MachairWind Offshore Windfarm

Appendix 15.2 Dubh Artach Lighthouse Technical Note

MachairWind Offshore Windfarm
Dubh Artach Lighthouse
Technical Note

Prepared by	Anatec Limited
Presented to	Haskoning
Date	18 November 2025
Revision Number	02
Document Reference	A4674-RHD-TN-01

	Aberdeen Office	**Cambridge Office**
Address	10 Exchange Street, Aberdeen, AB11 6PH, UK	Braemoor, No. 4 The Warren, Witchford Ely, Cambs, CB6 2HN, UK
Tel	01224 253700	01353 661200
Email	aberdeen@anatec.com	cambs@anatec.com

This study has been carried out by Anatec Ltd on behalf of Haskoning. The assessment represents Anatec's best judgment based on the information available at the time of preparation. Any use which a third party makes of this report is the responsibility of such third party. Anatec accepts no responsibility for damages suffered as a result of decisions made or actions taken in reliance on information contained in this report. The content of this document should not be edited without approval from Anatec. All figures within this report are copyright Anatec unless otherwise stated. No reproduction of these images is allowed without written consent from Anatec.

Revision Number	Date	Summary of Change
00	08 September 2025	Initial Draft
01	30 October 2025	Initial Updates
02	18 November 2025	Further Updates
03	27 November 2025	Further Updates
04	06 January 2026	Further Updates

Internal Use

Table of Contents

1 Introduction 1
1.1 Project Overview 1
2 NLB Assets 3
2.1 Lighthouses 3
2.2 Helicopter Operations 5
2.2.1 Carriage of Personnel 5
2.2.2 Carriage of Underslung Loads 5
2.2.3 Data Source 6
2.2.4 AIS Analysis 6
3 Consultation Summary 11
4 Recommended Distance 13
4.1 Weather 13
4.2 Approach and Take-off Distances Required 13
4.3 *Pharos* Searoom 13
4.4 Summary 14

Table of Figures

Figure 1.1 Windfarm Development Area Overview 2
Figure 2.1 Dubh Artach and Skerryvore Lighthouse Overview 3
Figure 2.2 Dubh Artach Lighthouse (Copyright: MarineTraffic.com) 4
Figure 2.3 Skerryvore Lighthouse (Copyright: MarineTraffic.com) 4
Figure 2.4 *Pharos* (Copyright: MarineTraffic.com) 6
Figure 2.5 *Pharos* AIS Tracks (2020-2025) 7
Figure 2.6 *Pharos* Operation Activity (2020-2025) 8
Figure 2.7 *Pharos* Positions (29th June 2022) 10
Figure 4.1 Dubh Artach Clearance 14

Table of Tables

Table 2.1 *Pharos* Operation Activity Details 8
Table 3.1 Scoping Response Summary 11

Internal Use

Abbreviations Table

Abbreviation	Definition
AIS	Automatic Identification System
AtoN	Aid to Navigation
CAT	Commercial Air Transport
CPA	Closest Point of Approach
ft	Foot
GLA	General Lighthouse Authority
HCA	Helideck Certification Agency
HLL	Helideck Landing Limitations
kt	Knot
m	Metre
NLB	Northern Lighthouse Board
NLV	Northern Lighthouse Vessel
nm	Nautical Mile
SPA-HOFO	Special Approval for Helicopter Offshore Operations
SPO-HESLO	Specialist Operations Helicopter Underslung Loads
VMC	Visual Meteorological Conditions

Internal Use

1 Introduction

The MachairWind (hereby referred to as the 'Project') Windfarm Development Area (WDA) is located in proximity to the Dubh Artach and Skerryvore Lighthouses, and it will therefore be necessary to ensure there is sufficient space and open access routes to facilitate safe marine and helicopter operations associated with the lighthouses. This was raised by the Northern Lighthouse Board (NLB) within their response to the Scoping Report process.

Anatec have produced this technical note in order to assess the impact and provide a recommendation on the necessary space requirement. The assessment has been undertaken in support of the MachairWind Environmental Impact Assessment (EIA) Report (EIAR), **Chapter 15 Military and Civil Aviation** and **Chapter 17 Infrastructure and Other Users**.

The assessment includes:

- An overview of the relevant aspects of the Project and the Dubh Artach and Skerryvore Lighthouses;
- Assessment of vessel traffic data to characterise marine operations;
- Summary of relevant consultation to date;
- Summary of helicopter access requirements; and
- Recommendations on a suitable distance from the wind turbine generators (WTGs).

1.1 Project Overview

The WDA is located approximately 8.1 nautical miles (nm) off the west coast of Scotland and covers an area of approximately 131 square nautical miles (nm^2). An overview of the WDA is presented in **Figure 1.1**.

It is noted that the WDA has been refined since scoping stage. The boundary used at scoping stage has been included in **Figure 1.1** for reference, noting this was the boundary upon which the NLB based their responses to the Scoping Report.

Internal Use

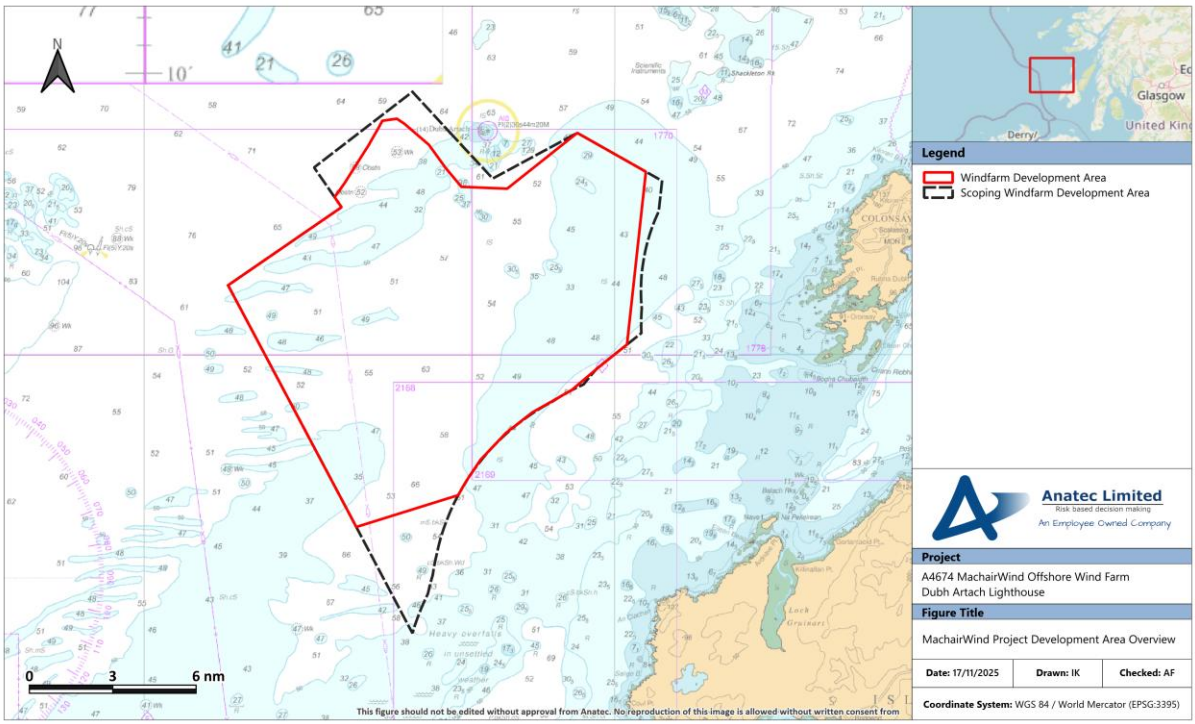

Figure 1.1 Windfarm Development Area Overview

Internal Use

2 NLB Assets

2.1 Lighthouses

The Dubh Artach Lighthouse is a 44 m-tall key Aid to Navigation (AtoN) situated 2 nm at its closest point from the northern periphery of the WDA. In addition to the marine light, the lighthouse is equipped with an Automatic Identification System (AIS) which is remotely monitored by the Northern Lighthouse Board (NLB), and has a helipad constructed alongside to allow helicopter operations to be undertaken.

Skerryvore lighthouse is situated approximately 16.6 nm to the northwest of the WDA, and is 48 m high. It also has a helipad constructed alongside, allowing helicopter operations.

Northern Lighthouse Vessels (NLV) are known to transit between the Skerryvore and Dubh Artach Lighthouses.

An overview of the Dubh Artach and Skerryvore Lighthouse positions relative to the WDA is presented in **Figure 2.1**. Images of the lighthouses are presented in **Figure 2.2** and **Figure 2.3**.

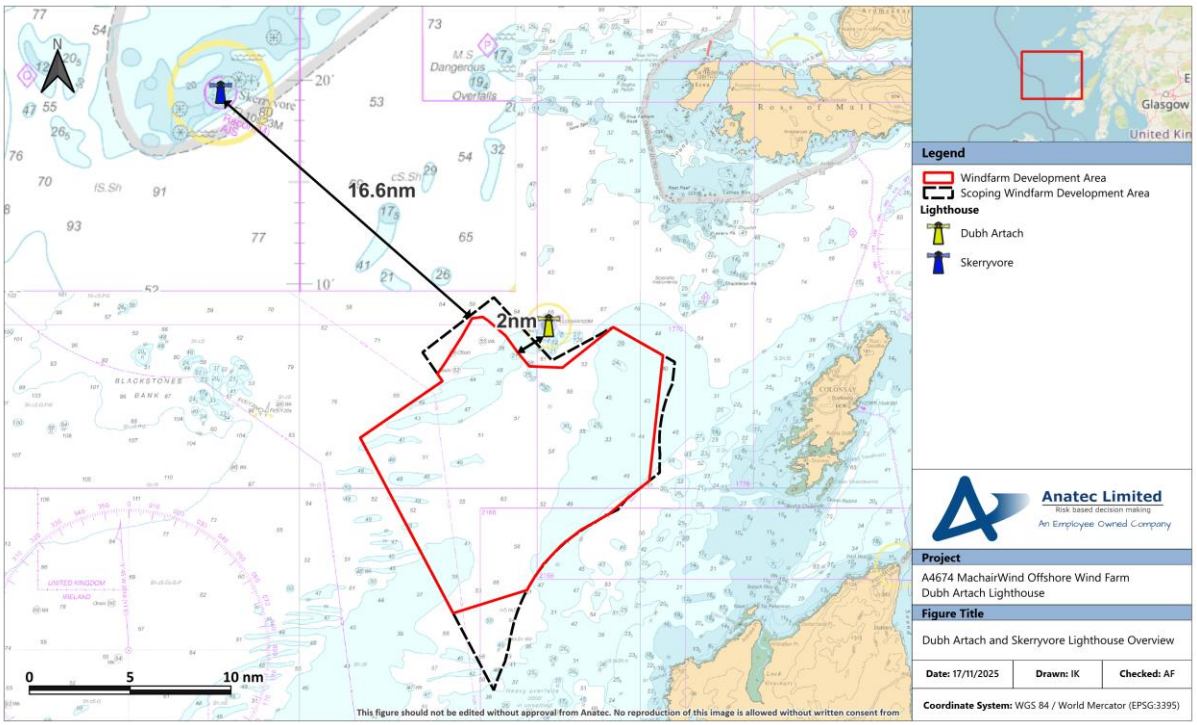

Figure 2.1 Dubh Artach and Skerryvore Lighthouse Overview

Internal Use

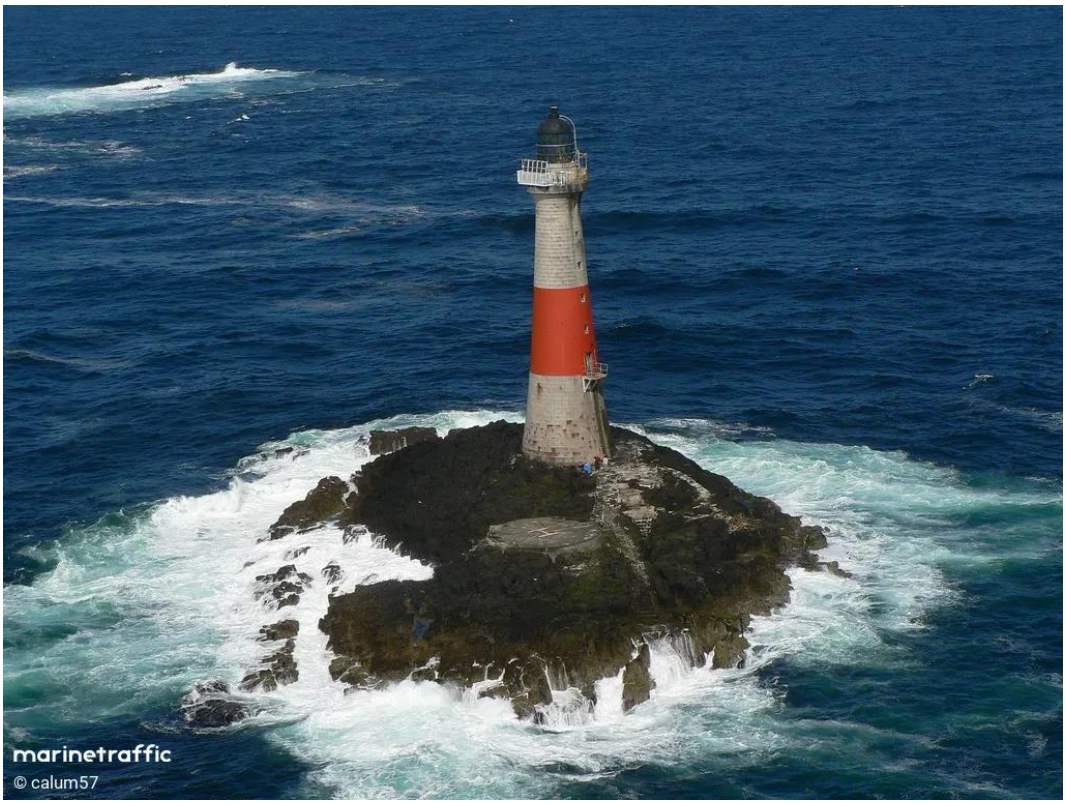

Figure 2.2 Dubh Artach Lighthouse (Copyright: MarineTraffic.com)

Figure 2.3 Skerryvore Lighthouse (Copyright: MarineTraffic.com)

Internal Use

Given the distance between the Skerryvore lighthouse and the WDA of 16.6 nm, there are not considered to be any access issues, significant effects are not anticipated and therefore it has been scoped out of further assessment. The remainder of this report considers the spacing between the WDA and the Dubh Artach Lighthouse.

2.2 Helicopter Operations

The NLB uses helicopters for various types of operations, including transporting personnel and equipment to remote lighthouses. To assist in accessing lighthouses in remote locations they use the vessel '*Pharos*' as a helicopter base. Past examples of *Pharos* operations are provided in **Section 2.2.4**.

The *Pharos* has a bow mounted helideck suitable for the H135 helicopter, currently under contract. The helicopter support contract is in the process of being retendered and so another helicopter type might be used in the near future. In addition, the *Pharos* is due to be replaced within the lifetime of the Project, and it is feasible that the replacement vessel will have a larger helideck, permitting larger helicopter types to be employed. For this reason, helicopter access to the Dubh Artach Lighthouse must take account of all possible helicopter types that might be used to access the lighthouse, and not just the current H135 helicopter.

2.2.1 Carriage of Personnel

Personnel are carried between the *Pharos*, or a shore base, to the lighthouse under Commercial Air Transport (CAT) Regulations; this includes operations under a Special Approval for Helicopter Offshore Operations (SPA-HOFO).

2.2.2 Carriage of Underslung Loads

Underslung loads are flown between the *Pharos* and Dubh Artach to transport larger items. The underslung loads can include building materials, fuel containers and backloading waste to the vessel. The underslung load operations are conducted under an approval for Specialist Operations Helicopter Underslung Loads (SPO-HESLO).

An image of the Pharos is presented in **Figure 2.4**.

Internal Use

Figure 2.4 *Pharos* (Copyright: MarineTraffic.com)

2.2.3 Data Source

Assessment of AIS data has been undertaken within a 3 nm buffer (the 'study area') of the Dubh Artach Lighthouse. This radius was considered adequate to identify any possible NLB associated operations being undertaken in relation to the Dubh Artach Lighthouse. This study area was presented to the NLB in a meeting held on the 25 September 2025.

The AIS data utilises terrestrial and satellite receivers and covers a period between January 2020 and January 2025 in order to establish a baseline of recent operations undertaken in the area.

The AIS data was filtered to only assess NLB associated activity, with vessel speeds analysed to carry out a behavioural analysis on those transiting at a low speed, to highlight vessels potentially carrying out operations associated with helicopters.

2.2.4 AIS Analysis

Historic positioning of the *Pharos* operating at the Dubh Artach Lighthouse has been analysed to identify if any intersections with the WDA boundary occurred. The tracks of the *Pharos* recorded within the study area during the 5-year period assessed are presented in **Figure 2.5**.

Internal Use

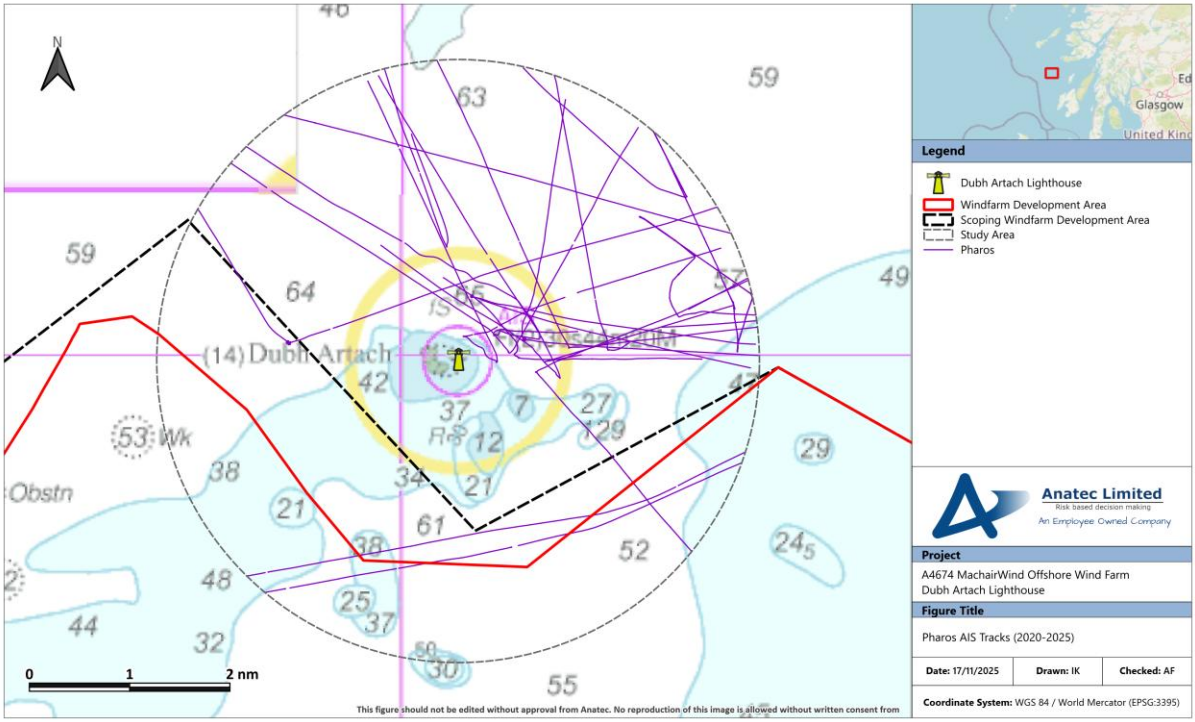

Figure 2.5 *Pharos* AIS Tracks (2020-2025)

Three tracks from the *Pharos* can be seen within the WDA boundary:

- Two instances noted in an east / west direction, with destinations of Blackrocks and Ardmucknish Bay on the Scottish west coast, both recorded during 16 May 2020.
- An instance heading from the southeast of the study area, to conduct operations at the Dubh Artach Lighthouse on the 16 May 2023.

All three intersections with the WDA were deemed likely to be cases of transit rather than a helicopter operation based on the track behaviour. To identify cases where the *Pharos* may have been undertaking a helicopter operation, any instances of periods where the vessel was at lower speeds for an extended period were identified. These instances are shown in **Figure 2.6**, with each labelled with an "operation ID". These points were all subsequently confirmed by the NLB as times when helicopter operations were being undertaken.

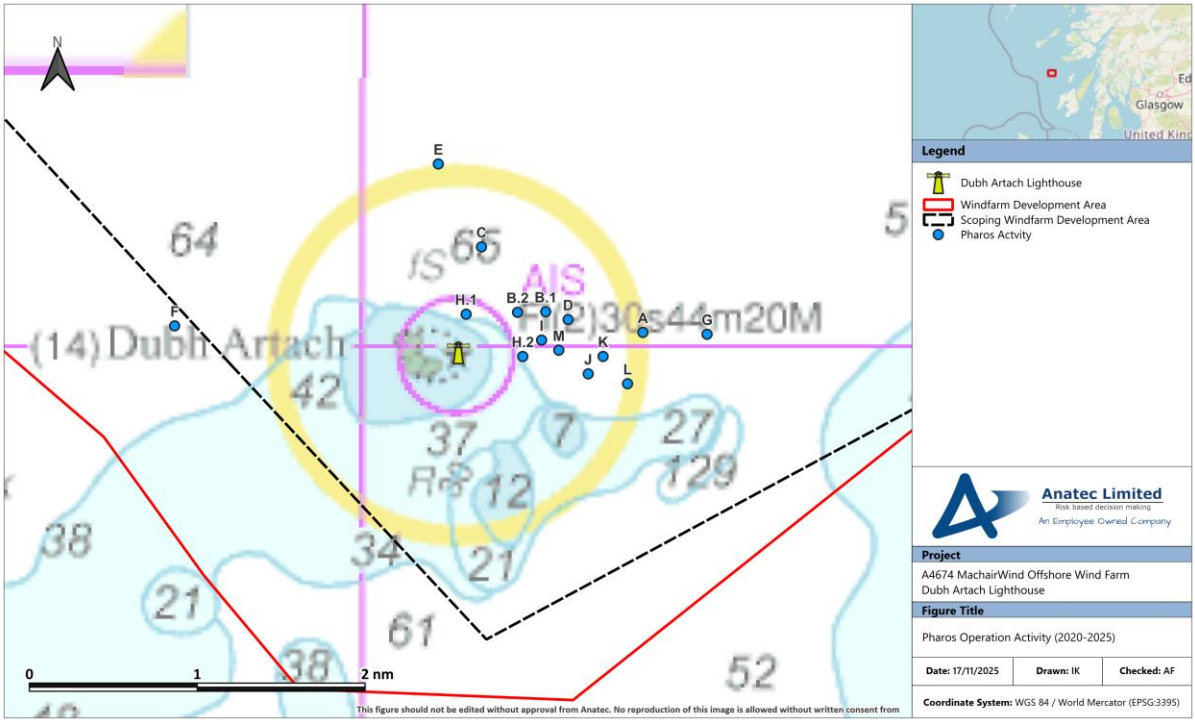

Figure 2.6 ***Pharos*** **Operation Activity (2020-2025)**

The Closest Point of Approach (CPA) and bearing of CPA of these points of activity are presented in **Table 2.1**, with measurements calculated from both the Dubh Artach Lighthouse and the WDA.

Table 2.1 ***Pharos*** **Operation Activity Details**

Operation ID	Date	Dubh Artach		The WDA	
		CPA (nm)	Bearing (°)	CPA (nm)	Bearing (°)
A	18 September 2020	1.1	81	1.5	140
B.1	12-13 April 2021	0.6	63	1.9	140
B.2		0.4	54	2.0	140
C	9-10 July 2021	0.7	11	2.5	140
D	12-14 July 2021	0.7	71	1.8	140
E	07 September 2021	1.1	352	2.6	229
F	9-10 September 2021	1.7	274	0.8	219
G	11 September 2021	1.5	84	1.2	140
H.1	29 June 2022	0.2	11	2.2	232

Operation ID	Date	Dubh Artach		The WDA	
		CPA (nm)	Bearing (°)	CPA (nm)	Bearing (°)
H.2		0.4	90	1.8	140
I	01 July 2022	0.5	79	1.8	140
J	16 May 2023	0.8	97	1.5	140
K	22 May 2023	0.9	89	1.5	140
L	29 May 2024	1.0	98	1.3	140
M	28 July 2024	0.6	86	1.7	140

It can be seen that no operations were undertaken within the WDA. 'Operation F' was the closest recorded, at a distance of approximately 0.8 nm. This was recorded between the 9 and 10 September 2021 approximately 1.7 nm west of the Dubh Artach Lighthouse, as the *Pharos* transited from the Skerryvore Lighthouse.

To illustrate an example of the activity, vessel tracks from the NLV *Pharos* recorded on the 29 June 2022 (Operations H1 and H2 in **Figure 2.6**) are presented in **Figure 2.7**, colour-coded by vessel speed. These are displayed using the approximate vessel dimensions, to give an indication of how the NLV's position and orientation changed while operations are underway. It can be seen that the *Pharos* recorded speeds of below 2 kts at three separate positions near Dubh Artach Lighthouse on this day.

Internal Use

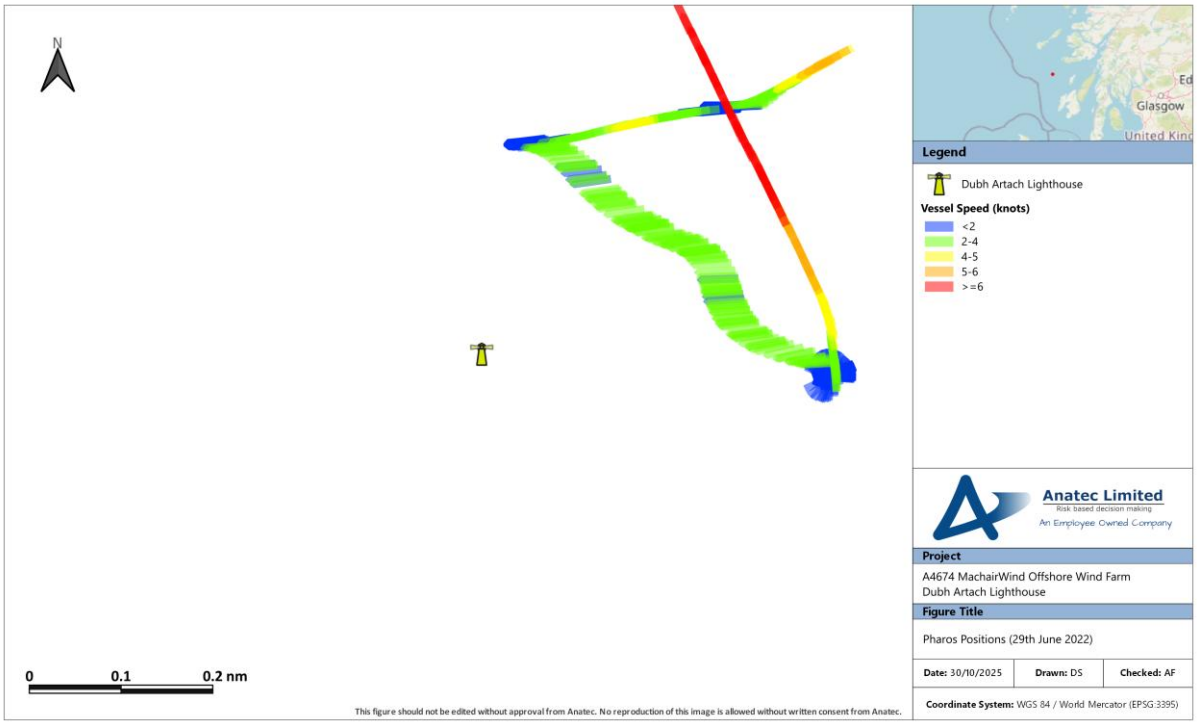

Figure 2.7 *Pharos* Positions (29th June 2022)

Internal Use

3 Consultation Summary

A consultation meeting was held with the NLB on the 30 April 2025 to discuss their response to the Project Scoping Report. The relevant feedback obtained from this meeting and the scoping report response itself is summarised in **Table 3.1**.

Table 3.1 Scoping Response Summary

Consultation Aspect	Summary	Where Addressed
Scoping Response – 4 November 2024	Northern Lighthouse Board's contract aircraft operate to Dubh Artach all year round subject to weather conditions. Approaches and departures occur from all directions. Under slinging operations from our vessel NLV Pharos also are carried out with the vessel positioning relatively close to the lighthouse as best suits the wind and sea state at the time. Safe helicopter and vessel operating areas to facilitate these operations are required.	Activity of the Pharos has been assessed in **Section 2.2.4**.
Scoping Response – 4 November 2024	Northern Lighthouse Board are scheduled to conduct major refurbishment projects on both Dubh Artach lighthouse, and nearby Skerryvore lighthouse, from 2027 through until 2032, and these works will utilise a large number of helicopter flights and ship visits to this area. These operations may coincide with the construction phase of the MachairWind project, and the need to define the safe limits for aviation and vessel operations in this area for both projects should be considered at an early stage. NLB is willing to engage with the project to deconflict aviation and maritime operations should any overlap occur.	**Section 4** uses consultation and assessment outputs to recommend a suitable spacing between Dubh Artach and the WDA taking account of the potential programme overlap in construction of the Project infrastructure and refurbishment projects to both lighthouses and typical ongoing lighthouse helicopter operations.

Internal Use

Consultation Aspect	Summary	Where Addressed
Consultation Meeting 30 April 2025	NLB confirmed that the *Pharos* requires 360-degree access around the lighthouse to account for different positioning in certain weather conditions, and that the vessel would be positioned a maximum of 1 nm away from the lighthouse. Additionally, the vessel would need to be 1 nm to allow for helicopter operations. NLB confirmed the *Pharos* operations would require a two nautical mile 360-degree clearance around the lighthouse.	**Section 4** uses consultation and assessment outputs to recommend a suitable spacing between Dubh Artach and the WDA.
Consultation Meeting 30 April 2025	The NLB confirmed that they would likely route across the WDA, but there are unlikely to be any issues, subject to implementation of the appropriate safety buffer.	**Section 4** uses consultation and assessment outputs to recommend a suitable spacing between Dubh Artach and the WDA.

Internal Use

4 Recommended Distance

This section provides assessment to provide a recommendation on a suitable distance between the helipad and the WDA.

4.1 Weather

All operations in the vicinity of lighthouses and associated vessels are currently conducted under day Visual Meteorological Conditions (VMC), and this will not change. The VMC limits are expected to increase from current values in an update to the SPA-HOFO regulations to a minimum cloud base of 700 feet (ft) and a minimum visibility of 5000 metres (m). While operations are underway, the Pharos helideck motion must remain within limits to permit landing on the helideck. The helideck motion limits are shown in the Helideck Certification Agency (HCA) Helideck Landing Limitations (HLL) Part C. As the vessel must remain within the helideck motion limits, 360-degree access must be available around Dubh Artach in order to seek calmer sea conditions, should the need arise.

4.2 Approach and Take-off Distances Required

The approach distance must take account of the reduced manoeuvrability of the helicopter when carrying an underslung load. It is reasonable to assume that turns will be no higher than Rate One, which results in a rate of turn of 3 degrees per second. For illustration, a Rate One turn at 70 knots (kt) airspeed would require an angle of bank of circa 11 degrees. Therefore, sufficient distance must be available for the helicopter to gently manoeuvre and then conduct an approach. This distance is independent of the helicopter type being used, as it only depends on the airspeed flown. Possible future helicopters for this operation all have similar approach speeds and consequently require a similar approach distance.

The take-off distance must take account of the remote possibility of an engine failure (one engine inoperative). The one engine inoperative performance of helicopters does vary between types. Flight planning will take account of the one engine inoperative performance, and the take-off distance available.

When the take-off and landing distances are considered, an obstacle free radius of 1 nm around both the helipad and the vessel will be necessary. This distance takes account of the performance of typical helicopters likely to be employed in this operation.

The NLB advised that the *Pharos* might need to operate up to 1 nm from the lighthouse, in any direction. Therefore, the total obstacle free radius around Dubh Artach must be 2 nm, comprising of 1 nm from the helipad to the vessel, plus the 1 nm obstacle free radius around the vessel.

4.3 *Pharos* Searoom

There is considered to be good correlation between the input provided by the NLB, and the findings of the AIS analysis in **Section 2.2.4** with regards to the behaviour of the *Pharos* when undertaking helicopter operations at Dubh Artach. The NLB stated that the vessel would

Internal Use

generally be positioned a maximum of approximately one nautical mile away from the lighthouse but is positioned closer for helicopter lifting operations. The AIS analysis showed the *Pharos* was positioned between 0.2 and 1.7 nm from Dubh Artach in the instances identified, but with an average distance of 0.8 nm.

4.4 Summary

As noted in **Section 3**, the NLB requested a setback distance of 2 nm between the helipad at Dubh Artach and the WDA, allowing for 1 nm of space for the helicopter operations and an additional 1 nm for the *Pharos.* As shown in **Figure 4.1**, the Scoping Boundary upon which the NLB provided their initial feedback did not allow for 2 nm of total searoom in all directions.

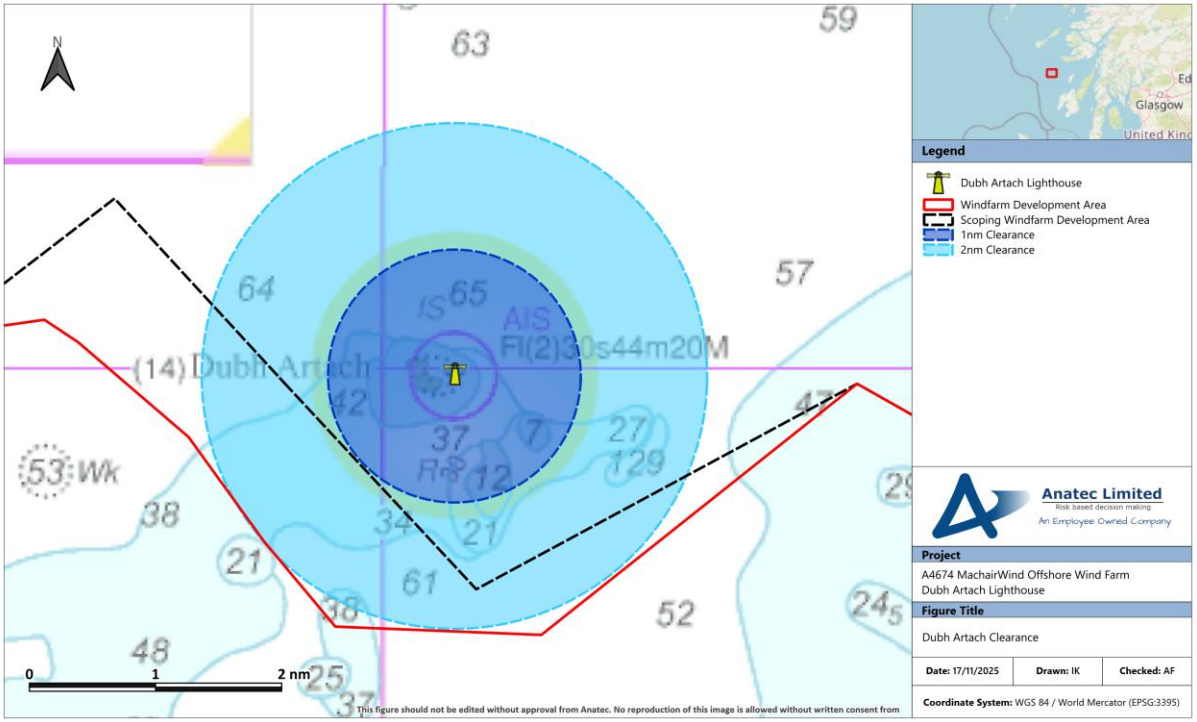

Figure 4.1 Dubh Artach Clearance

The WDA has since been refined, and as shown in **Figure 4.1** does now allow for a 2 nm spacing between the Dubh Artach helipad and where the WTGs will be located. Based on the assessment within this report and the NLB consultation input, this is considered sufficient to allow marine and helicopter operations to continue at the Dubh Artach Lighthouse throughout the construction, operation and maintenance and decommissioning of the Project.

Internal Use