



# Sheringham Shoal and Dudgeon Offshore Wind Farm Extension Projects

## Instrument Flight Procedures Assessment for Norwich Airport (Revision B)

### Revision B

Deadline 8

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# Norwich Airport – Dudgeon and Sheringham Offshore Wind Farm Extension

## IFP Assessment for Norwich Airport

Date: 14th July 2023

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# Executive Summary

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Osprey Consulting Services Ltd (Osprey) have been commissioned to carry out a check of the published Instrument Flight Procedures (IFPs) including the Air Traffic Control Surveillance Minimum Altitude Chart (ATCSMAC), for Norwich Airport in relation to proposed wind farm extensions at Sheringham and Dudgeon sites.

## Impact on the Minimum Sector Altitudes (MSAs)

**The proposed wind farm extensions at Sheringham and Dudgeon South would impact Norwich Airport's MSAs. This includes effects on the IFP MSAs, based on the NDB(L) NWI, as well as effects on the ATCSMAC MSAs, based on the ARP.**

**There are proposals for mitigation in this report, but the standard mitigation for the MSAs, based on the NDB(L) NWI (IFPs) and the ARP (ATCSMAC), would be to increase the Northwest and Northeast sectors to 2100ft.**

**These effects on the MSAs by the wind farm extensions, affect all published IFPs and the ATCSMAC.**

## Impact on the IFPs

**Other than the effects on the MSAs, the proposed wind farm extensions at Sheringham and Dudgeon South would not impact the IFPs in any other way.**

## Impact on the ATCSMAC

**Other than the effects on the MSAs, the proposed wind farm extensions at Sheringham and Dudgeon South would not impact the ATCSMAC Surveillance Minimum Altitude Area (SMAA).**

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# 1 Introduction

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## 1.1 Background

Osprey Consulting Services Ltd (Osprey) have been commissioned to carry out a check of the published Instrument Flight Procedures (IFPs) for Norwich Airport in relation to proposed wind farm extensions at Sheringham and Dudgeon sites.

## 1.2 Scope of the Assessment

This report examines the potential impact of the wind farm extensions on the published Instrument Flight Procedures (IFPs) at Norwich using the latest published charts in the State Aeronautical Information Publication (AIP), as of 20<sup>th</sup> April 2023. AutoCAD Autodesk, ASD PD Toolkit and ICAO Software was used to evaluate the proposal.

## 1.3 Data Provided by Client

Equinor ASA has informed Osprey that the blade tip height for all wind turbines will be 330m AMSL and also provided the following wind farm site information in the form of a KMZ file (AOI\_WGS1984\_20191122):



Figure 1 – Provided Wind Farm site information - AOI\_WGS1984\_20191122 (Shown in Google Earth)

Using the provided information, the wind farm border coordinates were extrapolated from Google Earth and modelled in AutoCAD.

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Point	Latitude	Longitude
1	53:16:40.460	1:19:9.980
2	53:17:15.110	1:26:5.550
3	53:18:0.200	1:25:39.200
4	53:18:17.430	1:25:24.420
5	53:18:17.800	1:17:51.070
6	53:18:18.180	1:19:28.570
7	53:18:23.000	1:19:18.150
8	53:18:33.980	1:25:3.960
9	53:18:34.640	1:23:20.400
10	53:18:35.080	1:22:55.030
11	53:18:55.490	1:20:33.660
12	53:18:9.280	1:22:13.960
13	53:19:2.650	1:12:19.910
14	53:19:27.380	1:17:16.540
15	53:19:36.080	1:24:8.190
16	53:19:9.770	1:24:23.540
17	53:20:32.500	1:15:58.750
18	53:20:46.300	1:18:7.200
19	53:20:5.290	1:23:59.990
20	53:20:54.100	1:24:1.370
21	53:20:58.850	1:18:37.480
22	53:21:16.870	1:18:58.260
23	53:21:57.800	1:23:24.290
24	53:21:9.220	1:10:11.070
25	53:21:9.550	1:17:32.280

Table 1 – Dudgeon North Coordinates



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Point	Latitude	Longitude
1	53:14:5.350	1:25:52.570
2	53:13:44.720	1:27:26.100
3	53:10:38.840	1:32:6.340
4	53:10:5.820	1:25:33.390
5	53:9:9.190	1:28:22.670
6	53:9:18.480	1:27:22.970

Table 2 – Dudgeon South Coordinates

Point	Latitude	Longitude
1	53:7:20.090	1:17:7.740
2	53:5:8.070	1:15:40.090
3	53:8:58.970	1:10:57.700
4	53:5:47.570	1:13:2.570
5	53:14:44.110	1:5:29.630
6	53:11:4.110	1:2:0.070

Table 3 – Sheringham Coordinates

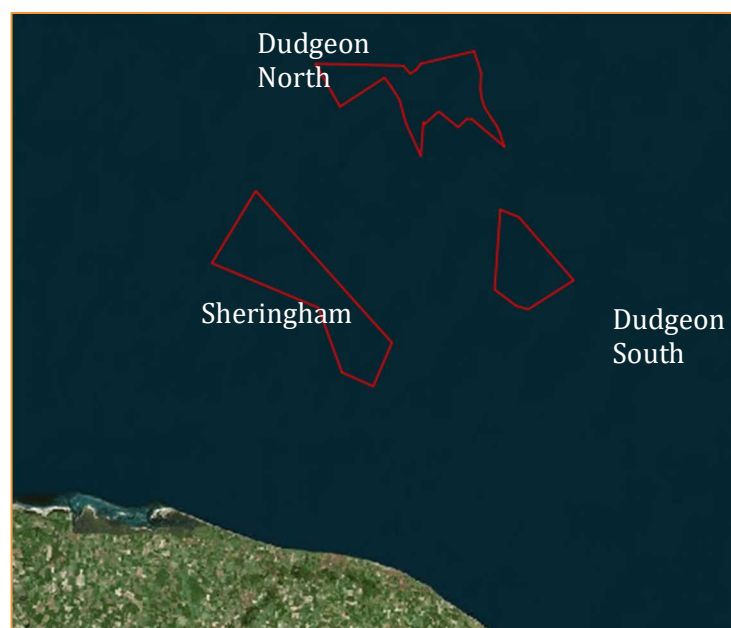


Figure 2 – Modelled Areas

## 1.4 Orientation



Figure 3 - Orientation to Airport

## 2 IFP Analysis

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### 2.1 General

The IFPs assessed are as follows:

#### AIP Effective 20<sup>th</sup> April 2023

- ATC SURVEILLANCE MINIMUM ALTITUDE CHART - **AD 2-EGSH-5-1** – 15 Jul 2021
- INSTRUMENT APPROACH CHART NDB(L)/DME RWY 09 – **AD 2.EGSH-8-1** – 01 Dec 2022
- INSTRUMENT APPROACH CHART ILS/DME/NDB(L) RWY 27 – **AD 2.EGSH-8-2** – 01 Dec 2022
- INSTRUMENT APPROACH CHART LOC/DME/NDB(L) RWY 27 – **AD 2.EGSH-8-3** – 01 Dec 2022
- INSTRUMENT APPROACH CHART NDB(L)/DME RWY 27 - **AD 2.EGSH-8-4** – 01 Dec 2022

### 2.2 Minimum Sector Altitudes (MSA)

#### 2.2.1 General

MSAs are established for each aerodrome and provide at least 300m (1000 ft) obstacle clearance within 25 NM (plus 5NM buffer) of the navigation aid, initial approach fix, or intermediate fix associated with the approach procedure for that aerodrome.

Norwich has two MSAs, one centred on NDB NWI which is used on all approach charts, and one based on the Aerodrome Reference Point (ARP) which is used on the ATCSMAC chart. Both have the same minima values.

#### 2.2.2 MSA – NDB(L) NWI

The MSA for Norwich Approaches are based on NDB NWI and is split into four sectors. The MSA that is applicable for the ATCSMAC is based on the ARP and is also split into four sectors.

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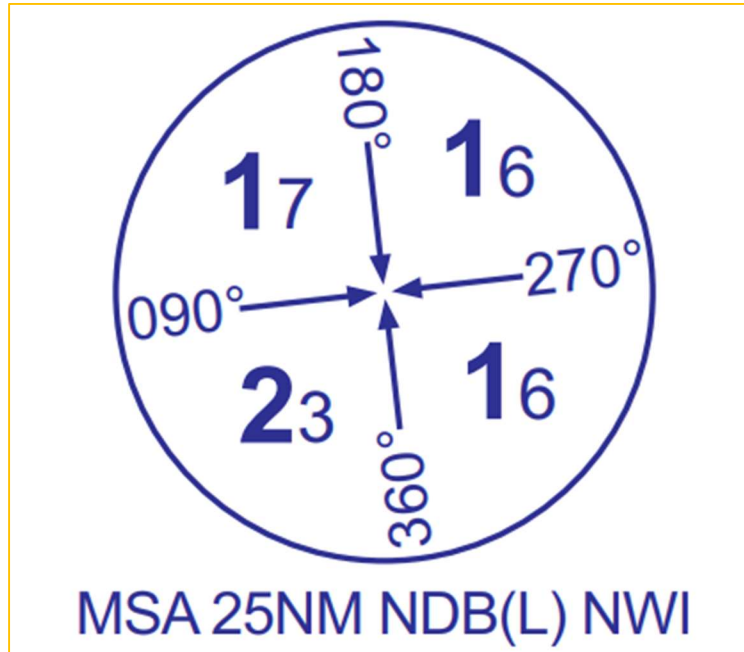


Figure 4 – Norwich MSA

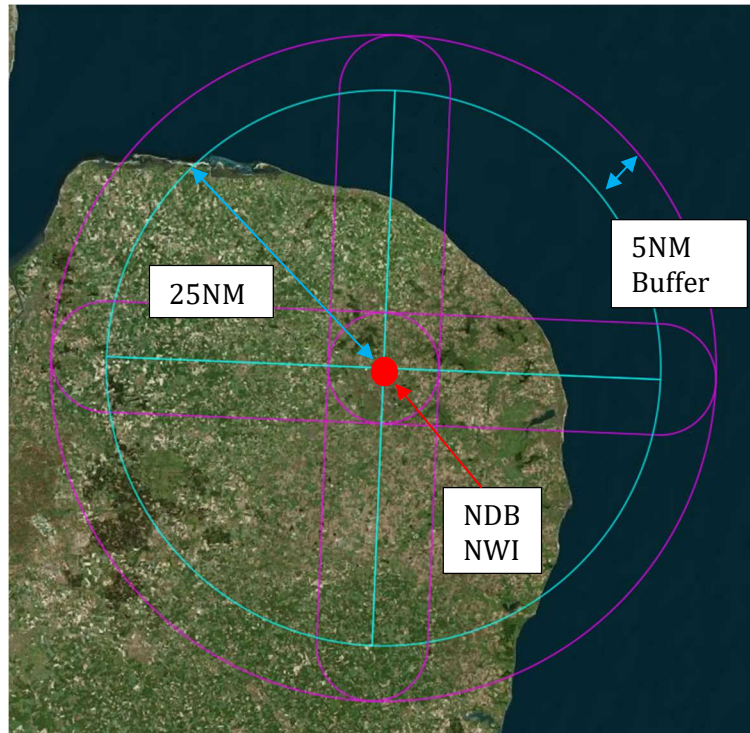


Figure 5 – Norwich MSA Areas

The Sheringham and South Dudgeon extensions are situated in the Northeast 1600ft sector and Sheringham extension is situated in the Northwest 1700ft sector.

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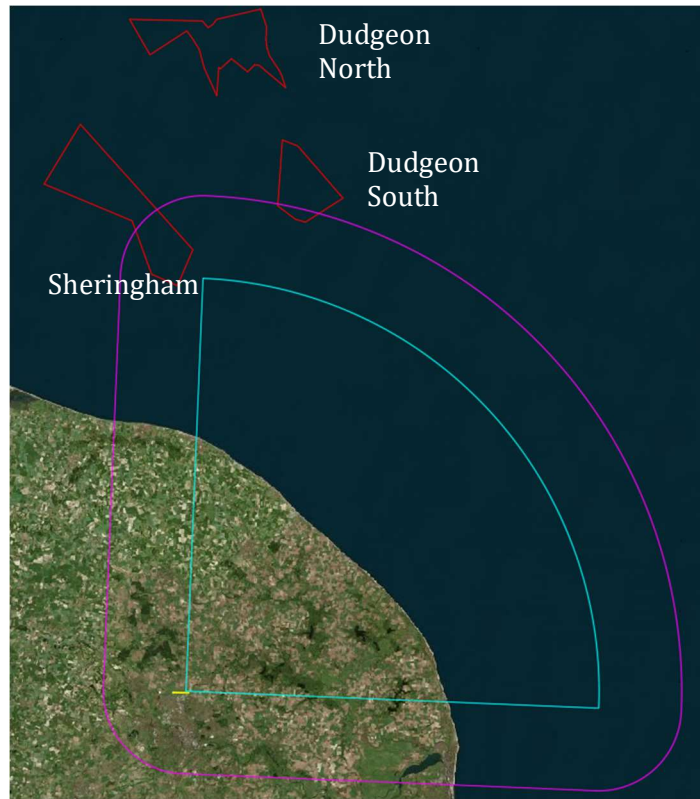


Figure 6 – Wind Farms within Norwich North East MSA Area

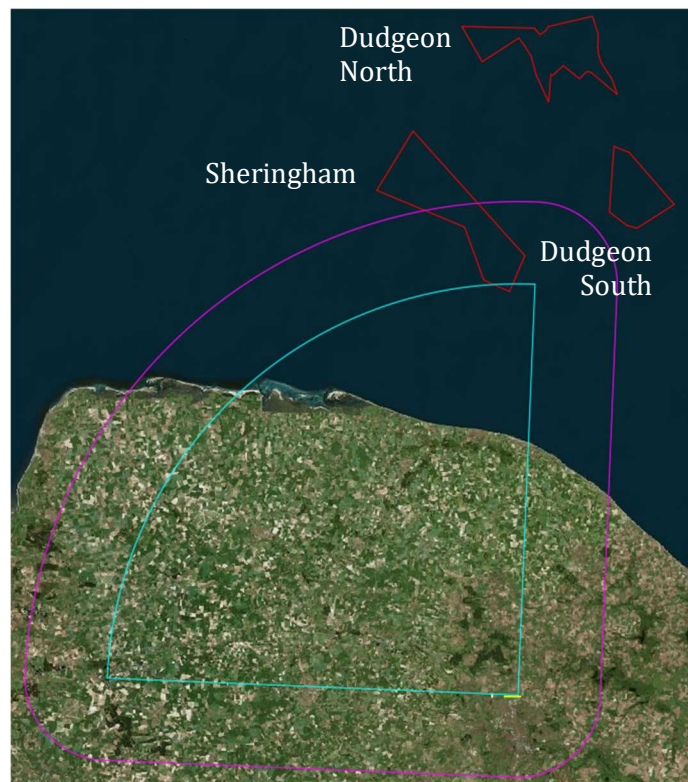


Figure 7 – Wind Farms within Norwich North West MSA Area

With a Blade tip elevation of 330m plus the 300m Minimum Obstacle Clearance (MOC) the resultant Minimum Obstacle Clearance Altitude (MOCA) for the Northeast

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and Northwest MSA sectors will be 630m or 2067ft rounded up to 2100ft for publications.

**This is above the published MSA values.**

**If the Wind Farms are to proceed the Northeast and Northwest MSA's need to be raised to 2100ft.**

If the extensions are to go ahead as planned a possible solution that will minimize impact on airport operations is to re-design the MSA with a separate MSA sector between the Northwest and Northeast sectors. An example of this is shown in Figure 8.

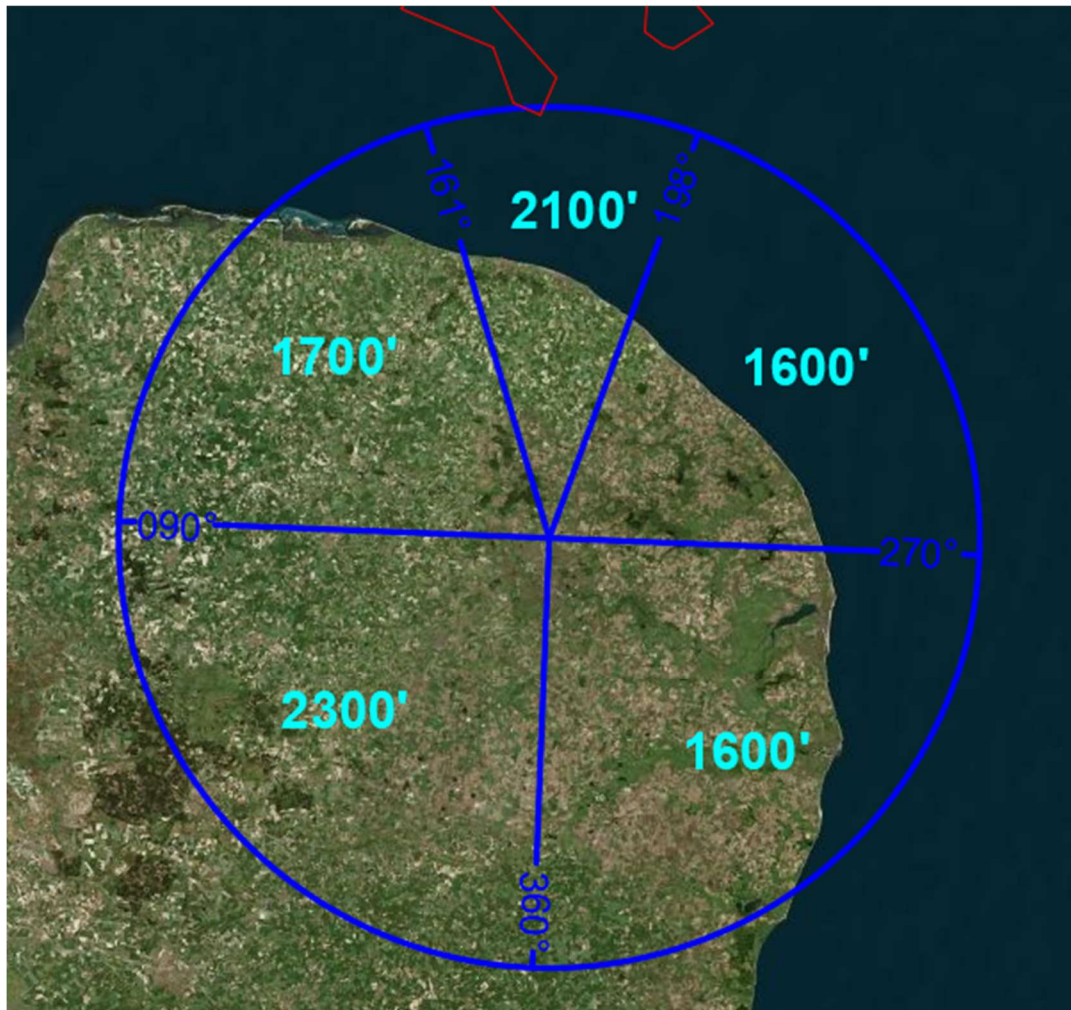


Figure 8 – Example of Amended MSA

The sectors above are all displayed in magnetic with the current Magnetic Variation at Norwich of 0.9°E. The two true values for the 2100ft sector is 161.9°T and 198.9°T.

**Note: This solution will require input from and discussion with the CAA. It is linked to the MSA issue associated with the ATCSMAC.**

Another mitigation would be to add a DME arc “step down” based on the I-NH DME which is associated with the ILS DME and NDB DME approach procedures. This will allow the MSA to only be raised to 2100ft beyond 15nm from the DME whilst keeping

the lower 1700ft and 1600ft figures closer to the airport. See Figure 9 – Second example of Amended MSA.

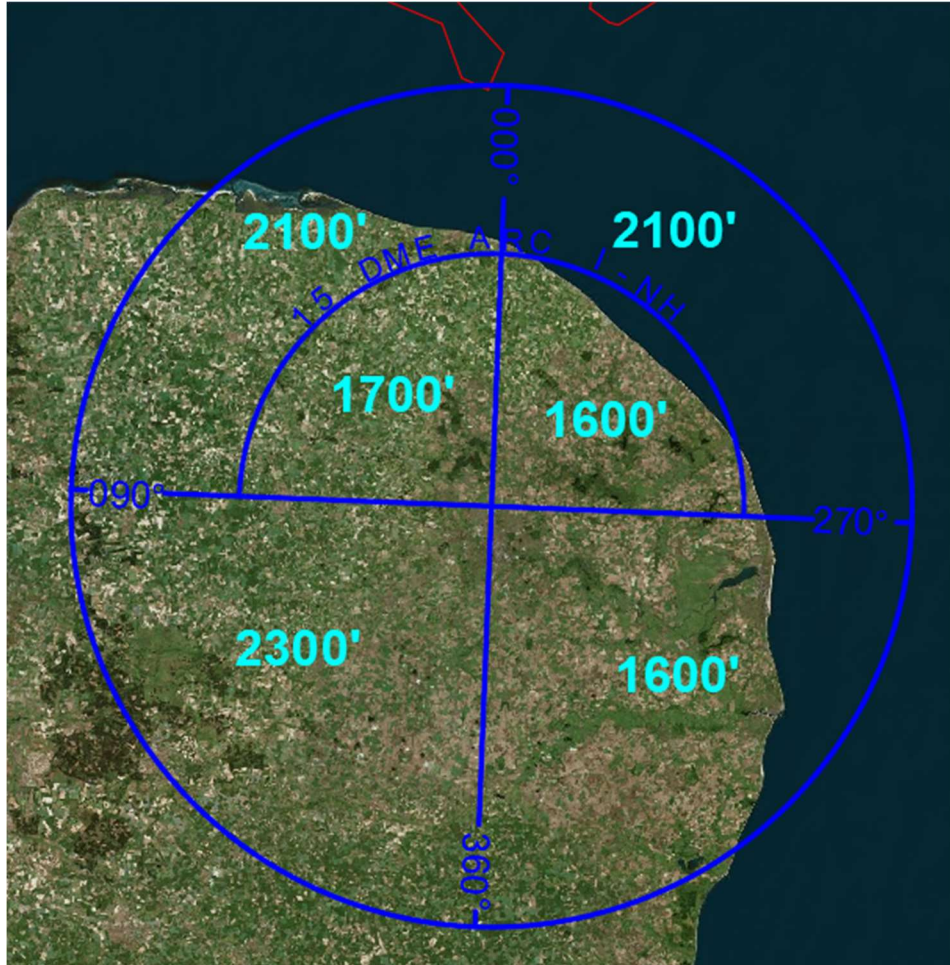


Figure 9 – Second example of Amended MSA.

**Note: This solution will require input from and discussion with the CAA. It is linked to the MSA issue associated with the ATCSMAC.**

### 2.2.3 MSA – ARP

The MSA that is applicable for the ATCSMAC is based on the ARP and is also split into four sectors.

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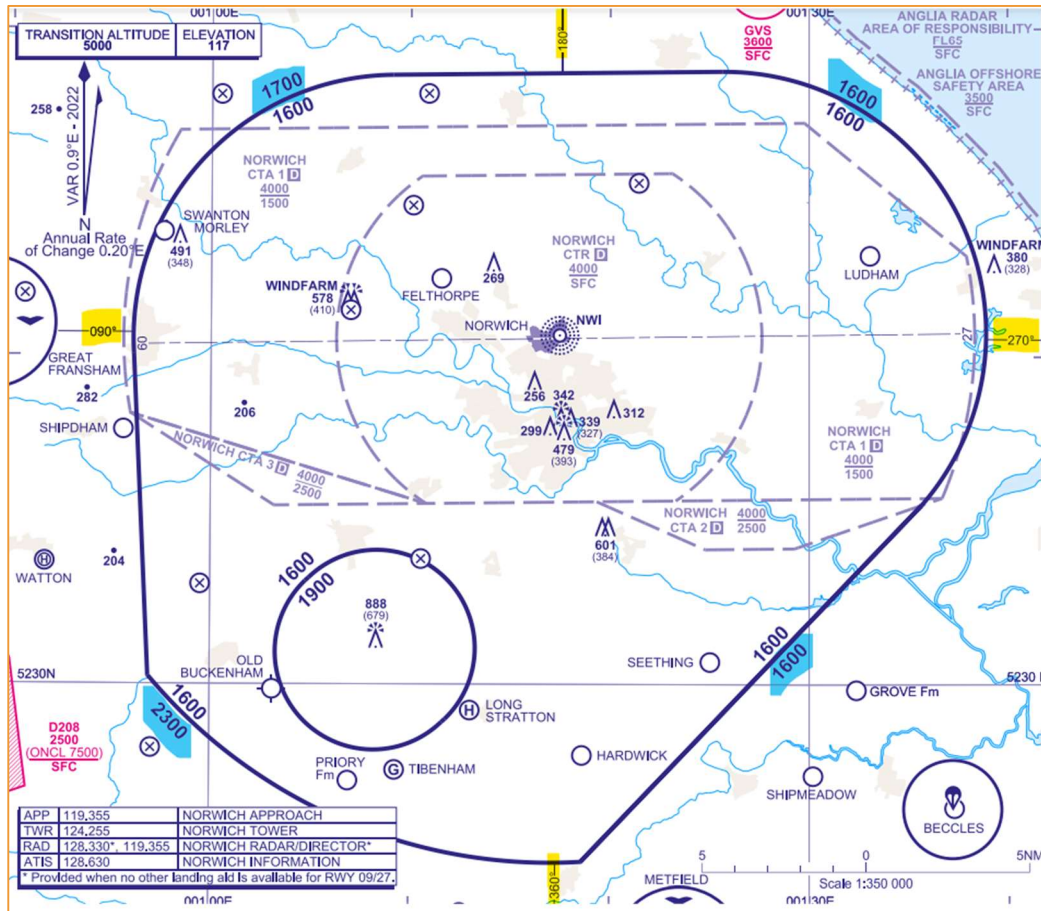


Figure 10 - Norwich MSA

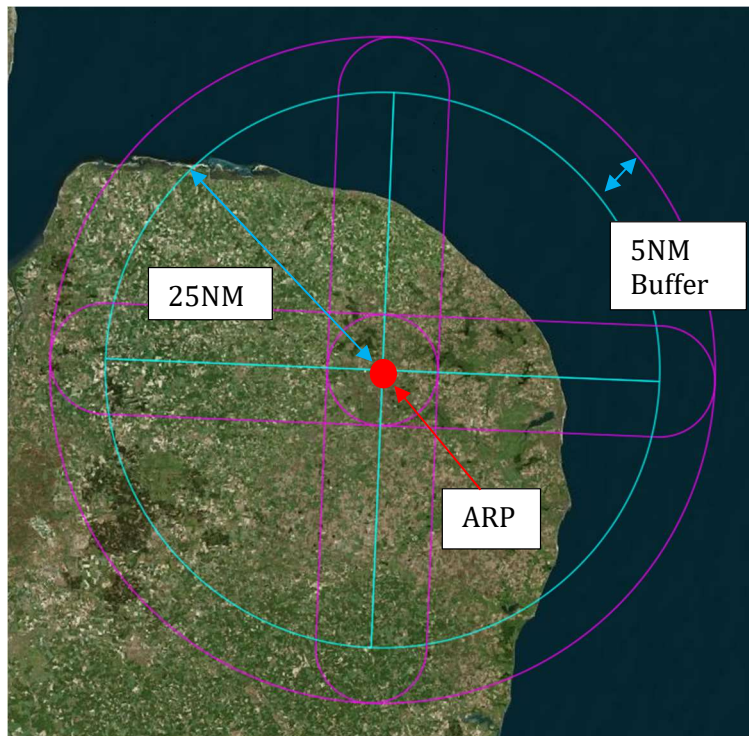


Figure 11 - Norwich MSA Areas

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The Sheringham and South Dudgeon extensions are situated in the Northeast 1600ft sector and Sheringham extension is situated in the Northwest 1700ft sector.

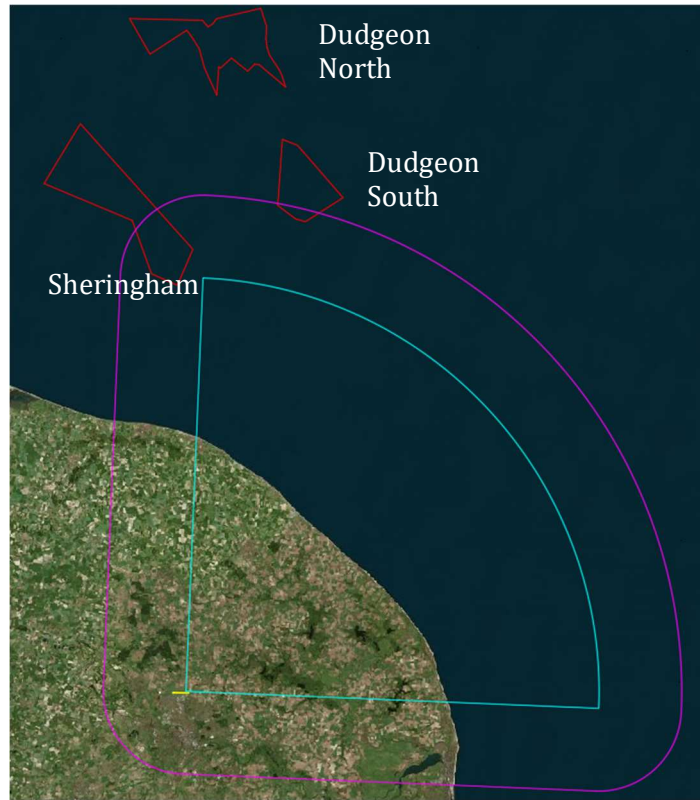


Figure 12 – Wind Farms within Norwich North East MSA Area

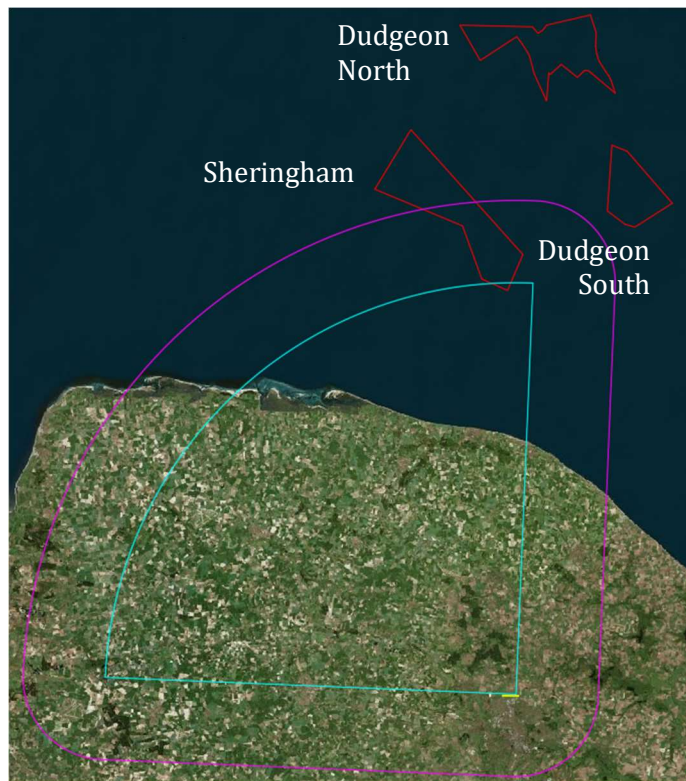


Figure 13 – Wind Farms within Norwich North West MSA Area

With a Blade tip elevation of 330m plus the 300m Minimum Obstacle Clearance (MOC) the resultant Minimum Obstacle Clearance Altitude (MOCA) for the Northeast and Northwest MSA sectors will be 630m or 2067ft rounded up to 2100ft for publications.

**This is above the published MSA values.**

**If the Wind Farms are to proceed the Northeast and Northwest MSA's need to be raised to 2100ft.**

As mentioned in 2.2.2, if the extensions are to go ahead as planned a possible, **non-standard**, solution that will minimize impact on airport operations is to re-design the MSA with a separate MSA sector between the Northwest and Northeast sectors or with a DME Arc as shown in Figure 8 and Figure 9.

**The reason this is a non-standard solution is found within CAP 777, where the CAA has stated that the MSA associated with the ATCSMAC is to use "Cardinal Points" (ie. North, East, South, West).**

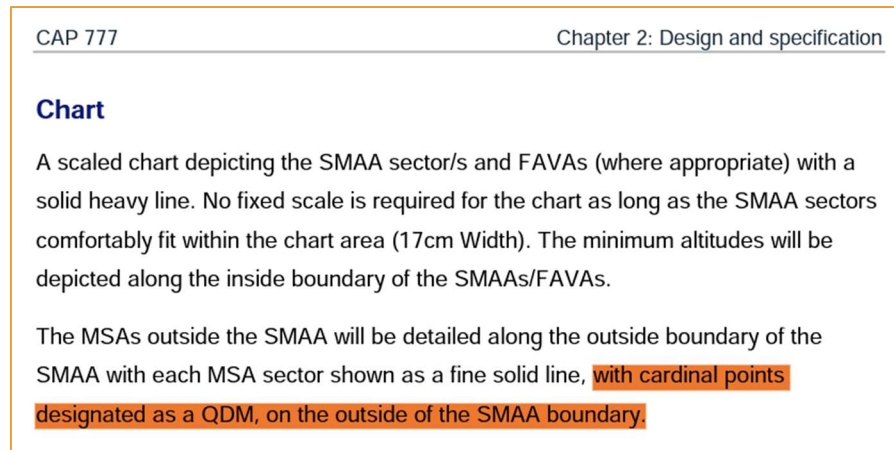


Figure 14 – Extract from CAP 777

Therefore, the proposal to have an additional 2100ft MSA sector for both the published IFPs, based on the NDB, and for the ATCSMAC, based on the ARP, needs to be approved by the CAA. We cannot see an example in the UK AIP whereby non-Cardinal Point MSAs are used on an ATCSMAC. The following will need to be clarified:

- Is it acceptable to the CAA for non-Cardinal Point MSAs to be used on the ATCSMAC. If yes, then the proposal of a 2100ft MSA sector for the IFPs and the ATCSMAC is feasible.

**Note: This is a UK NON-STANDARD solution and will require input and discussion with the CAA.**

If the extensions are to go ahead without affecting either of the MSAs, either the blade tip elevation at Sheringham and Dudgeon South are to be restricted to 187.68m AMSL (1600ft – 300m) or the extensions will need to be restricted to the following areas in green:

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Figure 15 – Extension safe areas (green)

Point	Latitude	Longitude
1*	53:10:16.158	1:25:34.218
2*	53:9:43.810	1:29:48.979
3	53:10:38.840	1:32:6.340
4	53:13:44.720	1:27:26.100
5	53:14:5.350	1:25:52.570

Table 4 – New Dudgeon South Area Coordinates

\*Points 1 and 2 joined by a 55660m arc centred on NDB NWI (52:40:39.15, 1:17:29.41)

Point	Latitude	Longitude
1*	53:9:57.646	1:6:46.098
2*	53:10:29.771	1:12:10.232
3	53:14:44.110	1:5:29.630
4	53:11:4.110	1:2:0.070

Table 5 – New Sheringham Area Coordinates

\*Points 1 and 2 joined by a 55660m arc centred on NDB NWI (52:40:39.15, 1:17:29.41)

## 2.3 ATC Surveillance Minimum Altitude Chart

The Wind Farm sites are located to the North of the Airport outside of the ATCSMAC protection areas.



Figure 16 - ATCSMAC

As the sites are outside of the ATCSMAC main areas and the 5nm buffer, they do not affect the ATCSMAC altitude restrictions. However, any obstacle outside of the ATCSMAC areas need to be assessed against the Minimum Sector Altitude (MSA) for the airport.

As noted in section 2.2.3 the MSA values will need to be raised in the Northwest and Northeast sectors to 2100ft.

As noted in 2.2.3 there is a non-standard mitigation that could be used to limit the area where the MSA would need to be raised.

Alternatively, if mitigation as described in 2.2.3 should not be acceptable an amended ATCSMAC area can be investigated to suit both the operational needs of the airport and the flight safety of the aircraft operators.

## 2.4 Arrivals

### 2.4.1 NDB(L)/DME RWY 09 (AD 2.EGSH-8-1 01 Dec 2022)

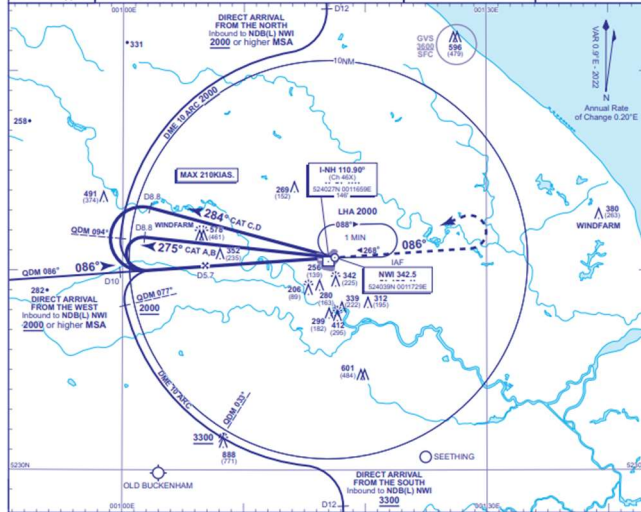


Figure 17 – NDB(L)/DME RWY 09 Procedure

In absence of textual descriptions of the Direct arrivals, they are deemed to commence at D12 I-NH, therefore the proposed wind farms are outside all protection areas.

**The wind farm would have no impact on the published procedure.**

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Figure 18 - NDB(L)/DME RWY 09 Protection Areas

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2.4.2 ILS/DME/NDB(L) RWY 27 (AD 2.EGSH-8-2 01 Dec 2022)

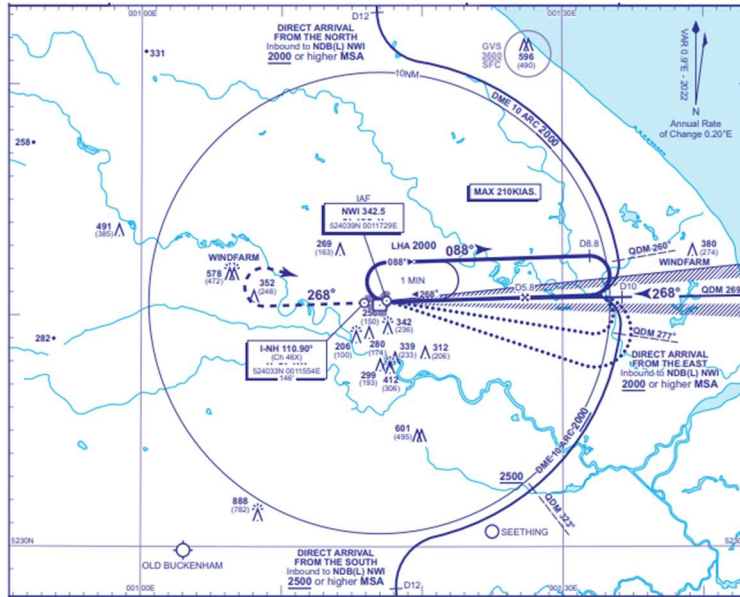


Figure 19 – ILS/DME/NDB(L) RWY 27 Procedure

In absence of textual descriptions of the Direct arrivals, they are deemed to commence at D12 I-NH, therefore the proposed wind farms are outside all protection areas.

**The wind farm would have no impact on the published procedure.**

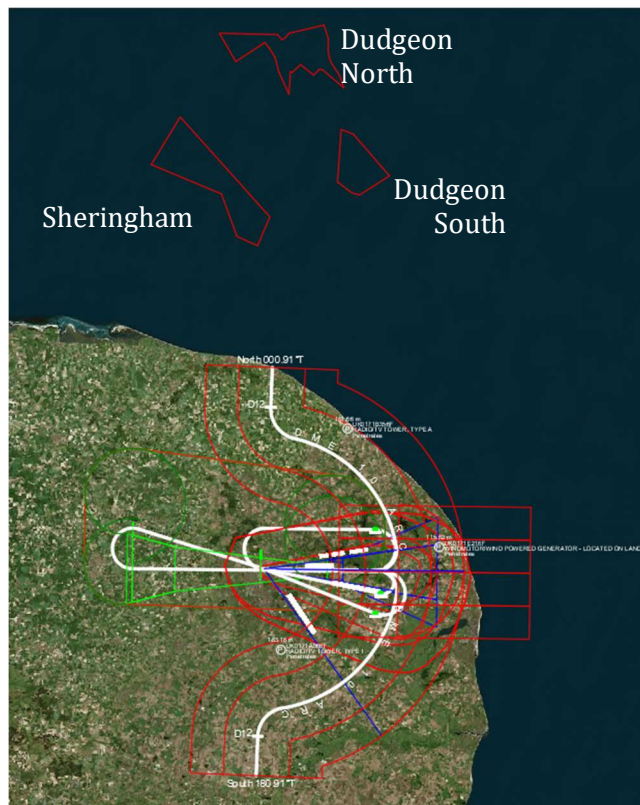


Figure 20 – ILS/DME/NDB(L) RWY 27 Protection Areas

2.4.3 LOC/DME/NDB(L) RWY 27 (AD 2.EGSH-8-3 01 Dec 2022)

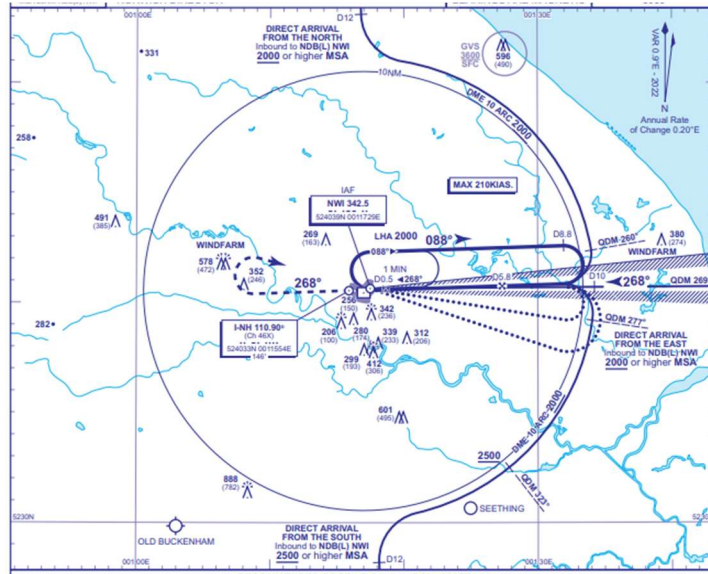


Figure 21 – LOC/DME/NDB(L) RWY 27 Procedure

In absence of textual descriptions of the Direct arrivals, they are deemed to commence at D12 I-NH, therefore the proposed wind farms are outside all protection areas.

**The wind farm would have no impact on the published procedure.**



Figure 22 – LOC/DME/NDB(L) RWY 27 Protection Areas



2.4.4 NDB(L)/DME RWY 27 (AD 2.EGSH-8-4 01 Dec 2022)

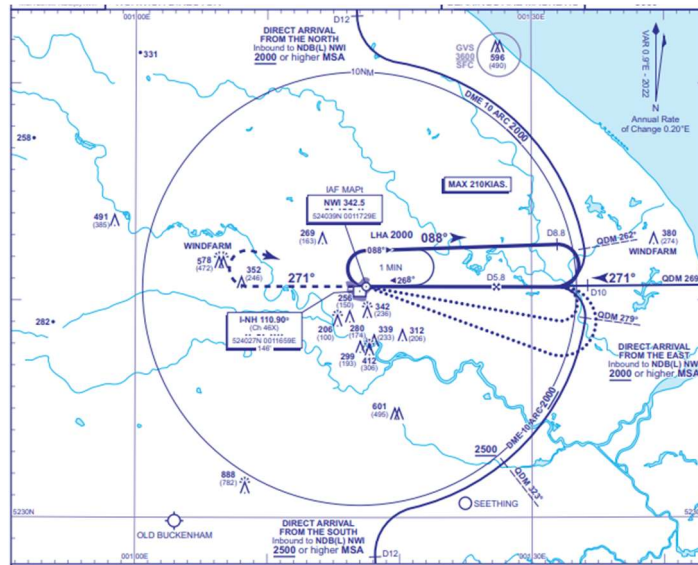


Figure 23 - NDB(L)/DME RWY 27 Procedure

In absence of textual descriptions of the Direct arrivals, they are deemed to commence at D12 I-NH, therefore the proposed wind farms are outside all protection areas.

**The wind farm would have no impact on the published procedure.**



Figure 24 - NDB(L)/DME RWY 27 Protection Areas

## 2.5 Visual Manoeuvring (Circling)

The proposed wind farm is outside all protection areas.

**The wind farm would have no impact on the Visual Circling.**

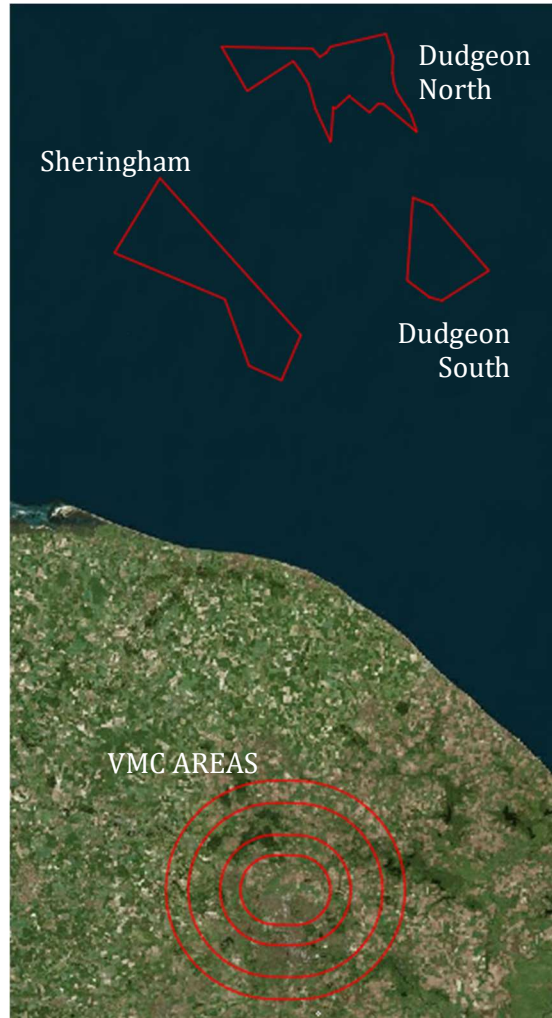


Figure 25 – NDB(L)/DME RWY 27 Protection Areas

## 2.6 Visual Segment Surface (VSS)

The proposed wind farm is outside all VSS areas.

**The wind farm would have no impact on the VSS for both runways.**



Figure 26 – VSS Protection Areas

## 2.7 Holding

The proposed wind farm is outside the protection area of the hold.

**The wind farm would have no impact on the hold.**

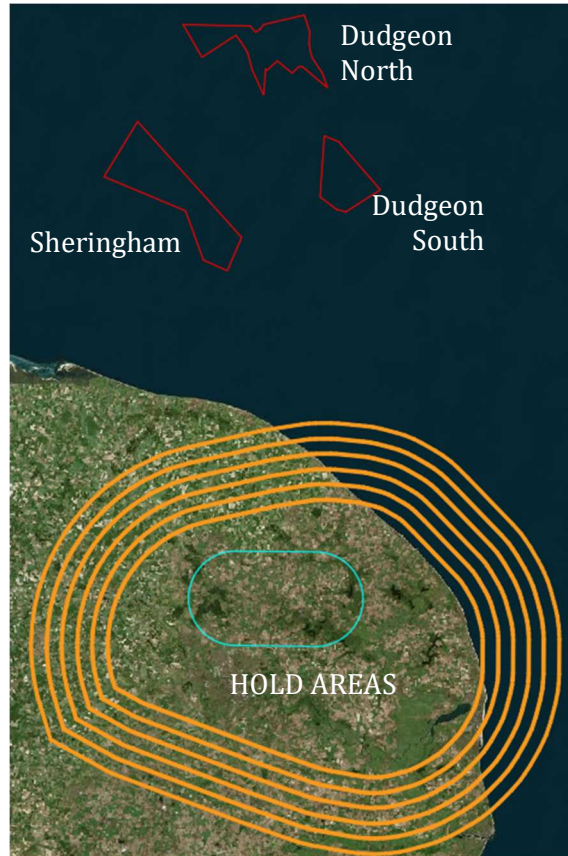


Figure 27 – Hold Protection Areas

## 3 Conclusions

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### Impact on the MSAs

**The proposed wind farm extensions at Sheringham and Dudgeon South would impact Norwich Airport's MSAs. This includes effects on the IFP MSAs, based on the NDB(L) NWI, as well as effects on the ATCSMAC MSAs, based on the ARP.**

**There are proposals for mitigation in this report, but the standard mitigation for the MSAs, based on the NDB(L) NWI (IFPs) and the ARP (ATCSMAC), would be to increase the Northwest and Northeast sectors to 2100ft.**

**These effects on the MSAs by the wind farm extensions, affect all published IFPs and the ATCSMAC.**

### Impact on the IFPs

**Other than the effects on the MSAs, the proposed wind farm extensions at Sheringham and Dudgeon South would not impact the IFPs in any other way.**

### Impact on the ATCSMAC

**Other than the effects on the MSAs, the proposed wind farm extensions at Sheringham and Dudgeon South would not impact the ATCSMAC SMAA.**