



WEST OF ORKNEY WINDFARM

Offshore EIA Report, Volume 3, Outline Plan 6: Outline Lighting and Marking Plan

OWPL Document Number	Originator Document Number	Revision	Status	Date
WO1-WOW-CON-EV-RP-0067	L-100632-S05-A-REPT-028	3	IFU	01/09/2023

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Approved by S. Kerr
Document Control 13/09/2023



Document Role

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OWPL Revision History

Revision Number	Issue Date	Document Status
1	16/06/2023	Issued for review
2	18/07/2023	Re-issued for review
3	01/09/2023	Issued for use

Revision Record

Revision Number	Revised Section	Description of Changes
2	Throughout	Addressing comments on revision 1.
3	Throughout	Finalisation of document.

Contents

Summary	1
1. Introduction	2
1.1 Purpose	2
1.2 Objectives	2
1.3 Consent compliance	2
1.4 Relevant other documents and plans	2
1.5 Structure of the plan	3
1.6 Location of the plan	3
1.7 Document control	4
2. Project background	5
3. Consultation	7
4. Guidance	8
4.1 Marine requirements	8
4.2 Aviation requirements	9
5. Construction	11
5.1 Marine lighting and marking	11
5.2 Aviation lighting and marking	11
6. Operation and maintenance	12
6.1 Marine lighting and marking	12
6.2 Aviation lighting and marking	12
7. References	13
8. Abbreviations	14
9. Glossary of terms	16

Summary

This outline Lighting and Marking Plan (LMP) has been prepared by Offshore Wind Power Limited (OWPL), hereafter referred to as 'the Developer' to support the Offshore Environmental Impact Assessment (EIA) Report for the offshore elements West of Orkney Windfarm (hereafter referred to as 'the offshore Project').

The purpose of this outline LMP is to provide information on the aviation and navigational lighting and marking of the offshore Project during the construction, operation and maintenance stages to certify the safe marking and lighting of the offshore Project (in accordance with regulatory requirements and guidance) and ensure the safe navigation of vessels and aircraft. The LMP will be finalised for approval by Scottish Ministers ahead of construction post-consent once the offshore Project design has been further refined, and in accordance with relevant Section 36 Consent and/or Marine Licence conditions. Following approval by the Scottish Ministers, the LMP will represent a 'live document' and will be revised as relevant to ensure the information is kept up to date, at intervals agreed with Scottish Ministers.

This outline LMP covers the following:

- Section 1 – Introduction; giving an overview of the document;
- Section 2 – Project background;
- Section 3 – Consultation;
- Section 4 – Guidance;
- Section 5 – Construction lighting and marking;
- Section 6 – Operation and maintenance lighting and marking stages;
- Section 7 – References;
- Section 8 – Abbreviations; and
- Section 9 – Glossary of terms.

All Developer personnel, Contractors and Subcontractors involved in the offshore Project must comply with the LMP.

The location of copies of the LMP is yet to be determined but will likely include:

- The West of Orkney Windfarm Office;
- All Site offices (including Contractors and Subcontractors); and
- All construction, operation and maintenance vessels.

1. Introduction

1.1 Purpose

This Outline Lighting and Marking Plan (LMP) has been prepared by Xodus Group (Xodus), Anatec and Coleman Aviation on behalf of Offshore Wind Power Limited (OWPL), hereafter referred to as ‘the Developer’, in support of the Offshore Environmental Impact Assessment (EIA) Report for the offshore elements of the West of Orkney Windfarm (hereafter referred to as ‘the offshore Project’). As this is an outline document, further information will be provided post-consent.

1.2 Objectives

The LMP provides information on the aviation and navigational lighting and marking of the offshore Project during the construction, operation and maintenance stages to certify the safe marking and lighting of the offshore Project (in accordance with regulatory requirements and guidance) and ensure the safe navigation of vessels and aircraft. It will cover the activities taking place as part of the offshore Project seaward of Mean High Water Springs (MHWS). The onshore Project, landward of Mean Low Water Springs (MLWS) is the subject a separate application for Planning Permission in Principle. All the Developer personnel, Contractors and Subcontractors involved in the offshore Project will be expected to comply with the LMP. Compliance with the plan will be monitored and audited accordingly.

The LMP will be finalised in the post-consent stage, ahead of construction, and in agreement with the relevant authorities and stakeholders including the Northern Lighthouse Board (NLB), Maritime and Coastguard Agency (MCA), Civil Aviation Authority (CAA) and Ministry of Defence (MoD).

The Developer will also be required to submit a Decommissioning Programme in accordance with Section 105(2) of the Energy Act 2004 and the ‘Decommissioning of Offshore Renewable Energy Installations in Scottish waters or in the Scottish part of the Renewable Energy Zone under The Energy Act 2004: Guidance notes for Industry (in Scotland)’ (Scottish Government, 2022). Decommissioning of the offshore Project will require a separate Marine Licence and therefore consideration of the lighting and marking requirements will be undertaken at the time of decommissioning to support the Marine Licence application. Therefore, this LMP does not consider the decommissioning stage of the offshore Project. The LMP will be updated prior to decommissioning in line with the Decommissioning Programme.

1.3 Consent compliance

The LMP fulfils the consent condition for the preparation of a LMP as outlined in Table 1-1. Details of where in this document specific requirements of the consent conditions are addressed will be provided in Table 1-1.

Table 1-1 Consent conditions relevant to the LMP

Consent reference	Condition	Relevant section
[To be added post consent]		

1.4 Relevant other documents and plans

The linkages between this LMP and other consent plans likely to be required are listed in Table 1-2. These documents will always reflect the commitments made in the Offshore EIA Report and any associated conditions of consent or requirements agreed with the relevant authorities.

Table 1-2 Links with other consent plans

Consent plan / document	Linkage with LMP
Construction Method Statement (CMS)	Details the offshore Project's construction methods, setting out good practice construction measures and detailing how the mitigation measures from the Offshore EIA report, associated documents, consents and those stated in LMP will be implemented during construction.
Development Specification and Layout Plan (DSLPL)	Provides information on the final design and layouts parameters of the offshore Project. The windfarm layout, Wind Turbine Generators (WTGs) and Offshore Substation Platform (OSP) specifications detailed in the DSLPL will be consistent with this LMP.
Windfarm and Offshore Transmission Infrastructure Operation and Maintenance Programmes (OMPs)	Details the good working practices and procedures of the operation and maintenance stages of the offshore Project, particularly around sensitive environmental periods.
Navigational Safety and Vessel Management Plan (NSVMP)	Provides the management and coordination of vessels to mitigate the impacts on other sea users.
Aids to Navigation Management Plan (ANMP)	Provides details of the Aids to Navigation (AtoN) associated with the offshore Project and how they will be managed including maintenance, repair and emergency provisions.
Emergency Response Co-operation plan (ERCoP)	Provides sufficient information about the Project, actions and details required in the event of an emergency situation.

1.5 Structure of the plan

This outline lighting and marking plan is divided into the following sections:

- Section 1 – Introduction; giving an overview of the document;
- Section 2 –Project background;
- Section 3 –Consultation;
- Section 4 – Guidance;
- Section 5 – Construction lighting and marking;
- Section 6 – Operation and maintenance lighting and marking stages;
- Section 7 – References;
- Section 8 – Abbreviations; and
- Section 9 – Glossary of terms.

1.6 Location of the plan

Details on where copies of the LMP are located will be included within the final LMP. At this stage, it is envisaged that copies will be located at:

- The West of Orkney Windfarm Office;
- All Site offices (including Contractors and Subcontractors); and
- All construction, operation and maintenance vessels.

1.7 Document control

It is acknowledged that there may be a requirement for the LMP to be revised and updated on occasion throughout each stage of the offshore Project (construction, operation and maintenance), to ensure the information is kept up to date. Any revisions will be submitted to Marine Directorate – Licensing Operations Team (MD-LOT). Linkages exist between a number of offshore consent plans as highlighted in section 1.4 within Table 1-2. As plans are updated, there will be a review of inter-linkages with other Consent Plans to ensure these are also updated as relevant.

2. Project background

The proposed West of Orkney Windfarm ('the Project'), an Offshore Windfarm (OWF), is located at least 23 kilometres (km) from the north coast of Scotland and 28 km from the west coast of Hoy, Orkney.

The offshore Project will comprise of WTGs and all infrastructure required to transmit the power generated by the WTGs to shore. The key offshore components of the offshore Project will include:

- Up to 125 WTGs with fixed-bottom foundations (monopile, piled jacket or suction bucket jacket);
- Up to five High Voltage Alternating Current (HVAC) OSPs;
- Up to 500 km of inter-array cables;
- Up to 150 km of interconnector cables; and
- Up to five offshore export cables to landfalls at Greeny Geo and/or Crosskirk at Caithness, with a total length of up to 320 km (average of 64 km per offshore export cable).

The offshore Project boundary (Figure 2-1) includes the array area and the offshore Export Cable Corridor (ECC). Therefore, the offshore Project boundary encompasses:

- Option Agreement Area (OAA) – where the WTGs and associated foundations and supporting structures, inter-array cables, interconnector cables, the OSPs (including offshore export cable connections) will be located;
- Offshore ECC – within which the offshore export cables will be located; and
- Landfall (up to MHWS) – where the offshore export cables come ashore and interface with the onshore Project.

[Section to be updated post-consent with final details of offshore Project]

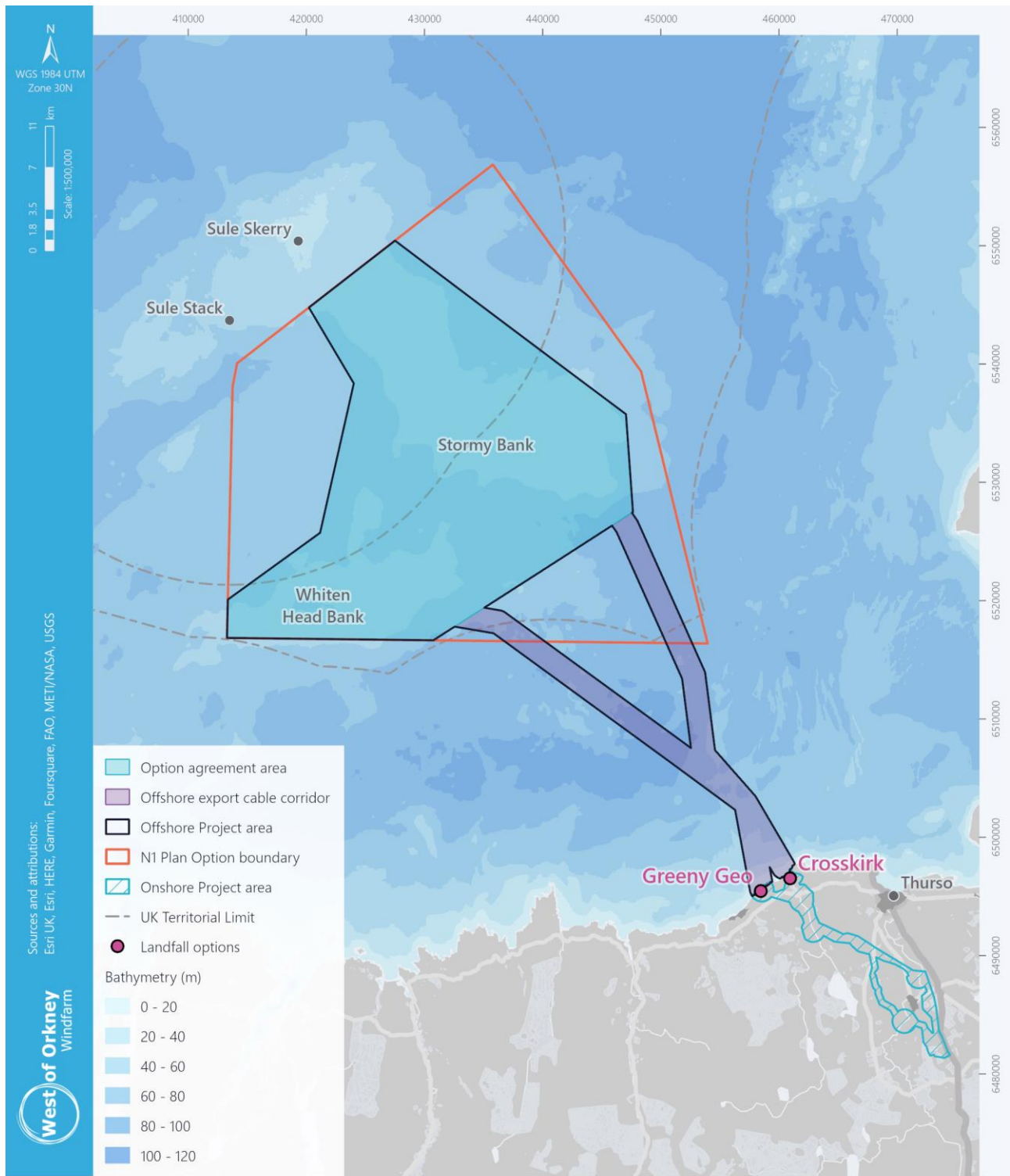


Figure 2-1 Offshore Project boundary

3. Consultation

Details of the consultation that will be held to inform the LMP will be described in this section post-consent.

4. Guidance

4.1 Marine requirements

The marine navigation lighting and marking detailed in this outline LMP will be consulted on with the relevant stakeholders. The Developer will abide by the requirements detailed in the following guidance documents:

- International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) RO139 Recommendations on the Marking of Man-made Offshore Structures (IALA, 2021a) and G1162 Guidance on the Marking of Man-made Offshore Structures (IALA, 2021b);
- IALA R1001 – The IALA Maritime Buoyage System. Edition One (IALA, 2017);
- MCA Marine Guidance Note (MGN) 654 and Annexes – Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response (MCA, 2021); and
- The Department for Business, Energy and Industrial Strategy (BEIS). Standard Marking Schedule for Offshore Installations (BEIS, 2011).

The following Table 4-1 highlights the minimum marine lighting and marking requirements during the operation and maintenance stage of the offshore Project.

Table 4-1 Indicative minimum operational marine lighting and marking requirements

Requirement	Guidance document	Offshore structure	Details
Lighting	IALA RO139, G1162	Significant Peripheral Structures (SPS)	<ul style="list-style-type: none"> • Synchronised flashing yellow lights (IALA ‘Special mark’); • Lights visible from all directions horizontally; • Lights placed below the arc of the rotor blades; • Between 6 m and 30 m above Highest Astronomical Tide (HAT) (8.5 m and 32.5 m above Lowest Astronomical Tide (LAT)); and • Minimum 5 nautical mile (nm) visibility.
		Intermediate Peripheral Structures (IPS)	<ul style="list-style-type: none"> • Synchronised flashing yellow lights (distinct from SPS); • Lights visible from all directions horizontally; • Lights placed below the arc of the rotor blades; • Between 6 m and 30 m above HAT (8.5 m and 32.5 m above LAT); and • Minimum 2 nm visibility.
		All other WTGs	<ul style="list-style-type: none"> • None
		All other structures (excluding WTGs)	<ul style="list-style-type: none"> • Flashing white lights; • Between 6 m and 30 m above HAT (8.5 m and 32.5 m above LAT); and • Minimum 10 m visibility.
Marking	IALA RO139, G1162, MGN 654	WTGs and OSPs	<ul style="list-style-type: none"> • Painted yellow between 0 m and a minimum of 15 m above HAT (-2.47 m and 17.5 m above LAT); • Identification panels – black numbers and yellow background – clearly visible in all directions at all times of the day from a distance of at least 150 m. Each ID number panel will be illuminated by a low

Requirement	Guidance document	Offshore structure	Details
			intensity light visible from a vessel, which will be hooded or baffled.
Hazard Warning Signals	RO139, G1162, MGN 654	SPS	<ul style="list-style-type: none"> • Located between 6 m and 30 m above HAT (8.5 m and 32.5 m above LAT); • Minimum range of 2 NM; • Sound signal of the morse character 'U' every 30s; • Minimum 0.75s short blast; and • Be operational when visibility is 2 nm or less.

4.2 Aviation requirements

The aviation lighting and marking detailed in this LMP will abide by the requirements detailed in the following legislation and guidance documents:

- CAA – The Air Navigation Order (ANO) 2016;
- CAP 393 – Regulations made under powers in the Civil Aviation Act 1982 and the Air Navigation Order 2016 (CAA, 2021a);
- CAA Civil Aviation Policy (CAP) 764 – Policy and Guidelines on Wind Turbines (CAA, 2016 (b));
- CAA CAP 437 – Standards for Offshore Helicopter Landing Areas (CAA, 2021b);
- MCA MGN 654 and Annexes – Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response (MCA, 2021); and
- MOD Obstruction Lighting Guidance (MOD, 2020).

The following Table 4-2 highlights the minimum aviation lighting and marking requirements during the operational stage of the offshore Project.

Table 4-2 Minimum operational aviation lighting and marking requirements

Requirement	Guidance document	Offshore structure	Details
Lighting – Helicopter hoisting operations (only required if helicopter hoists form part of normal operations)	CAP 437	All WTGs	<ul style="list-style-type: none"> • Low intensity green lights fitted to the WTG nacelle; • Steady green light to indicate WTGs safe for hoisting operation; • Flashing green light to indicate WTG is preparing for hoisting operations; and • No light indicating not safe for hoisting operations.
Lighting – Warning lights	CAP 764, CAP 393, MGN 654	Peripheral structures	<ul style="list-style-type: none"> • Red, medium intensity aviation warning lights; • 2000 candela (cd) when visibility is less than 5 km; • 200 cd when visibility is more than 5 km in all directions; • Located as close to the top of the nacelle as possible on all peripheral WTGs; • Simultaneously flash morse character 'W'; • Be switched on and off with twilight switches; • Plan of beam at 2000 cd elevated 3-4° degrees above horizontal plane;

Requirement	Guidance document	Offshore structure	Details
			<ul style="list-style-type: none"> • 20-45% of 2000 cd light visible at horizontal plane; and • Less than 10% of 2000 cd light visible 1.5° degrees below horizontal plane, and NVIS compatible.
Lighting – Search and Rescue (SAR)	MGN 654, SAR Annex 5	All WTGs	<ul style="list-style-type: none"> • Combi infra-red 200 cd steady red aviation hazard lights; • Individually switchable; and • Only switched on during SAR operations or at MCA request.
Marking – Blade Hover Reference	MGN 654, SAR Annex 5	All WTGs	<ul style="list-style-type: none"> • Three markings on both faces 10 m, 20 m and 30 m from hub end; • Markings should be in contrast to overall colour of the blades; • Markings should be at least 600 mm; and • Red (RA 3020) dots preferred.
Marking – Blade Tips	MGN 654, SAR Annex 5	All WTGs	<ul style="list-style-type: none"> • Tips of blades (approx. 2% of blade length) should be coloured; and • Colour should be in contrast to overall colour of the blades.
Marking – Nacelle	MGN 654, SAR Annex 5, CAP 764	All WTGs	<ul style="list-style-type: none"> • WTG identification numbers displayed on roof of nacelle; • Numbers at least 1.5 m in height and proportional width; and • Recognisable 500 ft above highest part of structure.

5. Construction

5.1 Marine lighting and marking

Temporary construction lighting and marking is required (as industry standard) during the construction stage of the offshore Project. As stated in section 4, there are a number of guidance documents dictating the lighting and marking requirements at the various stages of the Project. While the construction lighting and marking will be finalised post-consent, and in consultation with relevant stakeholders such as NLB, the following Table 5-1 details the minimum requirements during the construction stage.

Table 5-1 Temporary Construction marine lighting and marking requirements

Requirement	Guidance document	Offshore structure	Details
Lighting	Industry Standard	All offshore structures, regardless of construction status	<ul style="list-style-type: none">• Temporary Yellow Flashing lights;• Flash for 2.5 seconds; and• Visible 360° within 2 nm.
Construction buoys	IALA R1001	Buoys	<ul style="list-style-type: none">• Established prior to construction; and• Combination of cardinal marks and special marks.
Transition lighting and marking	[Information on transition from construction to operation and maintenance lighting to be completed post-consent]		

5.2 Aviation lighting and marking

There are no specific aviation lighting requirements during the construction stage of the offshore Project, under the guidance detailed in section 4. Any temporary obstacles of more than 91.4 m in height (e.g. construction infrastructure such as cranes), will be alerted to the aviation community by means of the Notice to Airmen (NOTAM) system.

The Developer will circulate the relevant information to the appropriate aviation authorities and stakeholders prior to and during the construction stage. [To be confirmed post-consent].

Lighting and marking during the transition to operation will be finalised post-consent and details will be included in this section.

6. Operation and maintenance

6.1 Marine lighting and marking

Table 6-1, in line with the guidance presented in section 4, presents details of the marine lighting to be implemented during operation and maintenance stage of the offshore Project.

[Further information and the following table will be completed on drafting of the LMP after consultation with the relevant authorities and stakeholders].

[If required by NLB details on buoyage requirements during the operation and maintenance stage of the offshore Project will be included here post-consent].

Table 6-1 Agreed marine lighting and marking protocol for the operation and maintenance stage of the offshore Project

Requirement	Guidance document	Offshore structure	Details
Lighting	[to be completed post-consent]	[to be completed post-consent]	[to be completed post-consent]
Marking	[to be completed post-consent]	[to be completed post-consent]	[to be completed post-consent]
Hazard Warning Signals	[to be completed post-consent]	[to be completed post-consent]	[to be completed post-consent]

6.2 Aviation lighting and marking

Table 6-2, in line with the guidance presented in section 4.2, presents details of the aviation lighting to be implemented during the normal operation of the offshore Project.

[Further information and the following table will be completed on drafting of the LMP after consultation with the relevant authorities and stakeholders.]

Table 6-2 Agreed marine lighting and marking protocols for the operation and maintenance stage of the offshore Project

Requirement	Guidance document	Offshore structure	Details
Lighting	[to be completed post-consent]	[to be completed post-consent]	[to be completed post-consent]
Marking	[to be completed post-consent]	[to be completed post-consent]	[to be completed post-consent]

7. References

- BEIS (2011). Standard Marking Schedule for Offshore Installations. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/208141/Standard_Markin_g_Schedule.pdf.
- CAA (2016b). Policy and Guidelines on Wind Turbines (CAP 764). Available at: CAP764 Issue6 FINAL Feb.pdf (caa.co.uk). Accessed on:
- CAA, (2021a). CAP 393 - Regulations made under powers in the Civil Aviation Act 1982 and the Air Navigation Order 2016. Available online at: <https://publicapps.caa.co.uk/modalapplication.aspx?catid=1&appid=11&mode=detail&id=7523> [Accessed 31/08/2023].
- CAA (2021b). Standards for offshore helicopter landing areas (CAP 437). Available at: Standards for offshore helicopter landing areas (caa.co.uk).
- IALA (2017). The IALA Maritime Buoyage System. Edition One. Available online at: https://www.iala-aism.org/content/uploads/woocommerce_uploads/2017/06/R1001-The-IALA-Maritime-Buoyage-System-Ed1.1-June-2017.pdf [Accessed 31/08/2023].
- IALA (2021a). R0139 (O-139) The Marking of Man-Made Structures. Available at: R0139 (O-139) The Marking of Man-Made Offshore Structures - IALA AISM (iala-aism.org).
- IALA (2021b). G1162 The Marking of Offshore Man-Made Structures. Available at: G1162 Ed1.0 The marking of offshore man-made structures - IALA AISM (iala-aism.org).
- MCA (2021). MGN 654 (M+F). Offshore Renewable Energy Installations (OREIs) Safety Response. Available at: MGN 654 (M+F) Offshore Renewable Energy Installations (OREI) safety response - GOV.UK (www.gov.uk).
- MOD (2020). Obstruction Lighting Guidance. Available online at: https://cdn.ymaws.com/www.renewableuk.com/resource/collection/0B792CF1-8B8A-474B-95B6-17886BF724A7/20190002-Windfarm_lighting_review__002_.pdf [Accessed 31/08/2023].
- Scottish Government, (2022). The Energy Act 2004 Decommissioning of Offshore Installations and Decommissioning of Offshore Renewable Energy Installations in Scottish waters.

8. Abbreviations

[The following table will be updated post-consent]

Term	Definition
ANO	Air Navigation Order
ANMP	Aids to Navigation Management Plan
AtoN	Aids to Navigation
BEIS	Business, Energy and Industrial Strategy
CAA	Civil Aviation Authority
cd	candela
CAP	Civil Aviation Policy
CMS	Construction Method Statement
DSLPL	Development Specification and Layout Plan
ECC	Export Cable Corridor
EIA	Environmental Impact Assessment
ERCoP	Emergency Response Co-operation Plan
HAT	Highest Astronomical Tide
HVAC	High Voltage Alternating Current
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
IPS	Intermediate Peripheral Structures
km	kilometres
LAT	Lowest Astronomical Tide
LMP	Lighting and Marking Plan
MCA	Maritime and Coastguard Agency
MD-LOT	Marine Directorate Licensing Operations Team
MHWS	Mean High Water Springs
MGN	Marine Guidance Note
MLWS	Mean Low Water Springs
MOD	Ministry of Defence
NLB	Northern Lighthouse Board
nm	nautical miles

Term	Definition
NOTAM	Notice to Airmen
NSVMP	Navigational Safety and Vessel Management Plan
OAA	Option Agreement Area
OMPs	Operation and Maintenance Programmes
OREIs	Offshore Renewable Energy Installations
OSP	Offshore Substation Platform
OWF	Offshore Windfarm
OWPL	Offshore Wind Power Limited
SAR	Search and Rescue
SPS	Significant Peripheral Structures
WTGs	Wind Turbine Generators

9. Glossary of terms

Term	Definition
[to be included post-consent]	

