Beatrice Offshore Wind Farm Consent Plan

Lighting and Marking Plan

January 2016

Beatrice
Offshore Windfarm Ltd

[Page intentionally left blank]

Project Title/ Location	Beatrice Offshore Wind Farm
Project Reference Number	LF000005
Date:	January 2015

Beatrice Offshore Wind Farm

Lighting & Marking Plan

Pursuant to 36 Consent Condition 20 and Marine Licence (Offshore Transmission Works) Condition 3.2.2.14

For approval of the Scottish Ministers

Rev	Prepared By	Sign Off	Checked By	Sign Off	Approved By	Sign Off	Date of Issue
02	Steve Bellew, GoBe Consultants Ltd	[redacted]	Jonathan Wilson, Consenting and Stakeholder Manager, BOWL	[redacted]	Steven Wilson, Senior PM, BOWL	[redacted]	15/01/2016

Consent Plan Overview

Purpose of the Plan

This Lighting and Marking Plan (LMP) has been prepared to address the specific requirements of the relevant conditions attached to Section 36 Consent and Marine Licences issued to Beatrice Offshore Windfarm Limited (BOWL).

The overall aim of the LMP is to set out the lighting and marking requirements during the construction and operation of the Beatrice Wind Farm and Offshore Transmission Works (OfTW).

Scope of the Plan

The LMP covers, in line with the requirements of Section 36 and Marine Licence conditions, and in line with industry standards and good practice, the following:

- Aviation lighting during construction and operation; and,

- Marine navigational lighting and marking during construction and operation.

Structure of the Plan

The LMP is structured as follows:

Sections 1 to 4 sets out the scope and objectives of the LMP, provides an overview of the Project, sets out broad statements of compliance and details the process for making updates and amendments to this document.

Section 5 describes the scope and development of the LMP.

Section 6 sets out the aviation lighting requirements during construction and operation including procedures in the event of a failure of any lighting.

Section 7 sets out the marine navigational lighting and marking requirements during construction and operation including buoyage.

Section 8 sets out the compliance of the proposed lighting and marking with the measures set out in the ES and SEIS.

Appendices list relevant legislation and compliance with the ES and SEIS in relation to lighting and marking.

Plan Audience

This LMP is intended to be referred to by personnel involved in the design, construction and operation of the Beatrice Project, including BOWL personnel, Key Contractors and Subcontractors.

Plan Locations

Copies of this LMP are to be held in the following locations:

- BOWL Head Office;

- At the premises of any agent, Key Contractor or Subcontractor acting on behalf of BOWL;
- All site offices dealing with marine operations;
- The BOWL Marine Coordination Centre at Wick; and
- On all vessels.

Table of Contents

List of Abbreviations and Definitions

Term	Definition / Description
AIS	Automatic Identification System.
ANO	Air Navigation Order.
Application	The application letters and Environmental Statement submitted to the Scottish Ministers by BOWL on 23 April 2012 and Supplementary Environmental Information Statement submitted to the Scottish Ministers by BOWL on 29 May 2013.
AtoN	Aids to Navigation.
BOWL	Beatrice Offshore Windfarm Limited (Company Number SC350248) and having its registered office at Inveralmond House, 200 Dunkeld Road, Perth, PH1 3AQ.
CAA	Civil Aviation Authority.
CAP	Civil Aviation Publication.
CMB	Cable Marker Board.
CMS	Construction Method Statement as required for approval under Condition 11 of the S36 Consent and Condition 3.2.2.4 of the OfTW Marine Licence.
COLREGS	International Regulations for Preventing Collisions at Sea 1972.
Commencement of the Wind Farm/OfTW	The date on which Construction begins on the site of the Wind Farm or the OfTW (as appropriate) in accordance with the S36 Consent or OfTW Marine Licence (as appropriate).
Construction	As defined at section 64(1) of the Electricity Act 1989, read with section 104 of the Energy Act 2004.
CoP	Construction Programme as required for approval under Condition 10 of the S36 Consent and Condition 3.2.2.3 of the OfTW Marine Licence.
Development	The Wind Farm and the OfTW.
DGC	Defence Geographic Centre.
DIO	Defence Infrastructure Organisation.
DSLP	Development Specification and Layout Plan as required for approval under Condition 13 of the S36 Consent and Condition 3.2.2.6 of the OfTW Marine Licence.
EMP	Environmental Management Plan as required for approval under Condition 15 of the S36 Consent and Condition 3.2.1.2 of the OfTW Marine Licence

Term	Definition / Description
ERCoP	Emergency Response Cooperation Plan.
ES	The Environmental Statement submitted to the Scottish Ministers by the Company on 23 April 2012 as part of the Application as defined above.
Fl	Flash, denotes a flashing light characteristic used in short range aids to navigation.
HAT	Highest Astronomical Tide.
HCA	Helideck Certification Agency.
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities.
IALA Recommendation O-139	IALA Recommendation O-139 on the Marking of Man Made Offshore Structures.
ID Marking	Identification Marking.
Inter-array cables/cabling	The AC electrical cables that connect the WTGs to the OTMs (and OTM to OTM)
IPS	Intermediate Periphery Structure.
JNCC	Joint Nature Conservation Committee.
Key Contractors	The Contractors appointed for the individual work steams of marine installation; transmission; and WTG installation.
km	Kilometres.
kV	Kilovolt
Landfall	The point above MHWS near Portgordon, where the OfTW cable connects to the onshore transmission works.
LAT	Lowest Astronomical Tide.
Licensing Authority	The Scottish Ministers
LMP	Lighting and Marking Plan as required for approval under Condition 20 of the S36 Consent and Condition 3.2.2.14 of the OfTW Marine Licence.
m	Metres.
Marine Licences	The written consents granted by the Scottish Ministers under Section 20(1) of the Marine (Scotland) Act 2010 and Part 4 of the Marine and Coastal Access Act 2009,dated 2 September 2014.
MCA	Maritime and Coastguard Agency.

Term	Definition / Description
MGN	Marine Guidance Note.
MHWS	Mean High Water Springs.
MOD	Ministry of Defence.
MS-LOT	Marine Scotland Licensing Operations Team.
MW	Megawatt
NLB	Northern Lighthouse Board.
nm	Nautical miles.
NOTAM	Notice to Airmen.
NSP	Navigational Safety Plan as required for approval under Condition 18 of the S36 Consent and Condition 3.2.2.9 of the OfTW Marine Licence.
NtoM	Notice to Mariners.
O&M	Operations and Maintenance.
OFCOM	Office of Communications.
OFTO	Offshore Transmission Operator.
OfTW	The Offshore Transmission Works. The OfTW includes the transmission cable required to connect the Wind Farm to the Onshore Transmission Works. This covers the offshore transmission module(s) (OTMs) and the cable route from the OTMs to the Mean High Water Springs (MHWS) at the landfall west of Portgordon on the Moray coast.
OMP	The Operation and Maintenance Programme as required for approval under S36 Consent condition 17 and OfTW Marine Licence condition 3.2.3.2.
OREI	Offshore Renewable Energy Installation.
OSP	Offshore Substation Platform.
OTM	Offshore Transformer Module means an alternating current (AC) OSP which is a standalone modular unit that utilises the same substructure and foundation design as a wind turbine generator.
Q	Quick, denotes a quickly flashing light characteristic used in short range aids to navigation.
s	Second.
S36 Consent	Consent granted by the Scottish Ministers under Section 36 of The Electricity Act 1989 to construct and operate the

Term	Definition / Description
	Beatrice Offshore Wind farm electricity generating station, dated 19th March 2014.
SAR	Search and Rescue.
SEIS	The Supplementary Environmental Information Statement submitted to the Scottish Ministers by the Company on 29 May 2013 as part of the Application as defined above.
SHL	Seaway Heavy Lifting Ltd
SNH	Scottish Natural Heritage.
SPS	Significant Periphery Structure, a corner structure, or other significant point on the boundary of the Wind Farm.
STDL	Siemens Transmission and Distribution Ltd.
Subcontractor	Subcontractors to the Key Contractors.
SWPL	Siemens Wind Power Ltd.
UIC	Unique Identification Characters
UKHO	United Kingdom Hydrographic Office.
V	Very. (in relation to the speed of flashing lights)
VMP	Vessel Management Plan as required for approval under Condition 16 of the S36 consent and Condition 3.2.2.8 of the OfTW Marine Licence.
W	White, a term used to describe a characteristic colour of short range aids to navigation.
Wind Farm	The offshore array development as assessed in the ES including wind turbines, their foundations, inter-array cabling and meteorological masts
WTG	Wind Turbine Generator.
Y	Yellow, a term used to describe the characteristic colour of short range aids to navigation.

1 Introduction

1.1 Background

1.1.1 The Beatrice Offshore Wind Farm received consent under Section 36 of the Electricity Act 1989 from the Scottish Ministers on 19th March 2014 (the S36 Consent) and was granted two Marine Licences from the Scottish Ministers, for the Wind Farm and associated Offshore Transmission Works (OfTW), on 2nd September 2014 (the Marine Licences).

1.2 Objectives of this Document

1.2.1 The S36 Consent and Marine Licences contain a variety of conditions that must be discharged through approval by the Scottish Ministers/Licensing Authority prior to the commencement of any offshore construction works. One such requirement is the approval of a Lighting and Marking Plan (LMP), which is to provide the details of the lighting and marking of the Development, in accordance with relevant aviation and marine navigation guidance, during construction and operation.

1.2.2 The relevant conditions setting out the requirement for a LMP for approval, and which are to be discharged by this LMP, are presented in full in Table 1.1.

1.2.3 This document is intended to satisfy the requirements of the S36 Consent and Marine Licence (OfTW) conditions by providing a lighting and marking plan that can be practically implemented during construction and operation to ensure safe navigation.

Table 1.1 - LMP consent conditions to be discharged by this document

Ref.	Condition Text	Where Addressed
S36 Consent Condition 20	The Company must, no later than 6 months prior to the Commencement of the [Wind Farm], submit a Lighting and Marking Plan (LMP), in writing, to the Scottish Ministers for their written approval.	This document sets out the LMP for approval by the Scottish Ministers.
	Such approval may only be granted following consultation by the Scottish Ministers with Maritime and Coastguard Agency (MCA), Northern Lighthouse Board (NLB), Civil Aviation Authority (CAA) and Defence Infrastructure Organisation (DIO) and any such other advisors as may be required at the discretion of the Scottish Ministers.	To be undertaken by the Scottish Ministers.
	The LMP must provide that the [Wind Farm] be lit and marked in accordance with the current CAA and DIO aviation lighting policy and guidance that is in place as at the date of the Scottish Ministers approval of the LMP, or any such other documents that may supersede said guidance prior to the approval of the LMP.	Section 6
	The LMP must also detail the navigational lighting requirements detailed in IALA Recommendation O-139 or any other documents that may supersede said guidance prior to approval of the LMP.	Section 7
	The Company must provide the LMP to the Highland Council, Moray Council, the Joint Nature Conservation Committee (JNCC), Scottish Natural Heritage (SNH) and any other bodies as may be required at the	A copy of the approved LMP will be provided to these bodies.

Ref.	Condition Text	Where Addressed
	discretion of the Scottish Ministers.	
	The [Wind Farm] must, at all times, be constructed and operated in accordance with the approved LMP (as updated and amended from time to time by the Company).	Section 2
	Any updates or amendments made to the LMP by the Company must be submitted, in writing, by the Company to the Scottish Ministers for their written approval.	Section 3
OfTW Marine Licence Condition 3.2.2.14	Navigational and Aviation Safety and Charting […] The Licensee must, no later than 6 months prior to the Commencement of the [OfTW], submit a LMP, in writing, to the Licensing Authority for their written approval.	This document sets out the LMP for approval by the Licensing Authority.
	Such approval may only be granted following consultation by the Licensing Authority with MCA, NLB, the CAA, the DIO and any such other advisors as may be required at the discretion of the Licensing Authority.	To be undertaken by the Licencing Authority.
	The LMP must provide that the [OfTW] be lit and marked in accordance with the current MCA, CAA and DIO navigational and aviation lighting policy and guidance that is in place as at the date of the Licensing Authority approval of the LMP, or any such other documents that may supersede said guidance prior to the approval of the LMP.	Section 6
	The LMP must also detail the navigational lighting requirements detailed in IALA Recommendations O-139 or any other documents that may supersede said guidance prior to approval of the LMP.	Section 7
	The Licensee must provide the LMP to the Highland Council, Moray Council, the JNCC, SNH and any other bodies as may be required at the discretion of the Licensing Authority. […]	A copy of the approved LMP will be provided to these bodies.

1.2.4 In addition to the specific consent requirements for a LMP and the requirements thereof (as set out in Table 1.1), this LMP also includes information in respect of a number of other conditions within the Project consents which are linked to the matter of lighting and marking; these are set out in Table 1.2.

Table 1.2 - Other consent conditions relevant to this LMP

Reference	Summary of condition	Where addressed
Wind Farm Marine Licence Condition 3.2.2.3	**Navigational Safety (during construction)** […] The [Wind Farm] shall be marked and/or lighted as required by the NLB and the marking to be continued unless and until the Licensing Authority rescind this direction. If it is desired to display any marks or lights not required by this licence then details must be submitted to the NLB and their ruling complied with. The display of unauthorised marks or lights is prohibited.	Section 7
Wind Farm Marine Licence Condition 3.2.2.4	**Markings, lighting and signals of the [Wind Farm] (during construction)** The Licensee must ensure that the [Wind Farm] are marked and lit in accordance with the requirements of the NLB and the CAA at all times and such marking and/or lighting must be continued unless and until	Section 6 Section 7 Cardinal buoy markings are detailed

Reference	Summary of condition	Where addressed
	such time as the Licensing Authority, by notice, relevantly varies this licence under section 30 of the 2010 Act. The Licensee must not display any marks and lights additional to those required by virtue of this licence and agreed in the Lighting and Marking Plan without the written approval of the Licencing Authority following consultation with the NLB, the CAA and the MCA. The Licensee must ensure that the meteorological masts are marked and lit in accordance with IALA Recommendation O-139. The Licensee must ensure the Site boundaries are marked by Cardinal Mark buoys (number to be determined when final layout is known). The Cardinal Mark buoys shall be a minimum of 3 metres in diameter at the waterline, have a focal plane of at least 3 metres above the waterline and be of suitable construction for the sea conditions commonly experienced in the Outer Moray Firth. The light range on these buoys shall be 5 nautical miles. All required buoyage shall remain in place until completion of this phase, or otherwise notified by the Licensing Authority. The Licensee must ensure that any meteorological masts within the Site area will have marking and lighting amended to suit the layout of the wind farm as it progresses should the meteorological masts be built prior to the Wind Turbine Generators (WTG).	in Table 7.2.
Wind Farm Marine Licence Condition 3.2.2.5	**Markings, lighting and signals of jack up barges and vessels (during construction)** The Licensee must ensure that any vessels permitted to engage in the [Wind Farm] are marked in accordance with the International Rules for the Prevention of Collisions at Sea whilst under way, and in accordance with the UK Standard Marking Schedule for Offshore Installations if secured to the seabed.	Section 5 Vessel marking requirements are detailed in paragraph 5.1.5.
Wind Farm Marine Licence Condition 3.2.3.4	Markings, lighting and signals of the [Wind Farm] (during operation) The Licensee must ensure that the [Wind Farm] are marked and lit in accordance with the requirements of the NLB and the CAA at all times and such marking and/or lighting must be continued unless and until such time as the Licensing Authority, by notice, relevantly varies this licence under section 30 of the 2010 Act. The Licensee must ensure that the required IALA availability target for Category 1 Aids to Navigation (AtoN) is achieved through redundancy, monitoring and repair, must be in place and arrangements made to warn the mariner promptly of any AtoN fault and its subsequent return to fully operational service. The Licensee must ensure that any meteorological mast(s) within the Site are marked and lit in accordance with IALA Recommendation O-139. The Licensee must ensure that any meteorological mast(s) within the Site will have marking and lighting amended to suit the final layout of the wind farm.	Section 6 Section 7 IALA availability targets are detailed in Table 7.3 (operational lighting and sound signals)
OfTW Marine Licence Condition 3.2.3.5	Navigational safety (during construction) […] The [OfTW] shall be marked and/or lighted as required by the NLB and the marking to be continued unless and until the Licensing Authority rescind this direction. If it is desired to display any marks or lights not required by this licence then details must be submitted to the NLB and their ruling complied	Section 7

Reference	Summary of condition	Where addressed
	with. The display of unauthorised marks or lights is prohibited.	
OfTW Marine Licence Condition 3.2.3.6	Markings, lighting and signals of the [OfTW] (during construction) The Licensee must ensure that the [OfTW] are marked and lit in accordance with the requirements of the NLB and the CAA at all times and such marking and/or lighting must be continued unless and until such time as the Licensing Authority, by notice, relevantly varies this licence under section 30 of the 2010 Act and under section 72 of the 2009 Act. The Licensee must ensure that no marks or lights, other than those required by virtue of this licence, are displayed unless they have been approved, in writing, by the Licensing Authority following consultation with the NLB and the CAA. The Licensee must ensure site boundaries are marked by Cardinal Mark buoys (number to be determined when the final layout of the [OfTW] is known). The Cardinal Mark buoys shall be a minimum of 3 metres in diameter at the waterline, have a focal plane of at least 3 metres above the waterline and be of suitable construction for the sea conditions commonly experienced in the Outer Moray Firth. The light range on these buoys shall be 5 nautical miles. All required buoyage shall remain in place until Completion of the [OfTW] or otherwise notified by the Licensing Authority.	Section 6 Section 7 Cardinal buoy markings are detailed in Table 7.2.
OfTW Marine Licence Condition 3.2.3.7	Markings, lighting and signals of jack up barges and vessels (during construction) The Licensee must ensure that any vessels permitted to engage in the [OfTW] are marked in accordance with the International Rules for the Prevention of Collisions at Sea whilst under way, and in accordance with the UK Standard Marking Schedule for Offshore Installations if secured to the seabed.	Section 5 Vessel marking requirements are detailed in paragraph 5.1.5.
OfTW Marine Licence Condition 3.2.4.6	Consent Condition 3.2.4.6 Markings, lighting and signals of the [OfTW] (during operation) The Licensee must ensure that the [OfTW] are marked and lit in accordance with the requirements of the NLB and the CAA at all times and such marking and/or lighting must be continued unless and until such time as the Licensing Authority, by notice, relevantly varies this licence under section 30 of the 2010 Act and under section 72 of the 2009 Act. The Licensee must ensure that the required IALA availability target for Category 1 AtoN is achieved through redundancy, monitoring and repair, must be in place and arrangements made to warn the mariner promptly of any AtoN fault and its subsequent return to fully operational service. The Licensee must ensure that lit Cable Marker Boards (CMBs) are positioned as near as possible to the shoreline so as to mark the points at which the cables come ashore. The CMBs shall be diamond shaped, with dimensions 2.5 metres long and 1.5 metres wide, background painted yellow with the inscription 'Cables' painted horizontally in black. The structures shall be mounted at least 4 metres above ground level, with a navigation light flashing yellow once every five seconds ("Flash (Fl) Yellow(Y) 5s") mounted on the upward apex of the board. The nominal range of these lights should be 3 nautical miles, and they should have an availability of not less than 97% (IALA Category 3) over a rolling three year period.	Section 6 Section 7 IALA availability targets are detailed in Table 7.3 (operational lighting and sound signals) CMBs are detailed in paragraph 7.3.14 and 7.3.15.

1.3 Linkages with other Consent Plans

1.3.1 This LMP document sets out the proposed lighting and marking specification for the Wind Farm and OfTW. However, ultimately it will form part of a suite of approved documents that will provide the framework for the construction process and in some cases the operation of the scheme – namely the other Consent Plans required under the S36 Consent and Marine Licences.

1.3.2 The consent conditions that require the development of an LMP do not explicitly identify linkages between this and other Consent Plans. However, other conditions require that several Consent Plans be consistent with the LMP; these plans are identified in Table 1.3.

Table 1.3 – LMP linkages with other Consent Plans

Other Consent Plan	Consistency with and linkage to LMP
The Vessel Management Plan (VMP) (required under S36 Consent Condition 16 and OfTW Marine Licence Condition 3.2.2.8)	The VMP will consider the management and coordination of vessels. The VMP must be, so far as is reasonably practicable, consistent with the LMP.
The Construction Method Statement (CMS) (required under S36 Consent Condition 11 and OfTW Marine Licence Condition 3.2.2.4)	The purpose of the CMS is to detail the methods that will be implemented during the construction of the Development. The CMS is, so far as is reasonably practicable, consistent with the LMP.
Operation and Maintenance Programme (OMP) (required under S36 Consent Condition 17 and OfTW Marine Licence Condition 3.2.3.2)	The OMP sets out the procedures and good working practices for the operational and maintenance (O&M) phase of the Development. The OMP must be, so far as is reasonably practicable, consistent with the LMP.

1.4 Structure of this LMP

1.4.1 In response to the specific requirements of the S36 Consent and the OfTW Marine Licence conditions, this LMP has been structured so as to be clear that each part of the specific requirements have been met and that the relevant information to allow the Scottish Ministers to approve the LMP has been provided. The document structure is set out in Table 1.3.

Table 1.3 – LMP linkages with other Consent Plans (and consent conditions)

Section		Summary of Content
1	Introduction	Background to consent requirements and overview of the LMP scope and structure; and Identifies those other Consent Plans relevant to the construction and operation of the Development and the linkage between those plans and the LMP.
2	BOWL Statements of Compliance	Sets out the BOWL statements of compliance in relation to the LMP consent conditions.
3	Updates and Amendments to this LMP	Sets out the procedures for any required updating to or amending of the approved LMP and subsequent further approval by the Scottish Ministers.
4	Project Overview	Provides an overview of the project relevant to the LMP and describes roles and responsibilities in the delivery of the LMP during construction and operation.
5	Scope and Development of this LMP	Describes the scope of the LMP and provides a summary of consultation undertaken to inform the development of the lighting and marking plan.
6	Aviation Lighting and Marking	Confirms the details of lighting and marking of the Development during construction and operation in line with aviation requirements.
7	Marine Navigation Lighting and Marking	Confirms the details of lighting and marking of the Development during construction and operation in line with marine navigation requirements.
8	Compliance with the Application, ES and SEIS	Sets out confirmation that the details set out in this LMP are in accordance with those assessed in the ES and SEIS; and Sets out how the mitigation measures related to lighting and marking identified in the ES and SEIS are to be delivered.

2 BOWL Statements of Compliance

2.1 Introduction

2.1.1 The following statements are intended to re-affirm the BOWL commitment to ensuring that the Development is constructed and operated in such a manner as to meet the relevant legislative requirements set out by the project consents but also broader legislative requirements. Specifically it sets out:

- A number of statements of compliance relating to this LMP and the broader requirements of the project consents; and
- Legislative requirements.

2.2 Statements of Compliance

2.2.1 BOWL in undertaking the construction and operation of the Development will ensure compliance with this LMP as approved by the Scottish Ministers (and as updated or amended from time to time following the procedure set out in Section 3 of this LMP).

2.2.2 Where significant updates or amendments to this LMP are required, BOWL will ensure the Scottish Ministers are informed as soon as reasonably practicable and where necessary the LMP will be updated and amended (see Section 3 below).

2.2.3 BOWL in undertaking the construction and operation of the Development will ensure compliance with other, relevant Consent Plans as approved by the Scottish Ministers and identified in Section 1.3 above.

2.2.4 BOWL in undertaking the construction and operation of the Development will ensure compliance with the limits defined by the original application and the project description defined in the Environmental Statement (ES) and Supplementary Environmental Information Statement (SEIS) and referred to in Annex 1 of the S36 Consent in so far as they apply to this LMP (unless otherwise approved in advance by the Scottish Ministers / the Licensing Authority) (see Section 8).

2.3 Legislative Requirements

2.3.1 BOWL will, in undertaking the construction and operation of the Development, ensure compliance with all relevant legislation and that all necessary licences and permissions are obtained by the Key Contractors and Subcontractors, through conditions of contract and by an appropriate auditing process.

2.3.2 BOWL will comply - and ensure that BOWL contractors comply - with the requirements of relevant environmental and maritime legislation as standard. A register of legislation, policy and guidance with which this LMP complies is presented in Appendix A.

3 Updates and Amendments to this LMP

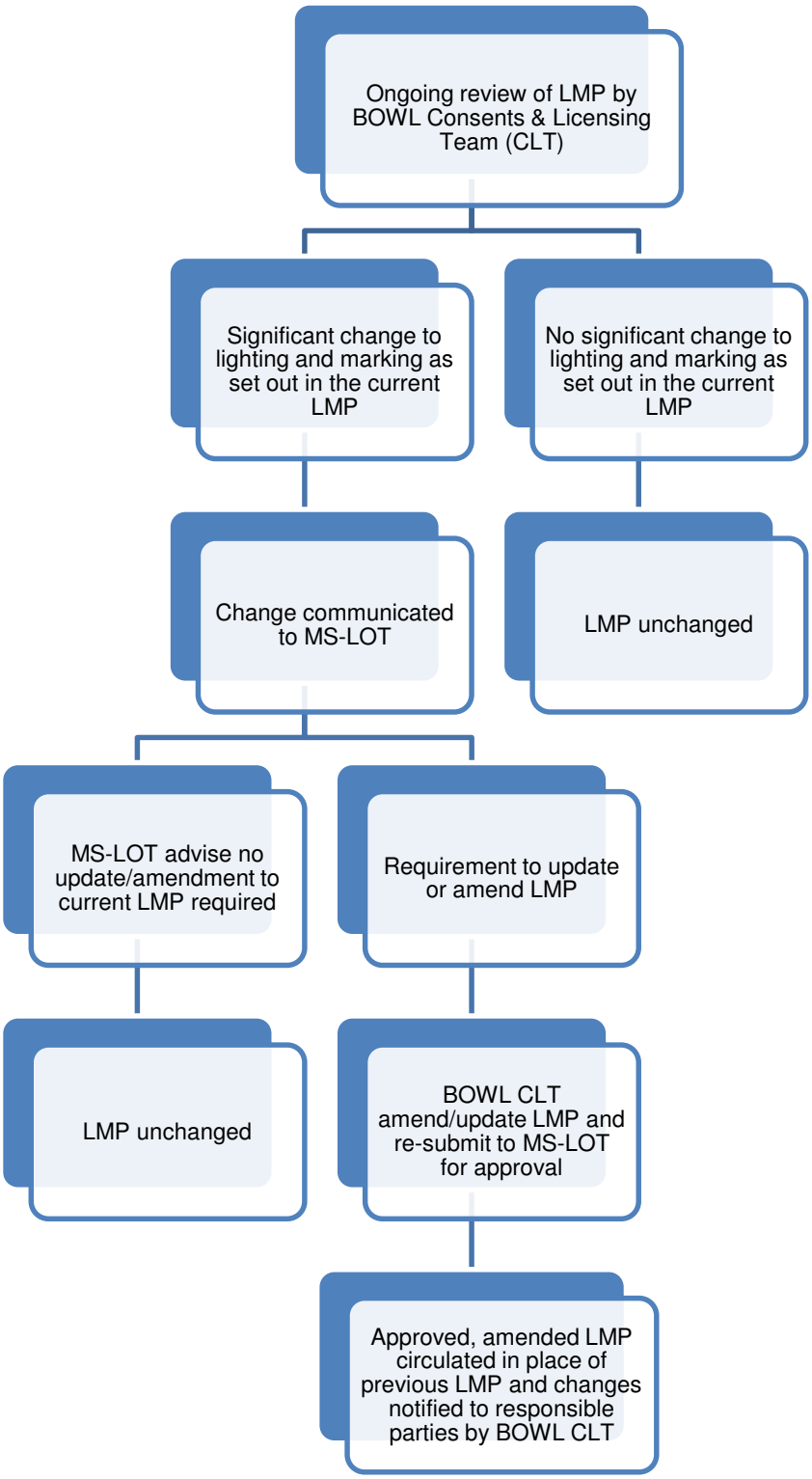
3.1.1 This LMP sets out the proposed lighting and marking of the Development.

3.1.2 The S36 Consent condition recognises that updates or amendments to this LMP may be required, stating that:

The Development [Wind Farm] must, at all times, be constructed and operated in accordance with the approved LMP (as updated and amended from time to time by the Company [BOWL]). Any updates or amendments made to the LMP by the Company [BOWL] must be submitted, in writing, by the Company [BOWL] to the Scottish Ministers for their written approval.

3.1.3 Where it is necessary to update this LMP in light of any significant new information related to lighting and marking requirements, BOWL propose to use the change management process set out in Figure 3.1 to identify such information, communicate changes to the Scottish Ministers, re-draft the LMP, seek further approval of amendments or updates, and disseminate the updated version of the LMP.

Figure 3.1 – LMP Change Management Procedure



4 Project Overview

4.1 Introduction

4.1.1 This section provides a brief overview of the Development relevant to the LMP and sets out in relation, to BOWL and the Key Contractors, main roles and responsibilities.

4.2 Development Overview and Layout

4.2.1 The Development will consist of the following main components:

- A total generating capacity of up to 588MW;
- Up to 84 wind turbines of 7MW rated generating capacity;
- Jacket substructures each installed on four pile foundations driven into the seabed;
- Two AC substation platforms, referred to as offshore transformer modules (OTMs) to collect the generated electricity and transform the electricity from 33kV to 220kV for transmission to shore;
- A network of circa 170 to 190km of inter-array, buried or (if burying is not possible) mechanically protected, subsea cables to connect strings of turbines together and to connect the turbines to the OTMs;
- 2 buried or (if burying is not possible) mechanically protected, subsea export cables, totalling circa 130km in length, to transmit the electricity from the OTMs to the land fall at Portgordon and connecting to the onshore buried export cables for transmission to the onshore substation and connection to the National Grid network; and
- Minor ancillary works such as the potential deployment of met buoys and permanent navigational marks as defined in this LMP.

4.2.2 Figure 4.1 below shows the location of the Development in the Moray Firth, and shows the route of the export cable route.

4.2.3 Figure 4.2 shows the final layout of wind turbines and OTMs across the Wind Farm site, subject to confirmation through final project design and engineering work, upon which this LMP is based. Further information on the layout of the Wind Farm, including the specifications of the wind turbines and OTMs and the location coordinates of each structure, is provided in the DSLP. Note that Figure 4.2 includes two spare locations. These spare locations would only be utilised in the event of difficulties being encountered during the foundation installation operations at one of the wind turbine or OTM locations that could not be otherwise overcome by micro-siting.

4.2.4 Details of the construction programme for the construction works are provided in the Construction Programme (CoP) submitted for approval (required under Condition 10 of the s36 consent and Condition 3.2.2.3 of the OfTW Marine Licence). For ease of reference the key milestone dates for the construction works are provided in Table 4.1.

Table 4.1 - Summary of Key Milestone Dates for Construction Activity

Milestone and activity	Anticipated Installation Period
Offshore construction start	April 2017
Installation of foundation piles	April – November 2017; and April – September 2018[1]
Installation of Jacket substructures (WTGs and OTMs)	May – September 2017; and April – September 2018
Installation of wind turbines	June 2018 – September 2018; and April – August 2019
Installation of OTM topsides	April 2018
Installation of inter-array cabling	July – September 2017; April – October 2018; and April – June 2019
Generation	1st generation: July 2018; and Full generation: October 2019
Offshore construction ends	October 2019

4.3 BOWL and Key Contractor Roles and Responsibilities

4.3.1 The Key Contractors, named as Seaway Heavy Lifting Offshore Contractors B.V. (SHL), Siemens Wind Power Ltd (SWPL) and Siemens Transmission and Distribution Ltd (STDL), will be responsible for constructing the Development as designed, which will include the specifications detailed in this LMP. They will also be responsible for the implementation and maintenance of construction marking, lighting and signalling as detailed in this LMP.

4.3.2 In summary, the main roles and responsibilities of the Key contractors will be as follows:

- SHL:
  - Wind turbine and OTM jacket foundation and substructure installation using SHL vessel(s) (with sub-contractors used for additional barges, anchor handling tugs and towing tugs as required);
  - OTM topside lift using SHL heavy lift vessel (with sub-contractors used for additional barges, anchor handling tugs and towing tugs as required);
  - Inter-array cable installation (using sub-contracted cable laying, trenching and support vessels and subcontractors).

[1] Note that provision is also made in the programme for the possible continuation of piling over the 2017-2018 winter period although this is considered unlikely to be required.

- SWPL:
  - Management of the construction laydown port facility where the wind turbine components will be pre-assembled ready for installation;
  - Wind turbine installation using a jack-up vessel
  - Wind turbine cable connections and commissioning works (with sub-contracted crew transfer vessels or dynamically positioned walk way vessels used to transport personnel to carry out completion and commissioning activities);
- STDL:
  - Export cable laying and trenching (using subcontractors (Nexans) and cable laying, trenching and support vessels).
  - OTM topside supply and commissioning (with sub-contracted crew transfer vessels or dynamically positioned walk way vessels used to transport personnel to carry out OTM completion and commissioning activities).

4.3.3 During the operational phase, BOWL and any appointed contractors will retain responsibility for operating and maintaining the Wind Farm and will therefore be responsible for the implementation of this LMP.

4.3.4 The OfTW assets will be sold to an Offshore Transmission Operator (OFTO) and thereafter the responsibility for the implementation of this LMP in so far as it applies to the OfTW assets will transfer to the OFTO. It should be noted that BOWL would prefer to maintain responsibility for managing the OfTW in this regard, providing that an agreement can be reached with the OFTO. However, in the absence of such an agreement being reached, the OFTO will be responsible for the implementation of this LMP in relation to the operation of the OfTW.

4.3.5 During construction and operation, BOWL and/or their contractors will undertake inspections of the Development and undertake regular maintenance to the lighting and marking installations. In addition, all contractors will be responsible for reporting any faults in lighting or defects to marking to BOWL. BOWL will be responsible for the reporting of faults as detailed under Sections 6.3 and 7.3.

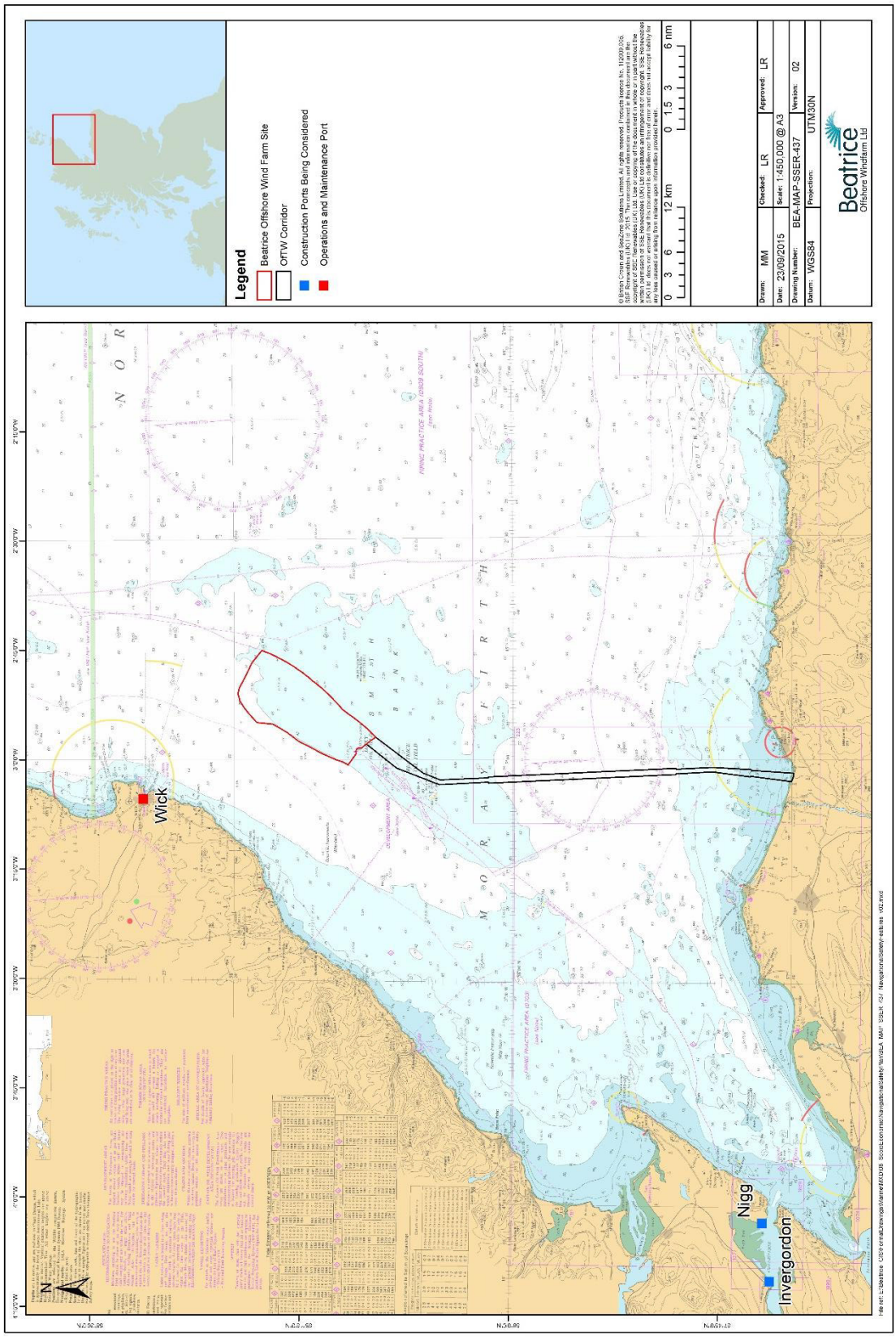


Figure 4.1 – Wind Farm location and OfTW cable route and Main Ports

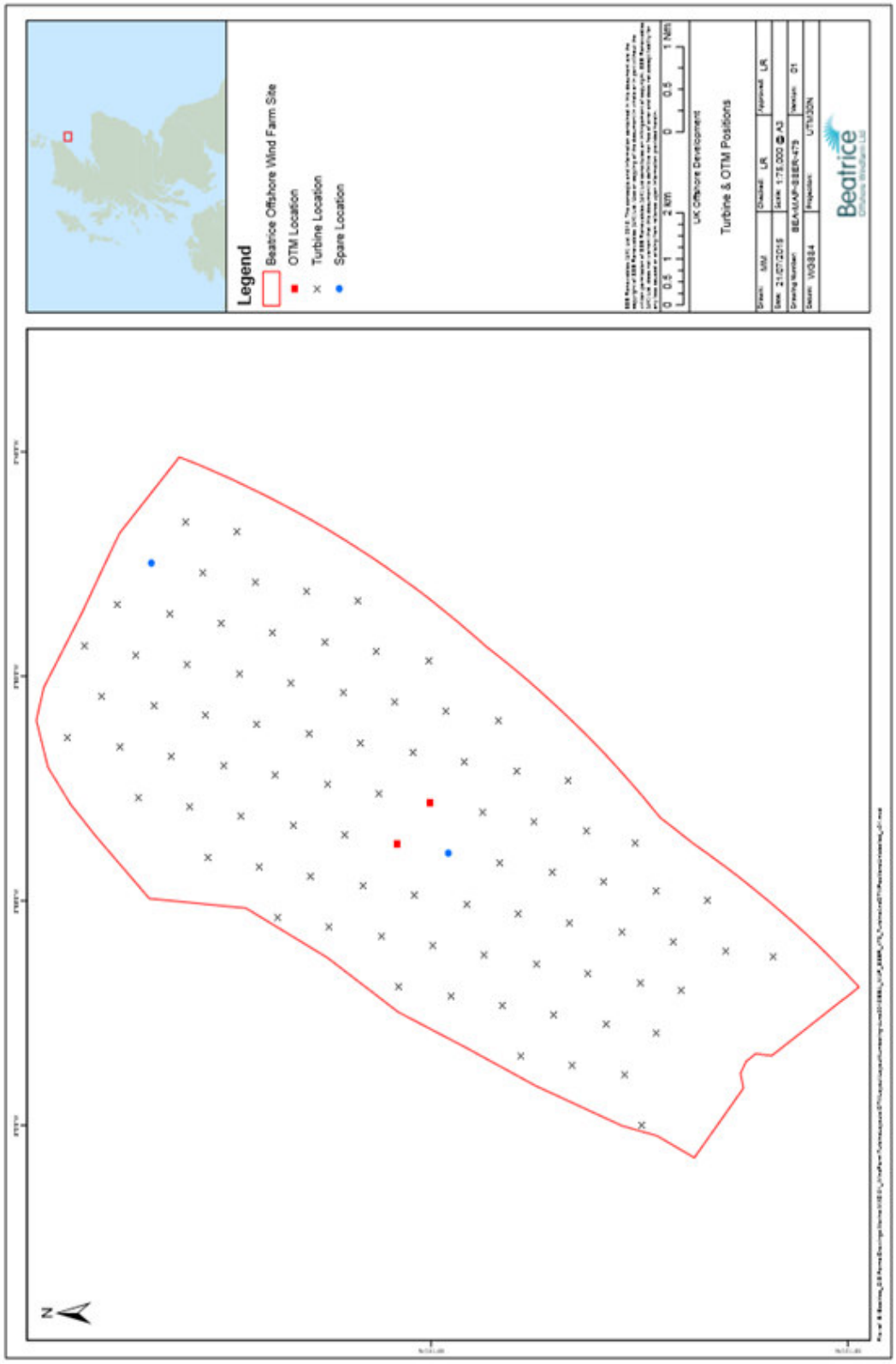


Figure 4.2 – Beatrice Wind Farm wind turbine and OTM layout

5 Scope and Development of this LMP

5.1.1 Sections 6 and 7 of this LMP set out the detail of the marking, lighting, and signalling of the Development, as required by the consent conditions set out in Table 1.1 in Section 1.2, in respect of aviation and marine navigational lighting and marking respectively.

5.1.2 This LMP applies to both the construction phase of the Development, covering lighting and marking of temporary or part-built fixed structures, and the operational phase of the Development, including additional associated buoyage.

5.1.3 This lighting and marking specification detailed in this LMP accords with current aviation and marine navigation lighting policy and guidance, as set out in Appendix A. Should any of the documents listed in Appendix A be updated or superseded, the LMP will be reviewed and, where necessary, amended to ensure it reflects current lighting and marking standards.

5.1.4 The Northern Lighthouse Board (NLB) and Maritime and Coastguard Agency (MCA) have been consulted during the development of this LMP with regard to marine navigational marking and lighting, as follows:

- BOWL consulted with the NLB in February and March 2015 and reached agreement on lighting and marking for the wind turbine and OTM layout at that time (the design basis layout[2]) with respect to marine aids to navigation (AtoN);
- BOWL undertook consultation with MCA in March 2015 and reached agreement on design principles with regards to search and rescue (SAR) for the WTG and OTM layout including the requirement for SAR lighting as defined in MGN 371 (MCA, 2008).

5.1.5 The lighting and marking of vessels during construction will be managed through marine regulations including the International Convention for the Prevention of Collision at Sea (COLREGS) 1972 which all vessels, regardless of nationality, are required to comply with. The COLREGS include specific lighting and marking requirements to designate a vessel's purpose and current activity and/or status.

5.1.6 This LMP relates to the Beatrice Offshore Wind Farm Development only and does not consider the adjacent Moray Firth Round 3 Zone offshore wind development. At the time of writing there is insufficient information regarding the layout or timescales for the progression of the Moray Firth Round 3 Zone projects to take account of it in this LMP. Should the Moray Firth Round 3 Zone development progress, and when sufficient information is available regarding its layout, it may be necessary to review the lighting and marking requirements for the wind turbines on the periphery of the site facing the MORL wind farms. Any such requirements will be discussed with NLB, CAA and MCA. If changes are required to the LMP as a result, the procedure described in

[2] Note the design basis layout has since been iterated to form the final layout shown in Figure 4.2.

Section 3 of this LMP would be followed.

5.1.7 Within this LMP, lighting and marking of the Development is presented separately in relation to aviation (Section 6) and marine AtoN (Section 7) given the different requirements of the two.

6 Aviation Lighting and Marking

6.1 Introduction

6.1.1 This section sets out the aviation lighting and marking arrangements for the Wind Farm and OfTW. It includes lighting and marking technical specifications.

6.1.2 The aviation marking and lighting proposed has been designed to be compliant with the current, standard Civil Aviation Authority (CAA) and Defence Infrastructure Organisation (DIO) requirements for offshore wind farm structures (as set out in Appendix A). The relevant guidance is set out in relation to each of the specific requirement in the following sections.

6.2 Aviation Awareness during Construction

6.2.1 The requirements for aviation lighting during the construction phase have been discussed with both the CAA and DIO to ensure it reflects the restrictions around the construction of a significant infrastructure project but also ensure that the risk to aviation receptors is effectively mitigated.

6.2.2 Therefore BOWL provides a commitment to the effective promulgation of information to the appropriate aviation authorities through the construction phase. The method of promulgation is detailed below to ensure that any unmarked hazards during the construction phase are identified and included within aviation warnings.

6.2.3 There is an international civil aviation requirement for all structures of 300 feet (91.4m) or more to be charted on aeronautical charts. Accordingly such structures will be reported by BOWL or BOWL contractors to the Defence Geographic Centre (DGC) which maintains the UK's data base of tall structures (the Digital Vertical Obstruction File) at least 10 weeks prior to the start of construction. The point of contact is: 0208 818 2702, mail to dvof@mod.uk.

6.2.4 The DGC also require the accurate location[3] of the turbines / meteorological masts, accurate maximum heights, the lighting status of the turbines and / or meteorological masts and the estimated start / end dates for construction together with the estimate of when the turbines are scheduled to be removed. In addition, BOWL or its contractor will provide the maximum height of any construction equipment required to build the turbines.

6.2.5 In order to ensure that aviation stakeholders are aware of the turbines and / or meteorological masts while aviation charts are in the process of being updated, BOWL

[3] Should a significant amount of development occur within a short time frame, BOWL or its contractors may submit a centre point and radius around all unmarked hazards rather than individual locations. This approach should be discussed with the DGC no later than 10 weeks prior to the development activity.

or its contractors will also need to notify stakeholders through the means of a Notice to Airmen (NOTAM). To discuss / arrange an associated NOTAM, BOWL or its contractors will contact the CAA's Airspace Utilisation Section (0207 453 6599, mail to ausops@caa.co.uk); providing the same information as required by the DGC at least 14 days prior to the start of construction.

6.2.6 There will not be any red aviation hazard lights as described in section 6.3 prior to the designated peripheral turbines being commissioned.

6.3 Aviation Lighting during Operation

6.3.1 The requirements for aviation lighting during the operational phase has been designed to be compliant with the relevant requirements set out in the following guidance and policy documents:

- The Air Navigation Order (ANO) 2009. Statutory Instrument No. 3015; with deviation to Article 220 at NLBs request.
- CAA Civil Aviation Publication (CAP) 764 – Policy and Guidelines on Wind Turbines (CAA, 2013b).
- Ministry of Defence Obstruction Lighting Guidance, November 2014 (MOD, 2014).
- CAA Policy Statement November 2012 - The lighting and marking of wind turbine generators and meteorological masts in United Kingdom territorial waters (CAA, 2012b).
- CAA CAP 437 – Standards for offshore helicopter landing areas (CAA, 2013a). Revision 8 of this document is currently under production. Where available BOWL have incorporated requirements detailed in the new revision due for publication mid-2016.
- MCA, Offshore Renewable Energy Installations, Emergency Response Co-operation Plans (ERCoP) for Construction and Operation Phase, and Requirements for Emergency Response and Search and Rescue (SAR) Helicopter Operations (MCA, 2014).

6.3.2 Following consultation with CAA and MoD (received by email on the 24th November 2015 and 3rd of December 2015 respectively), all peripheral turbines (where their height exceeds 60m or more) will have, during the operational phase, a medium intensity red light mounted on the top of each turbine nacelle in accordance with ANO Article 220. However as per standard marine practice and in accordance with standard NLB advice BOWL have requested a deviation from the steady red light detailed within the ANO in order to prevent confusion with marine lights and therefore the red aviation lights will flash Morse W.

6.3.3 All other turbines and OTMs will display a 200 candela aviation hazard light with fixed illumination on top of the turbine nacelle or the highest fixed point on the OTMs.

6.3.4 The proposed aviation lighting plan is presented in Figure 6.2 below and the technical specifications for the aviation lighting to be installed for the operational phase is set out in Table 6.2.

Table 6.2 – Aviation lighting during operation

Structure	Specification
Peripheral WTGs	Aviation warning lights will be mounted on top of the nacelle of all peripheral turbines and will have the following specifications: • Red medium intensity light (of 2,000 candelas) variable to not less than 10% (200 candela) of the minimum peak intensity when visibility in all directions from every WTG is greater than 5 kilometres (km); • Synchronised to flash Morse W asper NLB advice to deviate from ANO 220.
Internal WTGs and OTMs	• All internal WTGs of the Wind Farm shall be fitted with a single 200 candela red aviation hazard light, with fixed illumination (no flashing required) on the top of each nacelle. During routine operations (i.e. no SAR operations are underway in or around the Wind Farm) these lights shall be switched off. The lights may be required to be switched on at the request of the SAR coordination authority and/or a SAR helicopter or aircraft.
Heli-hoist and SAR Lights – **All WTGs and OTMs**	• Heli-hoist lighting will require low intensity fixed green lighting of 16-750 candela for all angles of azimuth and for angles of elevation from 0 to 90 degrees to be installed on the top of each nacelle or other fixed point fixed point on the WTGs and OTMs (see Table 6.3 for further details). These lights are used to indicate to the pilot when the WTG or OTM is in a safe configuration or condition to conduct hoist operations. • The 2,000 red candelas light (where fitted to peripheral structures as noted above) will be automatically adjustable in intensity to 200 candelas whenever the visibility is greater than 5 km. This requirement is also available where the SAR coordinating authority and/or the SAR helicopter or aircraft requests it. •

6.3.5 In addition, where heli-hoist operations would be conducted on wind turbines or OTMs, the following heli-hoist lighting requirements will also be met:

- A low intensity green light will be displayed which is capable of both steady and flashing illumination. A steady green light will indicate to the pilot that the turbine blades and nacelle are secure and safe to carry out heli-hoist operations. A flashing (120 flashes per minute) green signal will be displayed to indicate that the turbine is in a state of preparation to accept hoist operations, or when displayed during hoist operations, that parameters are moving out of limits. When the light is extinguished this indicates that it is not safe to conduct heli-hoist operations. The

heli-hoist light should be conspicuous at a range of at least 500m and detectable at a range of at least 700m in a meteorological visibility of 3km in daylight. The heli-hoist light will be visible from all angles of azimuth so as to be visible to the pilot during the approach to the wind turbine and throughout operations. The lighting specifications will adhere to the standards set out in the most recent CAP 437 document. The vertical beam intensity is presented in Table 6.3.

Table 6.3 – Vertical beam characteristics for helicopter hoist status lights.

	Min Intensity (candelas)		Max Intensity (candelas)	
	2° to 10°	>10° to 90°	2° to 15°	>15° to 90°
Day	410	16	750	120
Night	16	3	60	60

6.3.6 Aviation lighting will be controllable from the 24 hour Marine Co-ordination Centre that will be located in Wick Harbour. All aviation lights will be under the control of the Marine Co-ordination Centre so that they can be switched off/on as required by an emergency situation.

Blade Hover Reference Marking

6.3.7 The requirements for blade hover reference marking has been designed to be compliant with the relevant requirements set out in the following guidance and policy documents:

- MCA, Offshore Renewable Energy Installations, Emergency Response Co-operation Plans (ERCoP) for Construction and Operation Phase, and Requirements for Emergency Response and SAR Helicopter Operations (MCA, 2014).
- Maritime and Coastguard Agency, Marine Guidance Notice (MGN) 371, Offshore Renewable Energy Installations (OREIs) - Guidance on United Kingdom (UK) Navigational Practice, Safety and Emergency Response Issue (MCA, 2008).

6.3.8 Blade hover reference marks will be provided on the wind turbine generator blades. Wind turbine blades will be marked to provide a SAR helicopter pilot with a reference mark when hovering over a nacelle during a rescue. Three marks will be added - one each at the 10, 20 and 30 metre interval (starting from the hub) and placed near the trailing edge of the blades so that when they are feathered the marks lie upwards in view of the helicopter pilot when the blades are parked in the 'Y' position or offset 'Y' (i.e. one blade angled forward into the wind). The blade tip will also be marked in red. However noting the potential for the tip of the blade to contain lightning protection equipment, the red band may be moved inwards towards the nacelle and avoid the tip. Details of the final blade design will be provided to the MCA SAR branch.

6.3.9 The marks will be painted in a contrasting red colour on both sides of the blades. The diameter of the marks (which will be dots) will be at least 60 cm.

6.3.10 An example of the blade hover reference marks (based on those installed at the Westermost Roughs offshore wind farm) are shown in Figure 6.1.

Figure 6.1 – Example of blade hover marks installed at the Westermost Rough Offshore Wind Farm

WTG Nacelle Roof and OTM Roof Identification Numbers

6.3.11 Wind turbine nacelle roof and OTM door identification numbering will be provided. Individual identification (ID) numbers will be marked on the wind turbine nacelle or OTM roofs (or on the helipads) so that SAR helicopters and/or other low flying aircraft can locate and/or reference a particular turbine visually (see example shown in Figure 6.1)

6.3.12 ID numbers will be recognisable from an aircraft flying 500 feet (150 m) above the highest part of the fixed structure. The ID number will be as large as practicable but not less than 1.5 metres in height and of proportionate width.

Obstructions – Visual Markings

6.3.13 The requirements for aviation lighting during the operational phase has been designed to be compliant with the relevant requirements set out in the following guidance and policy documents:

- CAA CAP 764 – Policy and Guidelines on Wind Turbines (CAA, 2013b).

- CAA Civil Aviation Publication (CAP) 437 – Standards for offshore helicopter landing areas (CAA, 2013a).

6.3.14 The wind turbine and OTM structures will be coloured as follows:

- Jacket foundations will be painted yellow (RAL 1004 Golden Yellow) from 2m below LAT up to the interface point at 22m above LAT;
- Above this height, structures will be painted grey (RAL 7035 Light Grey).

6.3.15 In addition to the nacelle or OTM roof markings, each wind farm structure (wind turbine generators and OTMs) will display identification panels with black letters or numbers on a yellow background visible in all directions on the wind turbine towers (see Section 7.3: Additional Marine Navigational Marking and Lighting of Structures)).

6.3.16 Helihoist platforms on wind turbine nacelles will be marked in accordance with CAP437. The railing will be painted red, the safe zone will be marked green and the helihoist area marked yellow (see example in Figure 6.1 above).

6.3.17 Any other structures (i.e. a crane) on an OTM that will stand clear of the main platform will have additional marking if they are in the vicinity of a heli-deck or winch area, in line with CAP 437 requirements (painting of such structures red/black, red/yellow or yellow to be easily visible to helicopter pilot). It is noted that winching area arrangements on WTGs are currently unlicensed and will be subject to Helideck Certification Agency (HCA) approval in line with CAP 437 requirements. HCA approval will be sought during the design phase of Heli-deck winching arrangements on WTGs.

6.4 Emergency Response – Aviation Lighting and Marking Reporting

6.4.1 The requirements in relation to any failure of the installed aviation lighting during any phase of the Development has been designed to be compliant with the relevant requirements set out in the following guidance and policy document:

- Civil Aviation Authority (CAA) Policy Statement April 2012 - Failure of Aviation Warning Lights on Offshore Wind Turbines (CAA, 2012a).

6.4.2 The Air Navigation Order 2009 states:

In the event of the failure of any light which is required to be displayed by night the person in charge of a wind turbine generator must repair or replace the light as soon as reasonably practicable.

6.4.3 It is accepted in the case of offshore wind farms that there may be occasions when meteorological or sea conditions prohibit the safe transport of staff for repair tasks. Furthermore, there may be fault conditions which are wider ranging and would take longer to diagnose or repair. In such cases international standards and recommended practices require the issue of NOTAMs.

6.4.4 The CAA's Safety and Airspace Regulation Group 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 outage be anticipated to be greater than 36 hours in duration, the operator (BOWL or their appointed contractor or the OFTO as may be relevant) will request a NOTAM to be issued by informing the NOTAM section of the UK Aeronautical Information Service (AIS) as soon as possible by telephoning +44 (0) 20 8750 3773/3774 as soon as possible (AIS will also copy the details of the NOTAM to the operator and to the CAA via email (Windfarms@caa.co.uk)).

6.4.5 The following information will be provided when requesting a NOTAM:

- Name of wind farm (as already recorded in the AIP;
- Identifiers of affected lights (as listed in the AIP) or region of wind farm if fault is extensive (e.g. North east quadrant/south west quadrant/ entire or 3 NM centred on position 515151N 0010101W));
- Expected date of reinstatement; and
- Contact telephone number.

6.4.6 Upon completion of the remedial works, the AIS will be notified as soon as possible to enable a cancellation to be issued. The party that originally requested the NOTAM will then issue such notification so that a NOTAM cancelation notice can be issued. Such notification will include the name of the wind farm and the reference of the original NOTAM.

6.4.7 If an outage is expected to last longer than 14 days then the CAA will also be notified (at Windfarms@caa.co.uk) by the operator (BOWL or their appointed contractor or the OFTO as may be relevant) directly to discuss any issues that may arise and longer term strategies.

6.4.8 In order to expedite the dissemination of information during active aviation operations the operator (BOWL or their appointed contractor or the OFTO as may be relevant) may also establish a direct communication method with other operators in the area, for example Local Air Traffic Service Units, Local Airports, and Local Helicopter Operators (operations rooms). The information provided shall be the same as the information provided in the NOTAM and where possible include a NOTAM reference.

6.4.9 The operator (BOWL or their appointed contractor or the OFTO as may be relevant) will have overall responsibility for the issuing of NOTAMs and will undertake appropriate communications with CAA and other operators.

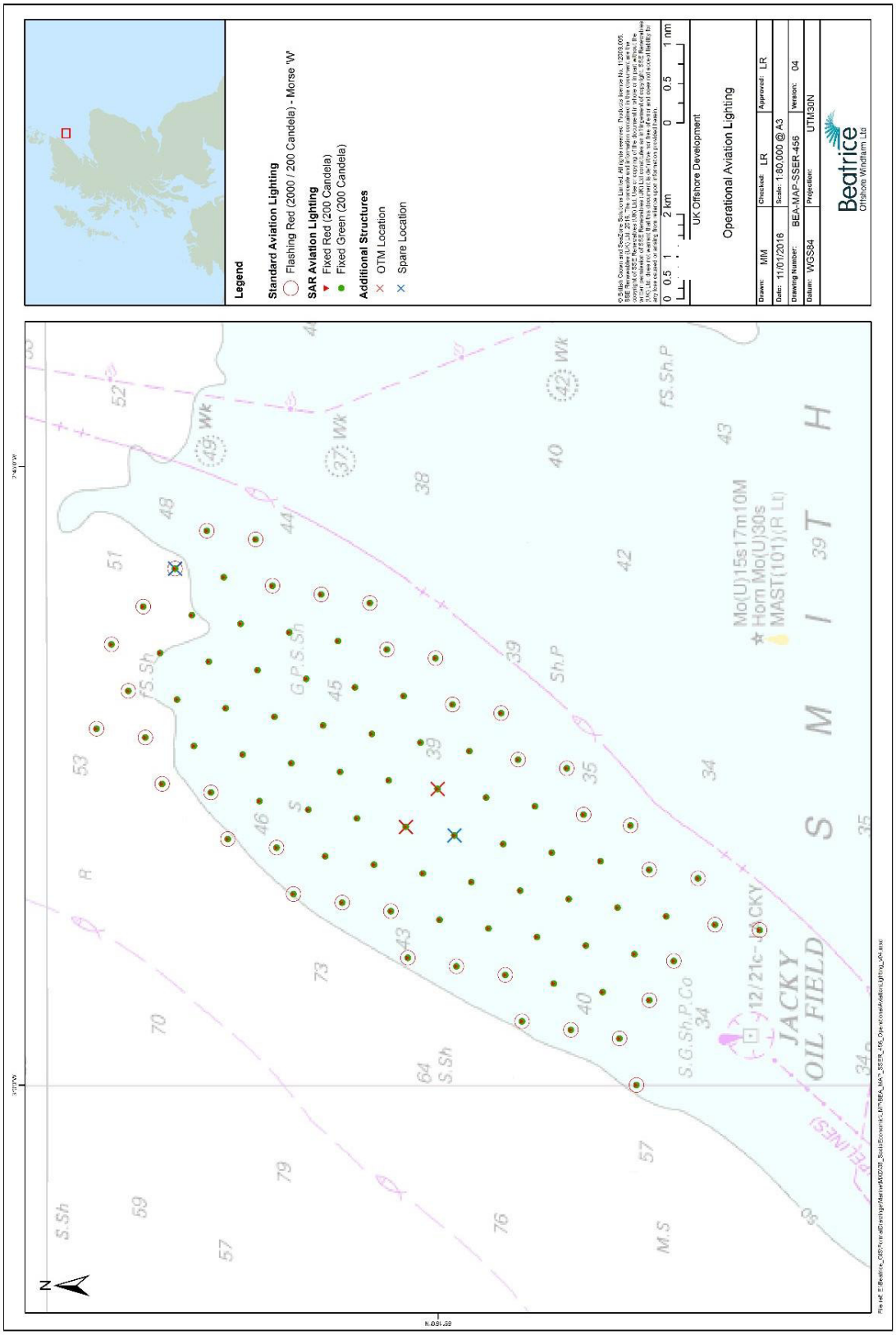


Figure 6.2 – Wind Farm WTG Operational Aviation Lighting

7 Marine Navigation Lighting and Marking

7.1 Introduction

7.1.1 This section sets out the marine navigation lighting and marking arrangements for the Wind Farm and OfTW. It includes a lighting and marking technical specification.

7.1.2 The marine navigational marking and lighting proposed has been agreed with NLB and MCA, and is compliant with the current, standard requirements for offshore wind farm structures (as set out in Appendix A). The relevant guidance is set out in relation to each of the specific requirement set out in the following sections.

7.1.3 BOWL and/or their chosen contractors will inform the NLB of all navigational marking and lighting of the site and its associated infrastructure and request Statutory Sanction prior to deployment.

7.2 Marine Navigation Lighting and Marking during Construction

7.2.1 This section details the temporary marine AtoN, including lighting and marking, during the construction of the Development.

7.2.2 The details have been agreed with NLB in principle and follow the relevant requirements of:

- International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) Recommendations 0-139 (The Marking of Man-Made Offshore Structures, Edition 2) (IALA, 2013).
- Department For Environment and Climate Change (DECC) Standard Marking Schedule for Offshore Installations (DECC, 2011).
- Maritime and Coastguard Agency (MCA), Marine Guidance Notice (MGN) 371, Offshore Renewable Energy Installations (OREIs) - Guidance on United Kingdom (UK) Navigational Practice, Safety and Emergency Response Issue (MCA, 2008).

Lighting and Marking of Structures

7.2.3 NLB have confirmed that there are no lighting or marking requirements for each installed jacket foundation or wind turbine prior to commissioning.

7.2.4 Partially completed piled foundations and/or jacket substructures may be left over the winter due to the proposed installation programme as summarised in Table 4.1 above.

7.2.5 In consultation with the NLB, it was agreed that the lighting and marking of temporary structures will be agreed as construction progresses, and in advance of any extended period of time where partially installed structures may be left during the construction programme. The proposed construction marking and lighting set out in Table 7.1 therefore sets out the principles of temporary lighting and marking, which may be refined during construction in agreement with NLB.

Table 7.1 – Marine navigation lighting during construction where required (where partially installed structures may be left during the construction programme for an extended period of time)

Structure	Specification
All wind turbine or OTM structures – To be confirmed with NLB	• All fixed structures marked with a Fl Y 2.5s light (visible through 360°) with a 2 nautical mile range. • Lights will meet an IALA Availability Category 2 (not less than 99%). • NLB also noted that synchronisation of these lights will not be required.

Construction Buoyage

7.2.6 The Wind Farm site will be marked as a construction area during the construction phase. The proposed construction buoyage has been developed in discussion and agreed with the NLB.

7.2.7 Table 7.2 details the specification required for the construction buoyage. All buoys will carry Automatic Identification System (AIS) transmitters set to message 21 – AtoN. BOWL or their appointed contractors will procure relevant licences for each transmission set by application to OFCOM.

7.2.8 Figure 7.1 shows the proposed layout of the construction buoyage. No structures will carry sound signals during the construction period, as agreed with the NLB.

Table 7.2 - Construction buoyage

Structure	Specification	Location (Degrees, Minutes and Seconds,)
North Cardinal	• With a focal plane of at least 3 metres. • Minimum of 3 metres in diameter at waterline. • Pillar shaped with a north cardinal shaped top mark, exhibiting a Quick (Q) White (W) light character (5 nautical miles (nm) nominal light range). • Category 1 Availability - 99.8% (IALA 2011). • Radar Reflector. • AIS AtoN transmitter (Category 3 Availability - 97.0%.).	58° 20' 13" N, 2° 50' 35" W

Structure	Specification	Location (Degrees, Minutes and Seconds,)
East Cardinal	• With a focal plane of at least 3 metres. • Minimum of 3 metres in diameter at waterline. • Pillar shaped with an east cardinal shaped top mark, exhibiting a Very (V) Q (3) 5 second (s) W light character (5 nm nominal light range and Category 1 Availability - 99.8%). • Radar Reflector. • AIS AtoN transmitter (Category 3 Availability - 97.0%.).	58° 17' 60" N, 2° 45' 6" W
South Cardinal	• With a focal plane of at least 3 metres. • Minimum of 3 metres in diameter at waterline. • Pillar shaped with a south cardinal shaped top mark, exhibiting a V Q (6) + L Fl 10s W light character (5 nm nominal light range and Category 1 Availability - 99.8%). • Radar Reflector. • AIS AtoN transmitter (Category 3 Availability - 97.0%.).	58° 10' 57" N, 2° 55' 25" W
West Cardinal	• With a focal plane of at least 3 metres. • Minimum of 3 metres in diameter at waterline. • Pillar shaped with a south cardinal shaped top mark, exhibiting a V Q (9) + L Fl 10s W light character (5 nm nominal light range and Category 1 Availability - 99.8%). • Radar Reflector. • AIS AtoN transmitter (Category 3 Availability - 97.0%.).	58° 12' 34" N, 3° 1' 19" W
Special Mark Buoy x 4	• Focal plane of at least 3 metres. • Minimum of 3 metres in diameter at waterline. • Pillar shaped with a yellow 'x' shaped top mark, exhibiting a Fl Y 5s light character (5 nm nominal light range). • Category 2 Availability – 99% • Radar Reflector	58° 12' 48" N, 2° 51' 40" W 58° 15' 22" N, 2° 47' 39" W 58° 18' 13" N, 2° 54' 14" W 58° 15' 20" N, 2° 57' 48" W

7.2.9 The availability of all Aids to Navigation (as stated in Table 7.2) employed throughout the construction phase shall be calculated over a rolling three year period.

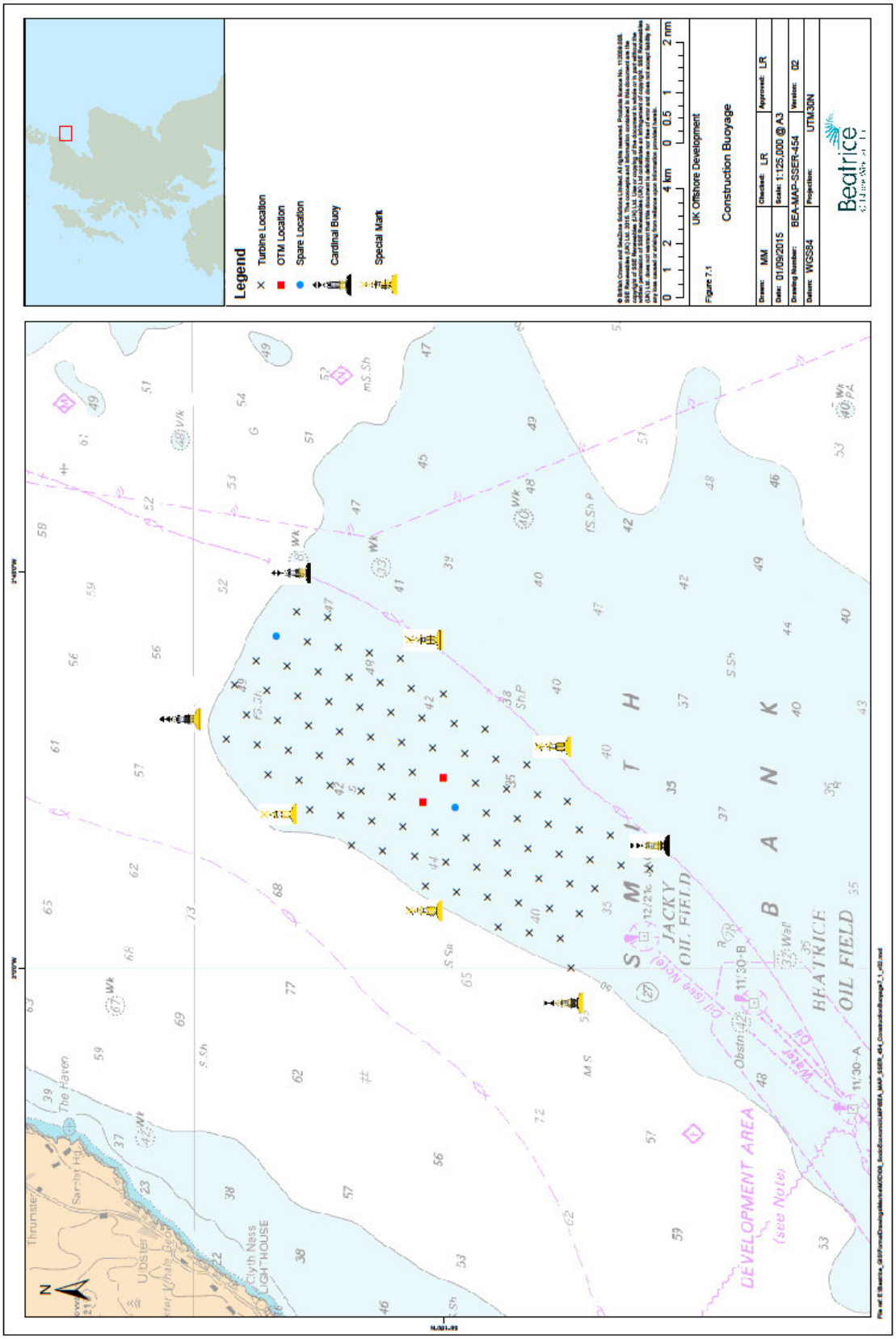


Figure 7.1 – Wind Farm Construction Buoyage

7.3 Marine Navigation Lighting and Marking during Operation

7.3.1 The details of the marking and lighting in the operational phase of the Development have been agreed with NLB in principle and follow the relevant requirements of:

- International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) Recommendations 0-139 (The Marking of Man-Made Offshore Structures, Edition 2) (IALA, 2013).
- Department For Environment and Climate Change (DECC) Standard Marking Schedule for Offshore Installations (DECC, 2011).
- Maritime and Coastguard Agency (MCA), Marine Guidance Notice (MGN) 371, Offshore Renewable Energy Installations (OREIs) - Guidance on United Kingdom (UK) Navigational Practice, Safety and Emergency Response Issue (MCA, 2008).

Marine Aids to Navigation

7.3.2 This section details the marine AtoN including lighting and marking during the operation of the Development.

7.3.3 Table 7.3 details the specification required for navigational lighting and sound signals to meet IALA and NLB requirements. Lighting will be provided on Significant Peripheral Structures (SPSs), i.e. those at the corners of the Wind Farm, and on selected Intermediate Peripheral Structures (IPSs).

Table 7.3 - Marine navigation lights and sound signals specification during operation

Structure/Type	Specification
Significant Peripheral Structures (SPS)	• Located on a corner or other significant point. • Each SPS will have 360º visibility, with flashing IALA special mark characteristics (yellow 5 second flash – FL.Y.5s) and with a range of not less than 5 nm. • IALA Category 1 Availability – 99.8%. • All SPS lights shall be synchronised. • Lights shall be located not less than 6 m and not more than 30 m above Highest Astronomical Tide (HAT).
Intermediate Peripheral Structure (IPS)	• Intermediate structures are those other than a SPS on the periphery. • Each IPS needs 360º visibility with a flashing yellow light different to the SPS (2.5 second – FL.Y.2.5s) and at a range of not less than 2 nm. • IALA Category 1 Availability – 99.8% • All IPS lights shall be synchronised. • Lights shall be located not less than 6 m and not more than 30 m above Highest Astronomical Tide (HAT).
Sound Signals	• Sound signals will be Morse U in rhythmic blasts every 30 seconds. • The minimum duration of each blast shall be 0.75 seconds. • The range will not be less than 2 nm. • Sound signals will be remotely operated to turn on when visibility drops below 2 nm or less.

Structure/Type	Specification
	• 360º audibility • IALA Category 3 Availability - 97.0%. • Will be fitted with a functionality test. • Mounted at least 9.9m above LAT and a maximum of 18.9m, and not higher than the lowest point of the arc of the rotor blades.

7.3.4 Figure 7.2 below illustrates the specific locations of the SPSs, IPSs and sound signals.

7.3.5 Table 7.4 details what specification is required for each of the SPSs and IPSs identified on Figure 7.2. Note that the letters are for reference only and not indicative of the proposed identification (ID) marking.

Table 7.4 – SPS and IPS specifications

Indicative Reference	Description	Indicative Reference	Description
A	SPS + SOUND	**H**	IPS
B	IPS	**I**	SPS + SOUND
C	SPS	**J**	SPS
D	SPS + SOUND	**K**	IPS
E	IPS	**L**	SPS + SOUND
F	IPS	**M**	IPS
G	SPS + SOUND	**N**	SPS + SOUND

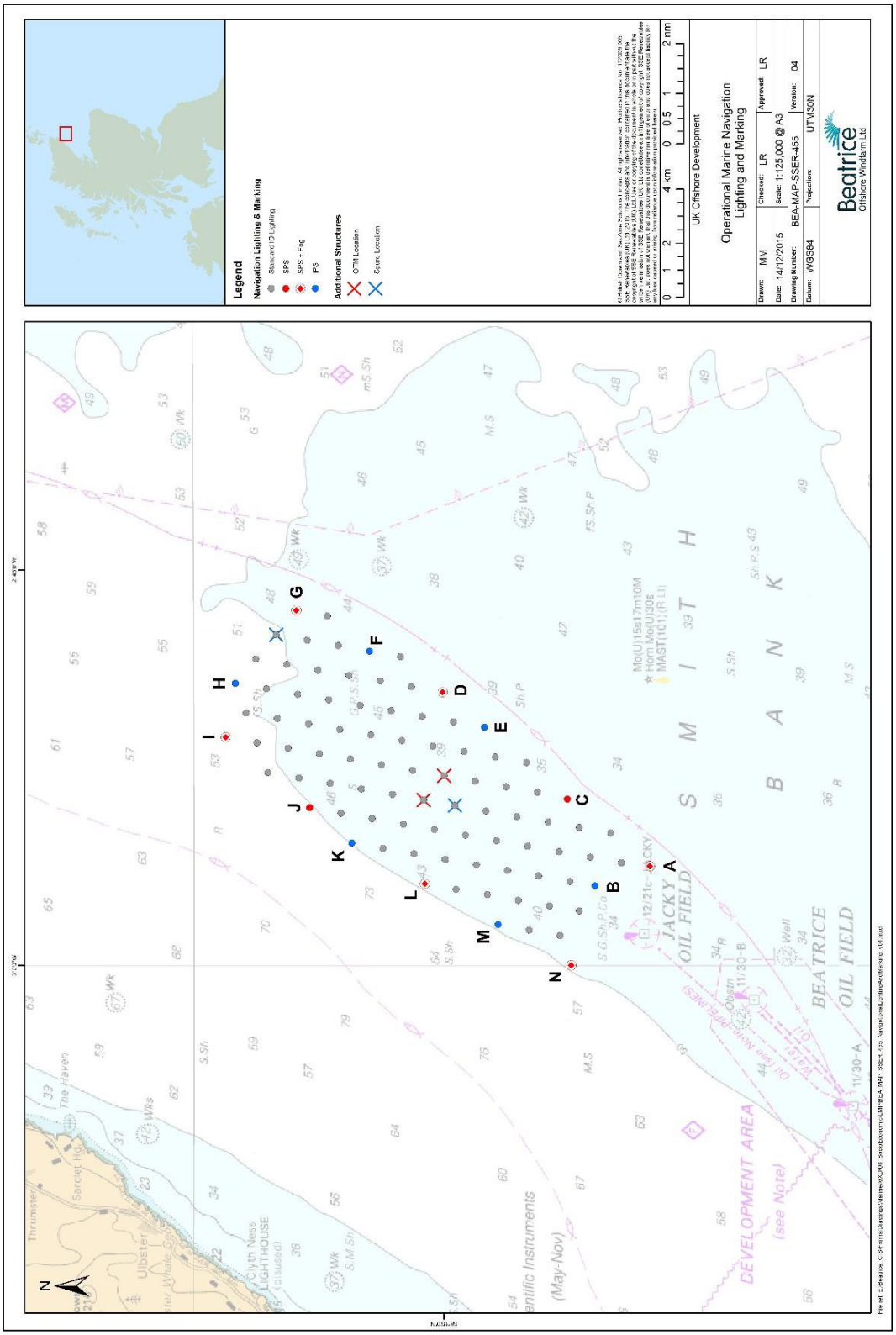


Figure 7.2 – Wind Farm Operational Marine Navigation and Lighting and Marking

Additional Marine Navigational Marking and Lighting of Structures

7.3.6 This section sets out the marking of structures above HAT, namely jacket foundations, transition pieces and wind turbines. Additional detail on the finishes and marking and identification of structure is provided for approval in the DSLP.

7.3.7 As noted above under paragraph 6.3.13, jacket foundations will be painted yellow (RAL 1004 Golden Yellow) from 2m below LAT up to the interface point at 22m above Lowest Astronomical Tides (LAT). Above this height, structures will be painted grey (RAL 7035 Light Grey).

7.3.8 Each wind farm structure (wind turbine generators and OTMs) will display identification panels with black letters or numbers on a yellow background visible in all directions. The identification characters will each be illuminated by a low-intensity light visible from a vessel thus enabling the structure to be detected at a suitable distance to avoid a collision with it. For offshore wind farms, the size of the identification characters in combination with the lighting will be such that, under normal conditions of visibility and all known tidal conditions, they are clearly readable by an observer stationed 3 metres above sea levels, and at a distance of not less than 150 metres from the structure.

7.3.9 Identification panels will be placed on the wind turbine towers directly above the yellow transition pieces and on the outside of the transition piece railings so as to provide adequate visual coverage and can therefore be read from all directions.

7.3.10 Identification marking is set out in the DSLP for approval and is compliant with the requirements of Marine Guidance Note (MGN) 371 (MCA, 2008) and will follow the search and rescue corridors approved by the MCA. In summary, the requirements will be as follows:

- Each unique turbine or OTM identifier is prefixed with a capital BE for Beatrice;
- The unique identifiers consist of a letter and a number;
- The use of O and I has been avoided to prevent confusion with numeric characters in line with MCA guidance (MGN 371);
- Consideration has been given to ‘SAR lanes’, and facilitating navigation thorough the Wind Farm.
- The lettering will be black on a yellow background illuminated by low intensity white shrouded lights (which will be controlled by a twilight sensor).

7.3.11 The wind turbine generators and OTMs will both be subject to the same lighting and marking requirements; although it is noted that OTMs are internal to the array and will not, therefore, be required to be lit by SPS or IPS lights.

7.3.12 BOWL does not intend to install any meteorological masts and as such there are no other structures within the Development area which require lighting or marking in relation to navigational safety.

7.3.13 BOWL propose to install 8 wave radar on the WTG and OTM foundations across the site. However, as an alternative three metocean buoys may be installed within the array area. In the event that metocean buoys are installed these will be identified as 'special marks', painted yellow in the majority with a mounted yellow cross for a day mark, and with a yellow navigational warning light flashing a sequence so as not to be confused with any other white light in the area.

Export Cable Marker Boards

7.3.14 Lit Cable Marker Boards (CMBs) will be positioned as near as possible to the shoreline (but above the MHWS) so as to mark the points at which the export cables come ashore. The CMBs shall be diamond shaped, with dimensions 2.5 metres long and 1.5 metres wide, background painted yellow with the inscription 'Cables' painted horizontally in black.

7.3.15 The cable boards shall be mounted at least 4 metres above ground level, with a navigation light flashing yellow once every five seconds ("Flash (Fl) Yellow(Y) 5s") mounted on the upward apex of the board. The nominal range of these lights will be 3 nautical miles (nm), and they will have an availability of not less than 97% (IALA Category 3) over a rolling three year period.

7.4 Emergency Response – Marine Aids to Navigation Reporting

7.4.1 A requirement of the management of AtoN within UK waters is to report navigation failures to NLB. This is done through an Aid to Navigation Availability Reporting database. 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.

7.4.2 The relevant operator (BOWL or its nominated contractor or the OFTO) will have overall responsibility to provide records of AtoN to NLB and provide details of failures or losses to NLB. The NSP provides specific details on other reporting requirements and notifications to local mariners.

7.4.3 It is noted that in the rare event of a significant loss of an AtoN such that a significant risk to navigation is considered likely to occur, a guard vessel may be required to maintain navigational safety until such time as the AtoN is repaired or replaced.

7.5 Additional Lighting not required by the Conditions

7.5.1 When using or installing working lights, such as down lighting on ladders and access platforms, they will not compromise the conspicuousness of navigational marking lights. Low level lighting will be used on the boat landing and will be fitted so as not to impact on navigational lights. The lighting will be such that during a transfer the boat landing will be visible in all directions during hours of poor visibility or darkness.

8 Compliance with the Application, ES and SEIS

8.1 Introduction

8.1.1 In addition to the conditions presented in Table 1.1, Condition 8 of the S36 Consent states:

The Development [Wind Farm] must be constructed and operated in accordance with the terms of the Application and related documents, including the accompanying ES, the SEIS and Annex 1 of this letter, except in so far as amended by the terms of this section 36 consent.

8.1.2 Sections 8.2 and 8.3 set out information from the ES/SEIS with regard to:

- Compliance with the lighting and marking scheme assessed; and
- Delivery of the stated lighting and marking-related mitigation.

8.2 Compliance with the ES/SEIS

8.2.1 The ES and SEIS described a range of specification and layout options that could be applied during the construction of the Development. This took the form of a broad 'Rochdale Envelope' incorporating a variety of options. The ES and SEIS defined likely lighting and marking requirements for the Development, based upon these broad options and which adhered to marine navigation and aviation standard guidance.

8.2.2 Since the Development consents were awarded, the design of the Development has been substantially refined. In order to demonstrate continued compliance of this refined design, Appendix B provides a tabulated comparison of lighting and marking specifications as presented in the ES/SEIS and this LMP.

8.3 Delivery of Mitigation Proposed in the ES/SEIS

8.3.1 The ES and SEIS detailed a number of mitigation commitments specific to the design of the Development. Measures relevant to lighting and marking are presented in full in Appendix C, which also identifies where each commitment has been addressed within this LMP (or within other relevant BOWL Consent Plans).

9 References

The Air Navigation Order 2009. Statutory Instruments No. 3015.

Civil Aviation Authority (CAA) (2012a), Failure of Aviation Warning Lights on Offshore Wind Turbines. Policy Statement Apr 2012.

CAA (2012b), The lighting and marking of wind turbine generators and meteorological masts in United Kingdom territorial waters. Policy Statement Nov. 2012.

CAA (2013a), Civil Aviation Publication (CAP) 437 – Standards for offshore helicopter landing areas.

CAA (2013b), CAP 764 – Policy and Guidelines on Wind Turbines.

Department For Environment and Climate Changes (DECC) (2011), Standard Marking Schedule for Offshore Installations.

International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) (2011), Recommendation O-130 – Categorisation and Availability Objectives for Short Range Aids to Navigation, Edition 2.

IALA (2013), Recommendation 0-139 - The Marking of Man-Made Offshore Structures, Edition 2.

Maritime and Coastguard Agency (MCA) (2008a), Marine Guidance Notice (MGN) 371, Offshore Renewable Energy Installations (OREIs) - Guidance on United Kingdom (UK) Navigational Practice, Safety and Emergency Response Issue.

MCA (2014), Offshore Renewable Energy Installations, Emergency Response Co-operation Plans (ERCoP) for Construction and Operation Phase, and Requirements for Emergency Response and Search and Rescue (SAR) Helicopter Operations.

Ministry of Defence (MOD) (2014), Ministry of Defence Obstruction Lighting Guidance, November 2014, published on the Renewable UK website at: http://www.renewableuk.com/en/utilities/document-summary.cfm/docid/243606FF-735D-4C1B-A037572619727ACB [accessed 20/05/2015].

Appendix A: Legislation, Policy and Guidance

The following relevant legislation, policy and guidance are in place at the time of completing this LMP, and have informed its preparation:

Marine Navigation:

- International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) Recommendations 0-139 (The Marking of Man-Made Offshore Structures, Edition 2) (IALA, 2013).
- Department For Environment and Climate Change (DECC) Standard Marking Schedule for Offshore Installations (DECC, 2011).
- Maritime and Coastguard Agency (MCA), Marine Guidance Notice (MGN) 371, Offshore Renewable Energy Installations (OREIs) - Guidance on United Kingdom (UK) Navigational Practice, Safety and Emergency Response Issue (MCA, 2008).

Aviation & DIO:

- The Air Navigation Order 2009. Statutory Instrument No. 3015. With deviation to Article 220 at NLBs request.
- Civil Aviation Authority (CAA) Policy Statement April 2012 - Failure of Aviation Warning Lights on Offshore Wind Turbines (CAA, 2012a).
- CAA Policy Statement November 2012 - The lighting and marking of wind turbine generators and meteorological masts in United Kingdom territorial waters (CAA, 2012b).
- CAA Civil Aviation Publication (CAP) 437 – Standards for offshore helicopter landing areas (CAA, 2013a).
- CAA CAP 764 – Policy and Guidelines on Wind Turbines (CAA, 2013b).
- Ministry of Defence Obstruction Lighting Guidance, November 2014 (MOD, 2014).

Emergency Response:

- MCA, Offshore Renewable Energy Installations, Emergency Response Co-operation Plans (ERCoP) for Construction and Operation Phase, and Requirements for Emergency Response and Search and Rescue (SAR) Helicopter Operations (MCA, 2014).

Appendix B: Compliance with lighting and marking assessed in the ES/SEIS

Table B1 presents a comparison of consented lighting and marking specifications against the details set out in this LMP.

Table B1 – Comparison of ES/SEIS Rochdale Envelope and LMP lighting and marking specifications

Lighting and marking element	ES/SEIS	LMP
Turbine Markings	Unique Identification: • There will be Unique Identification Characters (UIC) including numbering on turbine towers and nacelle roofs. • The UICs on the turbine tower will be clearly readable in all directions under normal conditions of visibility and all known tidal conditions by an observer at sea level (6.9 m above LAT). The UIC will be visible from a distance of 500 feet (150 m) in all directions as well as from above for aviation purposes. • The UIC, where practicable, will be displayed in black letters or numbers 1 m in height on a yellow background. However, precise dimensions will be determined by the height of lights and necessary range of visibility of the identification numbers. • The UICs will each be illuminated by a low-intensity light controlled from the site Control Centre and activated as required. Blade Markings: • Turbines will have high contrast markings (dots or stripes) placed at 10 metre intervals on both sides of the blades to provide search and rescue helicopter pilots with a hover-reference point.	Unique Identification: • LMP confirms use of identification numbers, as described in the ES/SEIS. See LMP paras 6.3.10 -6.3.14 and 7.3.8 – 7.3.9. Blade Markings: • LMP confirms use of blade marking, as described in the ES/SEIS. See LMP paras 6.3.7- 6.3.9 .
Turbine Obstruction Lighting	• Obstruction lighting is to be fitted on offshore turbines with a height of 60 m or more above the highest astronomical tide. At least one medium intensity steady red light (2,000 candela) should be positioned as close as possible to the top of the fixed structure with a requirement for some downward spillage of light. Where four or more wind turbines are located together in the same group, with the permission of the CAA, only those on the periphery of the group need to be fitted with obstruction lighting. • For any structure with potential to conduct heli-hoist operations the	• LMP confirms obstruction and heli-hoist lighting. See LMP Table 6.3 and para 6.3.4. • Note that rather that the red light being steady, as per CAA guidance, NLB has requested a flashing light so as to avoid confusion with navigational lights in compliance with

Lighting and marking element	ES/SEIS	LMP
	following requirements will be met. The red light positioned for navigational purposes will be visible from all angles of azimuth and have a minimum intensity of 50 candelas for angles of elevation between 0 and 15 degrees, and a minimum intensity of 200 candelas between 5 and 8 degrees, but will not be visible below the level of the winching area platform	current CAA and MCA guidance.
Perimeter and Route Lighting	• In consultation with the relevant stakeholders, the precise location of buoys or beacons will be agreed and will be placed to mark the perimeter of a group of structures, or to mark routes/channels through a group of structures. • At least one light will be visible upon approaching the structure from any direction. • The light will be placed not less than 9.4 m above LAT and not more than 33.4 m above LAT. The vertical distribution of the projected beam will be such that the light will be visible from the immediate vicinity of the structure to the maximum luminous range of the light. The lighting will have a minimum effective intensity of 1400 candelas. • Both SPSs and IPSs will be synchronised to display an IALA special mark characteristic, yellow flashing lights every five seconds with a range of not less than five nautical miles. The lights will be operated in unison with a flashing character according to • Morse letter “U” and with a maximum period of 15 seconds. The intermediate structures will have a yellow flash character with a range of not less than two nautical miles. The lights will be visible from all directions in the horizontal plane and have an availability of no less than 99%.	• LMP confirms perimeter lighting as described in the ES/SEIS. See LMP Section 7.3, specification agreed with NLB.
Heli-hoist Platform Lighting	• A green light will be located in the safety zone to indicate that the turbine blades and nacelle are secured in position prior to helicopter hoist operations commencing. This would be capable of being operated both remotely, and from the heli-hoist platform itself. • The green light will have a minimum intensity of 16 candelas and a maximum	• LMP confirms lighting to allow safe heli-hoist operations as described in the ES/SEIS. See LMP Table 6.3 and Paragraph 6.3.4 which sets out the relevant lighting

Lighting and marking element	ES/SEIS	LMP
	intensity of 60 candelas for all angles of azimuth and for all angles of elevation from 0 to 90 degrees but will not be visible below the level of the winching area platform. The lighting will be visible from a minimum distance of 150 m in all directions and from above.	requirements in compliance with relevant guidance. Please note that the heli-hoist lighting detailed in the LMP has been updated in light of the forthcoming publication of Revision 8 of CAA Civil Aviation Publication (CAP) 437.
Turbine Boat Landing Lighting	• Boat landings will be illuminated during personnel transfers. The lighting will be such that during a transfer the boat landing will be visible in all directions during hours of poor visibility and darkness.	• LMP confirms illumination of landings as described in the ES/SEIS. See LMP Section 7.5.
Further Aids to Navigation	• The Wind Farm will be marked with sound signals such as fog horns. These will be operated when the meteorological visibility is two nautical miles or less. • When required there will be rhythmic blasts corresponding to Morse letter "U" every 30 seconds with the minimum duration of the short blast being 0.75 seconds and covering a range of no less than two nautical miles. • Sound signals will be mounted at least 9.9 m above the level of the LAT but not higher than 18.9 m and not higher than the lowest point of the arc of the rotor blades.	• LMP confirms sound signals as described in the ES/SEIS. See LMP Table 7.3 and Table 7.4, specification agreed with NLB.

Appendix C: ES and SEIS Commitments

Table B1 presents the commitments made by BOWL in the ES and SEIS to mitigation measures relevant to this LMP. The table provides details of the commitments and a cross-reference to where each commitment is implemented.

A complete register of the mitigation, management and monitoring commitments made in the ES/SEIS and required by consent conditions is set out in the commitments registers included as part of the Environmental Management Plan (EMP).

Table B1 – ES and SEIS mitigation relevant to the LMP

Source	Reference (ES or SEIS chapter)	Details of Commitment	Implementation
ES	Project Description	Turbines will incorporate turbine identification markings including, but not limited to, an identifier on the turbine tower, an identifier on the nacelle roof, contrast stripes on the blades and illuminated signage on the turbine tower.	LMP paragraph 6.3.7 – 6.3.12 and Section 7.3.8 – 7.3.9
ES	Project Description	The external colour scheme and marking requirements of the OSP [OTM] will comply with the guidelines set by the MCA, RYA [Royal Yachting Association] and IALA	LMP Section 7.3.11 (note RYA does not publish separate guidelines)
ES	Project Description	All required lighting and markings on Metocean Buoys will be adhered to and the locations of the equipment will be publicised through the appropriate notification procedures.	No meteorological masts are currently planned by BOWL. Metocean buoys - paragraph 7.3.13
ES	Project Description	Marine navigational marking, including lights and marks on significant and intermediate peripheral structures will be provided in accordance with NLB requirements	LMP Section 7.3
ES	Project Description	Turbines and OSPs [OTMs] will incorporate the identification markings, safety markings and signage as specified in requirements and guidelines set by the MCA, RYA and IALA	LMP Section 7.3 (note RYA does not publish separate guidelines)
ES	Project Description	There will be Unique Identification Characters (UIC) including numbering on turbine towers and nacelle roofs. Precise dimensions of the letters or numbers will be determined by the height of lights and necessary range of visibility of the identification numbers. The UICs will each be illuminated by a low-intensity light controlled from the site Control Centre and activated as required. The UICs on the turbine tower will be positioned so as to be clearly readable in all directions under normal conditions of visibility and all known	LMP paragraph 6.3.10 – 6.3.12 and Section 7.3.8 – 7.3.9 (note UICs are referred to as ID Markings within the LMP)

Source	Reference (ES or SEIS chapter)	Details of Commitment	Implementation
		tidal conditions by an observer at sea level (6.9m above LAT). The UIC will be visible from a distance of 500 feet (150m) in all directions as well as from above for aviation purposes.	
ES	Project Description	Turbines will have high contrast markings (dots or stripes) placed at 10 metre intervals on both sides of the blades	LMP paragraph 6.3.7 – 6.3.10 – blade hover reference markings
ES	Project Description	All offshore structures taller than 63.9 m above LAT will feature at least one medium intensity steady red light positioned as close as possible to the top of the fixed structure. The obstruction lighting will be for use at night and the lights will be operated in unison with a flashing character according to Morse letter "W" and with a maximum period of 15 seconds	LMP confirms obstruction lighting. See LMP Section 6.3 and Table 6.2.
ES	Project Description	For any structure with potential to conduct heli-hoist operations the following requirements will be met. The red light positioned for navigational purposes will be visible from all angles of azimuth and have a minimum intensity of 50 candelas for angles of elevation between 0 and 15 degrees, and a minimum intensity of 200 candelas between 5 and 8 degrees, but will not be visible below the level of the winching area platform	LMP paragraph 6.3.5
ES	Project Description	At least one light will be visible upon approaching the structure from any direction. The light will be placed not less than 9.4 m above LAT and not more than 33.4 m above LAT. The vertical distribution of the projected beam will be such that the light will be visible from the immediate vicinity of the structure to the maximum luminous range of the light. The lighting will have a minimum effective intensity of 1400 candelas	LMP Section 7.3 (note minimum of 6 m above HAT and maximum of 30 m above HAT has been agreed with NLB)
ES	Project Description	Significant Peripheral Structures and Intermediate Structures will be synchronised to display an IALA special mark characteristic, yellow flashing lights every five seconds with a range of not less than five nautical miles. The intermediate structures will have a yellow flash character with a range of not less than two nautical miles. The lights will be visible from all directions in the horizontal plane and have an availability of no less than 99%	LMP Section 7.3 and Table 7.3 and 7.4

Source	Reference (ES or SEIS chapter)	Details of Commitment	Implementation
ES	Project Description	Heli-hoist platforms will be illuminated during transfer of personnel. A green light will be located in the safety zone to indicate that the turbine blades and nacelle are secured in position prior to helicopter hoist operations commencing. This would be capable of being operated both remotely, and from the heli-hoist platform itself. The green light will have a minimum intensity of 16 candelas and a maximum intensity of 60 candelas for all angles of azimuth and for all angles of elevation from 0 to 90 degrees but will not be visible below the level of the winching area platform. The lighting will be visible from a minimum distance of 150 m in all directions and from above	LMP Paragraph 6.3.5 and Table 6.2
ES	Project Description	Boat landings will be illuminated during personnel transfers. The lighting will be such that during a transfer the boat landing will be visible in all directions during hours of poor visibility and darkness	LMP Section 7.5
ES	Project Description	The Wind Farm will be marked with sound signals such as fog horns. These will be operated when the meteorological visibility is two nautical miles or less. When required there will be rhythmic blasts corresponding to Morse letter "U" every 30 seconds with the minimum duration of the short blast being 0.75 seconds and covering a range of no less than two nautical miles. Sound signals will be mounted at least 9.9 m above the level of the LAT but not higher than 18.9 m and not higher than the lowest point of the arc of the rotor blades	LMP Section 7.3 – table 7.3 and 7.4 (fog signals as per NLB and IALA standards)
ES	Commercial Fisheries	All infrastructure installed during the construction phase will be marked and lit, in line with standard industry practice, and as further described in the [ES Chapter] 18: Wind Farm Shipping and Navigation. The information will be distributed to fishermen through agreed channels as defined in the construction management programme	LMP Section 7.2 and 7.3 Notification procedures are set out in the NSP.
ES	Shipping and Navigation	Marine navigational marking, including lights and marks on significant and intermediate peripheral structures will be provided in accordance with NLB requirements, which will comply with IALA Recommendation 0-139 (the Marking of Offshore Wind Farms) and the requirements of MCA MGN 371	LMP Section 7.3

Source	Reference (ES or SEIS chapter)	Details of Commitment	Implementation
ES	Shipping and Navigation	All wind turbine generators (WTGs) and other wind farm individual structures will each be marked with clearly visible unique identification characters which can be seen by both vessels at sea level and aircraft (helicopters and fixed wing) from above	LMP paragraph 6.3.10 – 6.3.12 and Section 7.3.8 – 7.3.9
ES	Shipping and Navigation	The identification characters shall each be illuminated by a low-intensity light visible from a vessel thus enabling the structure to be detected at a suitable distance to avoid a collision with it. The size of the identification characters in combination with the lighting will be such that, under normal conditions of visibility and all known tidal conditions, they are clearly readable by an observer, stationed three metres above sea levels, and at a distance of at least 150 metres from the turbine	LMP paragraph 6.3.10 – 6.3.12 and Section 7.3.8 – 7.3.9
ES	Aviation	The Wind Farm will be equipped with a lighting scheme which fulfils the requirements set out in Article 220 of CAP 393 Air Navigation: The Order and the Regulations and as detailed to support winching operations at the wind farm. The lighting scheme will be agreed with aviation stakeholders and developed in accordance with the most current policy and strategy articulated by the CAA and the Department of Energy and Climate Change	LMP Section 6.3. The proposed aviation lighting is compliant with relevant guidance and will be confirmed through consultation on this LMP.
SEIS	Shipping and Navigation	- Marine navigational marking will be provided	LMP Section 7