Muir Mhòr Offshore Wind Farm

Environmental Impact Assessment Report

Volume 4, Appendix 7: Outline Lighting and Marking Plan

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Glossary

Term	Definition
Array Area	The area in which the generation infrastructure (including Wind Turbine Generators and associated foundations and inter-array cables), Offshore Electrical Platform(s), and an interconnector cable will be located.
Automatic Identification System (AIS)	A system by which vessels automatically broadcast their identity, key statistics including location, destination, length, speed, and current status, e.g., under power. Most commercial vessels and United Kingdom (UK)/European Union (EU) fishing vessels over 15 metre (m) length are required to carry AIS.
Developer	Muir Mhòr Offshore Wind Farm Limited
Floating Foundations	The floating structures on which the Wind Turbine Generators are installed.
Formal Safety Assessment (FSA)	A structured and systematic process for assessing the risks and costs (if applicable) associated with shipping activity.
Foundation anchors	The structures which anchor the Floating Foundations to the seabed, connected to the foundation mooring.
Foundation mooring	The mooring structures which connect the Floating Foundations to the anchors.
Inter-array cable	Cables which link the Wind Turbines Generators to each other and the Offshore Electrical Platform(s).
Interconnector cable	Cable which links the Offshore Electrical Platform(s) to one another, allowing for power to be transferred between the platforms
Landfall	The area between Mean High Water Springs (MHWS) and Mean Low Water Springs (MLWS) where the offshore export cables are brought onshore.
Marine Guidance Note (MGN)	A system of guidance notes issued by the Maritime and Coastguard Agency (MCA) which provide significant advice relating to the improvement of the safety of shipping at sea, and to prevent or minimise pollution from shipping.
Navigational Risk Assessment (NRA)	A document which assesses the hazards to Shipping and Navigation of a proposed Offshore Renewable Energy Installation (OREI) based upon Formal Safety Assessment (FSA).
Offshore Electrical Platform (OEP)	Offshore platform consisting of High Voltage Alternating Current (HVAC) equipment, details depending on the final electrical set up of the Project.
Offshore export cables	The subsea electricity cable circuits running from the Offshore Electrical Platform(s) to the landfall which will transmit the electricity generated by the offshore wind farm to the onshore export cables for transmission onwards to the onshore substation and the national electrical transmission system along with auxiliary cables such as fibre optic cables.
Project	Muir Mhòr Offshore Wind Farm – comprises the wind farm and all associated offshore and onshore components.
Proposed Development	The offshore Muir Mhòr Offshore Wind Farm project elements to which this Lighting and Marking Plan relates.
Wind Turbine Generator (WTG)	The wind turbines that generate electricity consisting of tubular towers and blades attached to a nacelle housing mechanical and electrical generating equipment.

Acronyms

Term	Definition
ACOMS	Airspace Co-ordination Obstacle Management Service
AIS	Automatic Identification System
AtoN	Aid to Navigation
BEIS	Department for Business, Energy and Industrial Strategy
CAA	Civil Aviation Authority
DDM	Degrees Decimal Minutes
EIAR	Environmental Impact Assessment Report
EU	European Union
FSA	Formal Safety Assessment
HVAC	High Voltage Alternating Current
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
ID	Identification
IPS	Intermediate Peripheral Structure
LATON	Local Aids to Navigation
LMP	Lighting and Marking Plan
MCA	Maritime and Coastguard Agency
MD-LOT	Marine Directorate - Licensing Operations Team
MGN	Marine Guidance Note
MHWS	Mean High Water Springs
MOD	Ministry of Defence
NLB	Northern Lighthouse Board
NOTAM	Notice to Airmen
O&M	Operation and Maintenance
OEP	Offshore Electrical Platform
OREI	Offshore Renewable Energy Installation
OWF	Offshore Wind Farm
SAR	Search and Rescue
SPS	Significant Peripheral Structure
UK	United Kingdom
WTG	Wind Turbine Generator

1. INTRODUCTION

1.1. BACKGROUND

1.1.1. Muir Mhòr Offshore Wind Farm Limited (hereafter referred to as 'the Developer') is proposing to develop the Muir Mhòr Offshore Wind Farm (hereafter 'the Project'). The Project is made up of both offshore and onshore components. The subject of this offshore Environmental Impact Assessment Report (EIAR) is the offshore infrastructure of the Project seaward of Mean High-Water Springs (MHWS) which is hereafter referred to as 'the Proposed Development'.

1.1.2. The Muir Mhòr array area covers an area of approximately 58 nm^2 (200 km^2) and is located approximately 34 nm (63 km) east of Peterhead on the east coast of Scotland. The offshore infrastructure of the Proposed Development includes Wind Turbine Generators (WTGs) and associated floating foundations, the Offshore Electrical Platform(s) (OEP(s)) and associated foundations, the inter-array cables, interconnector cable, offshore export cables and landfall.

1.1.3. The Lighting and Marking Plan (LMP) intends to discharge the offshore consent conditions relevant to the LMP. These will be detailed in Table 1-1 post consent, which includes reference to how and where the condition clauses have been addressed within the LMP.

Table 1-1 Consent conditions to be discharged by LMP

Condition reference	Condition text	Where addressed within LMP
[Consent condition details to be added post consent]		

1.2. PROJECT DESCRIPTION

1.2.1. The final Array Area layout to be utilised by the Developer is presented in Figure 1-1, which includes the proposed Identification (ID) marking that will be implemented. A summary of relevant project design parameters are provided in Table 1-2.

[Figure showing final array layout including ID marking to be added post consent in agreement with MCA and NLB]

Figure 1-1 Overview of Final Array Area Layout

Table 1-2 Design parameters

Project Component	Specification
Number of WTGs	TBC
WTG floating foundations	TBC
Number of OEP(s)	TBC
OEP foundations	TBC

2. GUIDANCE AND CONSULTATION

2.1. MARINE

2.1.1. The marine navigation lighting and marking detailed in Section 3.2 and 4.2 will be discussed in consultation with both the Northern Lighthouse Board (NLB) and the Maritime and Coastguard Agency (MCA), and will be based on the following guidance documents:

- International Association of Marine Aids to Navigation and Lighthouse Authority (IALA). Recommendations O-139 on the Marking of Man-Made Offshore Structures (IALA, 2021) and Guidance G1162 on the Marking of Man-Made Offshore Structures (IALA, 2022);
- IALA R1001 – The IALA Maritime Buoyage System. Edition Two. (IALA, 2023); and
- Marine Guidance Note (MGN) 654 and Annexes – Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response (MCA, 2021).

2.1.2. Consideration has also been given to:

- Department for Business, Energy and Industrial Strategy (BEIS). Standard Marking Schedule for Offshore Installations (BEIS, 2011).

2.2. AVIATION

2.2.1. The aviation lighting and marking detailed in Section 3.3 and Section 4.3 will be discussed in consultation with the NLB, MCA, and the Civil Aviation Authority (CAA), and follows the requirements set out in the following guidance documents:

- CAA CAP 393 Regulations made under powers in the Civil Aviation Act 1982 and the Air Navigation Order 2016 (CAA, 2021);
- CAA CAP 437 – Standards for Offshore Helicopter Landing Areas (CAA, 2023);
- CAA CAP 764 – Policy and Guidelines on Wind Turbines (CAA, 2016)[1];
- MGN 654 and Annexes – Offshore Renewable Energy Installations (OREIs) – Guidance on United Kingdom (UK) Navigational Practice, Safety and Emergency Response (MCA, 2021); and
- Ministry of Defence (MOD) Obstruction Lighting Guidance (MOD, 2020).

2.3. CONSULTATION

2.3.1. It is noted that in addition to consideration and compliance with the relevant guidance, the preparation of this LMP post consent will be informed by consultation with the NLB, MCA and CAA as key stakeholders of relevance to lighting and marking.

2.3.2. Such consultation will involve the issuing of draft proposed layouts with associated lighting and marking proposals, which will be updated following feedback received and amendments to the layout. Following submission to Marine Directorate – Licensing Operations Team (MD-

[1] Noting an updated version of CAP 764 is expected to be published imminently following a consultation period earlier in 2024.

LOT), consultation will be carried out by MD-LOT with stakeholders as described in the consent conditions listed in Table 1-1.

3. CONSTRUCTION PHASE

3.1. INTRODUCTION

3.1.1. This Section presents the marine (Section 3.2) and aviation (Section 3.3) lighting and marking to be implemented during the construction phase.

3.2. MARINE

3.2.1. The marine lighting and marking to be implemented during the construction phase is summarised in Table 3-1 which also includes a guidance column, listing the relevant guidance/stakeholder for each lighting and marking aspect where appropriate, noting that the guidance provides the full technical specifications required by the relevant stakeholders.

3.2.2. Figure 3-1 sets out the positions of the construction buoyage for the Proposed Development, with the associated coordinates and specifications presented in Table 3-2. For clarity, an ID is provided for each of the buoys presented in Figure 3-1 and Table 3-2.

3.2.3. Construction buoyage shall be established eight weeks prior to the Proposed Development commencing construction and remain in place until the operational marking requirements have been installed, then inspected and passed by NLB. All construction buoyage will meet the following standard specifications:

- [Construction buoyage specifications to be added post consent];

Table 3-1 Construction Phase Lighting and Marking

Lighting and Marking Aspect	Relevant Structures	Specifications	Figure Illustration	Relevant Guidance or Stakeholder Requirements
Temporary construction lighting (WTG and OEP)	[Relevant structures to be added post consent once final array layout agreed]	[Specifications to be added post consent]	N/A	Industry standard
Construction buoyage – numbers and types	N/A	[Specifications to be added post consent]	Figure 3-1	Standard NLB requirement IALA R1001
Construction buoyage removal	N/A	Construction buoyage removed once NLB have provided written approval of the operational lighting and marking on the structures.	N/A	IALA R1001

[Figure showing construction buoyage locations relative to the final array layout to be added post consent]

Figure 3-1 Construction Buoyage

Table 3-2 Construction Buoyage Positions and Specifications

Buoy	ID	Location		Light and Top Mark Specifications
		Latitude (Degrees Decimal Minutes (DDMM.mm)	Longitude (DDDMM.mm)	
[Details of each buoy to be added post consent]				

3.3. AVIATION

3.3.1. There will be no specific aviation lighting and marking implemented during the construction phase; however relevant information of relating to the Proposed Development will be promulgated to aviation stakeholders as required under the relevant CAA guidance (see Section 2.2) throughout the construction and operation and maintenance (O&M) phases of the Proposed Development.

4. O&M PHASE

4.1. INTRODUCTION

4.1.1. This Section presents the marine (Section 4.2) and aviation (Section 4.3) lighting and marking to be implemented during the O&M phase.

4.1.2. It is not currently known whether any spare locations will be designated in the final array layout. If there are spare locations designated, then their use will not be anticipated in the operational lighting and marking presented in this Section. If the use of a spare location is then required, any amendment to lighting and marking requirements will be discussed with MCA, NLB and CAA.

4.2. MARINE

4.2.1. The marine operational lighting and marking to be implemented for the WTGs and OEP(s) are summarised in Table 4-1 and Table 4-2 respectively, and then illustrated in Figure 4-1. These include a guidance column listing the relevant guidance/stakeholder for each lighting and marking aspect where appropriate, noting that this guidance provides the full technical specifications required by the relevant stakeholders.

4.2.2. As per Section 2.3, NLB will be consulted on the marine lighting and marking scheme.

Table 4-1 O&M Phase WTG Marine Lighting and Marking Summary

Lighting and Marking Aspect	Relevant Structures	Specifications	Figure Illustration	Relevant Guidance or Stakeholder Requirements
Significant Peripheral Structures (SPS) lighting	[Relevant structures to be added post consent once final array layout agreed]	[Specifications to be added post consent – details of any IPSs agreed with NLB will also be included]	Figure 4-1	IALA O-139/G1162 and standard requirement
Intermediate Peripheral Structures (IPS)			Figure 4-1	IALA O-139/G1162 and standard requirement
Sound Signals			Figure 4-1	IALA O-139/G1162 and standard requirement
Visibility meters			Figure 4-1	IALA O-139/G1162 and standard requirement
Automatic Identification System (AIS)			Figure 4-1	Regulator requirement
ID marker boards			N/A	MGN 654
WTG paint			N/A	IALA O-139/G1162 and standard requirement

Table 4-2 O&M Phase OEP[2] Marine Lighting and Marking Summary

Lighting and Marking Aspect	Relevant Structures	Specifications	Relevant Guidance or Stakeholder Requirements
ID marker boards	[Relevant structures to be added post consent once final array layout agreed – expected to be all structures in the case of ID marker boards]	[Specifications to be added post consent]	MGN 654
OEP paint			IALA O-139/G1162 and standard requirement

[Figure showing marine operational lighting and marking locations for the final array layout to be added post consent]

Figure 4-1 Marine Operational Lighting and Marking

[2] Note, assumes the OEP(s) are located internally within the Array Area. If it is located on the periphery, additional lights may be required.

FAILURE OF MARINE LIGHTING

4.2.3. A requirement of the management of Aids to Navigation (AtoN) within UK waters is to report navigation failures to the NLB (noting this does not include temporary lighting). This is done through an AtoN Availability Reporting database (Local Aids to Navigation (LATONs)). The system is administered by NLB in order to assist wind farm operators to fulfil their responsibility to maintain records of AtoN availability and to provide summaries of these to NLB. This should be undertaken in the event of any failure or loss of availability and should be carried out during both the construction and O&M phases as per the required availability standards. In the event of a significant loss of an AtoN such that a significant risk to navigation is considered likely to occur, consultation shall be undertaken with the NLB and MCA to determine the need for any additional mitigation.

4.3. AVIATION

4.3.1. The aviation operational lighting and marking to be implemented for the WTGs and OEP(s) are summarised in Table 4-3 and Table 4-4, respectively, and then illustrated in Figure 4-2. These include a guidance column listing the relevant guidance/stakeholder for each lighting and marking aspect where appropriate, noting that this guidance provides the full technical specifications required by the relevant stakeholders.

Table 4-3 O&M Phase WTGs Aviation Lighting and Marking Summary

Lighting and Marking Aspect	Relevant Structures	Specifications	Figure Illustration	Relevant Guidance or Stakeholder Requirements
Aviation warning lighting (dual purpose for warning lights and Search and Rescue (SAR) lights)	[Relevant structures to be added post consent once final array layout agreed]	[Specifications to be added post consent]	Figure 4-2	Air Navigation Order 225a CAP 794 MGN 654
Aviation warning lighting visibility meters			N/A	CAA standard requirement CAP 764
SAR lights			Figure 4-2	MGN 654
Green heli-hoist light			Figure 4-2	CAP 437
Blade markings			N/A	MGN 654
Blade tip markings			N/A	MGN 654
ID markings			N/A	CAP 764 MGN 654
Hoist area markings	These are not covered within this plan but should meet the standards set out in the following guidance documents and in consultation with the appropriate authorities: • CAA CAP 764 – Policy and Guidelines on Wind Turbines (CAA, 2016); • CAA CAP 437 – Standards for Offshore Helicopter Landing Areas (CAA, 2023); and • Consultation with Helicopter Certification Agency (MCA and CAA).			

Table 4-4 O&M Phase OEPs Aviation Lighting and Marking Summary

Lighting and Marking Aspect	Relevant Structures	Specifications	Figure Illustration	Relevant Guidance or Stakeholder Requirements
SAR lights	OEP(s)	[Specifications to be added post consent]	Figure 4-2	MGN 654
Green heli-hoist light	OEP(s)		Figure 4-2	CAP 764
ID markings	OEP(s)		N/A	CAP 764 MGN 654
Hoist area marking[3]	Are not covered within this plan but should meet the standards set out in the following guidance documents and in consultation with the appropriate authorities: • CAA CAP 764 – Policy and Guidelines on Wind Turbines (CAA, 2016); • CAA CAP 437 – Standards for Offshore Helicopter Landing Areas (CAA, 2023); and • Consultation with Helicopter Certification Agency (MCA and CAA).			

[Figure showing aviation operational lighting and marking locations for the final array layout to be added post consent]

Figure 4-2 Aviation Operational Lighting and Marking

[3] As per CAP 437, a helicopter landing area should always be provided in preference to a hoist area on OEP(s), unless they are for "occasional use" only.

FAILURE OF AVIATION LIGHTING

4.3.2. The Air Navigation Order (CAA, 2016) states that "in the event of the failure of any lighting which is required by this article to be displayed by night the person in charge must repair or replace the light as soon as reasonably practicable."

4.3.3. It is accepted that there may be occasions when meteorological or sea conditions prohibit the safe transport of personnel for repair tasks. Furthermore, there may be fault conditions that are wider ranging and would take longer to diagnose or repair. In such cases, international standards and recommendation practices require the issue of a Notice to Airmen (NOTAM).

4.3.4. The CAA's Airspace Regulation department considers the operator of an offshore wind farm as an appropriate person for the request of a NOTAM relating to the lighting of their wind farm. Should the anticipated outage be greater than 36 hours, the Proposed Development shall request a NOTAM to be issued by informing the CAA through the Airspace Co-ordination Obstacle Management Service (ACOMS) via the CAA customer portal[4].

4.3.5. Upon completion of the remedial works, the Aeronautical Information Service shall be notified as soon as possible to enable a cancellation to be issued. If an outage is expected to last longer than 14 days, then the CAA shall also be notified directly to discuss any issues that may arise and longer-term strategies.

5. CUMULATIVE SCENARIO

5.1.1. Cumulative temporal overlap between the Proposed Development and any other relevant offshore developments will be discussed with stakeholders (MCA, CAA, and NLB) to determine any changes that may be required depending on the construction and O&M schedules.

6. REFERENCES

BEIS (2011). Standard Marking Schedule for Offshore Installations. London: BEIS.

CAA (2016). CAP 764 Policy and Guidelines on Wind Turbines. London: CAA.

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[4] www.caa.co.uk/commercial-industry/airspace/event-and-obstacle-notification/obstacle-notification.