Obstacle Clearance
MOCA	Minimum Obstacle Clearance Altitude
MRVA	Minimum Radar Vectoring Altitude
MSA	Minimum Sector Altitude
NAVAID	Navigational Aid
NDB	Non-directional radio beacon
OBST	Obstacle
OCA/H	Obstacle Clearance Altitude/Height
PANS-OPS	Procedures for Air Navigation Services – Operations
PSA	Preliminary Safety Assessment

**10 History of document**

Version	Date of issue	Author	Action / Items of change / Remarks
0.1	2023-01-05	L. Favey	Wind turbines assessment
0.2	2023-01-11	JF Missire	Cross-check
1.0	2023-01-12	L. Favey	Released version
1.1	2023-01-16	L. Favey	Modification of LSZR-ARFA ASMA assessment
2.0	2023-01-16	L. Favey	Released version