

Technical Note on the impacts of accessing the Waveney Installation with DEP Wind Turbines within 1.5nm.

This technical note provides an overview of predicted impacts on accessing the Waveney Installation (by helicopter) when the wind turbine generator bases are within 1.34nm (assuming rotors of 300m diameter).

1. Data

Two datasets have been used:

A: Data at hourly intervals for the Waveney platform from 1/1/2021 to 31/12/2022

B: Data at 10-minute intervals for the Waveney platform from 16/7/2019 to 31/12/2020

Dataset A contains more parameters allowing a fuller analysis and has better data quality.

The following parameters have been used in the analysis:

Parameter	Units	Tag in Source Data
Wind Direction	Degrees	WindDir_deg_10min
Visibility	m	Visibility_m
Wind Speed	Knots	WindSpeed_kts_2min
Air Temperature	Degrees Celsius	AirTemp_degC_2min_Mean
Cloud-base	Feet	Cloud_Height1_ft
Significant Wave Height <i>Dataset A only</i>	m	WaveRadar_Hs_4RMS_m_30min
Dew Point	Degrees Celsius	DewPoint_degC_2min

Data points falling outside the period of normal helicopter operations at Waveney: 06:30 – 21:30, were excluded from the analysis.

For each data point it was determined whether or not it was within daylight hours (from 30 mins before sunrise to 30 mins after sunrise) by reference to the times of sunrise and sunset at Norwich as found at [REDACTED].

2. Flying Conditions

For any flights to be possible, the wind speed must be no more than 60 knots and the significant wave height no more than 6m. In addition, for operations under instrument flight rules (IFR), the visibility must be at least 1.5km and the cloud base at least 300' in daylight or 400' at other times. Flying is only possible when aircraft will not suffer icing. Icing can be expected to occur under clear air conditions (when visibility is at least 1km) and the temperature measured at the platform is less than 1.5°C for low level flying or 4°C when flying at the minimum safe altitude (MSA) over the array.

Flying under visual flight rules (VFR) requires the visibility to be at least 4km in daylight or 5km at other times and the cloud base to be at least 600' in daylight or 1200' at other times.

Under rules agreed between the helicopter operators and the Civil Aviation Authority (CAA) which are soon to be implemented, any flights to/from a facility located within 3nm of any wind turbine generator will be limited to daylight and when visibility is at least 5km and the cloudbase is at least 700'.

3. Logistical Constraints

Before a flight departs, weather forecasts will be used to verify whether conditions will permit the flight to land at its destination. If the forecast weather window unfavourable or is too short, the flight would not depart. For the purposes of these calculations, it has been assumed that a minimum weather window of 2 hours would be required for a flight to be scheduled.

Helicopters operating out of Norwich airport support operations at many installations. Should weather conditions prevent a flight from being operated, there is limited opportunity to re-schedule the flight later in the day. This effect has not been explicitly modelled but the analysis shows the proportion of times within the day when conditions would permit one or two flights as appropriate. The denominator where one flight is required (flights to a non-producing installation (NPI) such as a rig at Waveney or rotors turning flights for a system reset) is the total number of times within the day that meet the conditions of being within the normal operating hours and (in the case of flights to the Waveney platform) are also daylight. Where 2 flights are required to the Waveney platform within the day, the denominator is reduced to only include those times where both flights would fall within normal operating hours and daylight.

The Waveney platform is a normally unattended installation (NUI) which provides no accommodation except in an emergency. The helideck is rated for daylight use only. For a crew to carry out work on the platform, either:

- two flights are required on the same day within the hours of daylight and with sufficient time between them to allow work to be undertaken; or
- a helicopter must remain on the platform with rotors turning whilst work is undertaken.

The former is the most common but, where a system reset is required which can be undertaken within around 20 minutes, the latter may occur. For the purposes of this analysis, it has been assumed that rotors turning visits account for 10% of all platform visits. Where two flights are required within the day, they need to be separated by at least 5-8 hours. For the purposes of this analysis a minimum separation of 5 hours is assumed.

When an NPI such as a rig is stationed at Waveney, as required for a well workover or when the wells are being plugged and abandoned, the NPI will have a helideck rated for day and night use. The NPI also has accommodation. Although typically, NPI operations are serviced by 2 flights per day, these flights would not be dependent on one another. For the purposes of this analysis, as long as one flight can be made during the day, no impairment to operations is assumed.

4. Scenarios

4.1 Current Status (baseline)

The baseline for this analysis is the current status. Currently, flights can operate under instrument flight rules (IFR) to the Waveney NUI in daylight and to an NPI stationed at the Waveney platform in daylight or at night.

4.2 DEP greater than 1.34nm^{1,2} but within 3nm of Waveney

Under the new rules agreed by helicopter operators with the CAA and to be introduced shortly, the presence of wind turbine generators within 3nm of Waveney will restrict flights to the NUI and to a rig stationed at Waveney.

4.3 DEP less than 1.34nm¹ from Waveney

As there would be insufficient space to turn into a stabilised final approach track, flights would be restricted to when the wind is broadly from the west or from the east. As shown in Figure 1 below, the permitted wind directions are from between 78° and 102° or between 258° and 282°.

Calculation of acceptable wind directions for <1.34nm case

Excluded sectors to N and S have an angle of 2a at platform

where $\cos(a) = 500 / (1.34 \times 1852)$

a = 78 degrees

Therefore sectors to E and W each have an angle of 24 degrees

Wind must be within +/-12 degrees of 90 or 270.

NB: Calculation does not account for rotors (300m diameter) extending beyond boundary of windfarm

Platform is 500m from boundary

red = 1.34nm radius from platform

White = 1.01nm radius from platform

To allow take-off and landing wind must be within sectors to E or W

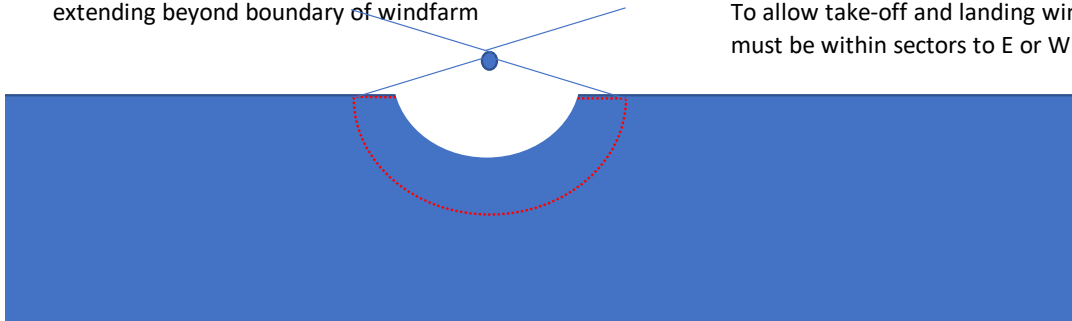


Figure 1: Calculation of Available Wind Directions

5. Results

A simple count of all daylight times when visual flight rules (VFR) are possible yields the same result (94% of daylight hours) as presented by the Applicant in Anatec's Helicopter Access Report. This, and the other percentages presented by the Applicant do not however represent the proportion of helicopter operations that will be unaffected. Comparative discussions with the Applicant and Anatec revealed that the Applicant has over-simplified their analysis whilst Perenco has applied a more rigorous methodology (set out in Sections 2 and 3 above) to assess the realistic impact on future aviation operations.

As shown in Figure 2, flights to an NPI stationed at Waveney will be significantly affected by the construction of DEP. If, as proposed by Perenco, the distance from Waveney to the nearest rotor tip is at least 1.5nm for all wind turbine generators except for one which may have rotor tips no less than 1.01nm from Waveney, then operations in support of a rig at Waveney would be viable, but almost half of the flights currently possible would become unavailable in some months. If, as suggested by the Applicant, the rotor tip of any wind turbine generator were less than 1.01nm from Waveney, helicopter

¹ Distance is to wind turbine base assuming rotor diameter of 300m. It could also be expressed as 1.26nm to rotor tip.

² This distance is based on the space required to make a turn into a stabilised final approach track as set out in Section 3.8 of Harbour Energy's Summary of Oral Submission at ISH6 submitted at Deadline 8 () and is irrespective of payload or wind.

support of rig operations would be completely impracticable with only a small percentage of current flying windows being available.

As shown in Figure 3, the impact of DEP on flights to the Waveney platform is less than to an NPI. This is because flights to the NUI are already restricted to daylight hours. Never-the-less if, as proposed by Perenco, the distance from Waveney to the nearest rotor tip is at least 1.5nm for all wind turbine generators except for one which may have rotor tips no less than 1.01nm from Waveney, then operations in support of a rig at Waveney would be viable, but around one in 10 flights currently possible would become unavailable in all months. If, as suggested by the Applicant, the rotor tip of any wind turbine generator were less than 1.01nm from Waveney, helicopter support of rig operations would be completely impracticable with only a small percentage of current flying windows being available.

Results from the much larger 2019-21 dataset (dataset B) are entirely consistent with those shown in Figures 2 and 3.

06:30-21:00 Day and night (Rig)

Data from 1/1/21-31/12/22

Flight times available as a proportion of current status

Month	With ≥ 1.34nm to WTG base (1.26nm to rotor tip)	With < 1.34nm (access only from E or W)
January	55%	7%
February	63%	9%
March	73%	7%
April	91%	4%
May	93%	6%
June	95%	4%
July	94%	5%
August	93%	5%
September	83%	7%
October	71%	3%
November	59%	6%
December	52%	3%
Annual Average	77%	6%

Figure 2: Flight Times Available to a Rig as a Proportion of the Current Status

06:30-21:00 Daylight only (Waveney) - Requires two flights per day within 05:00-10:00 hrs of each other.

Data from 1/1/21-31/12/22

Flight times available as a proportion of current status

Month	With >=1.34nm to WTG base (1.26nm to rotor tip)	With <1.34nm (access only from E or W)
January	94%	6%
February	90%	7%
March	88%	5%
April	98%	2%
May	92%	2%
June	93%	2%
July	93%	2%
August	97%	2%
September	95%	3%
October	91%	2%
November	93%	3%
December	84%	1%
Annual Average	93%	3%

Figure 3: Flight Times Available to a Waveney NUI as a Proportion of the Current Status