

Volume 9: Appendices (Offshore)

# Appendix 17.2

## Vessel Management Plan



# North Irish Sea Array Offshore Wind Farm Lighting and Marking Plan

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**Presented to** North Irish Sea Array Windfarm Ltd  
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## Abbreviations Table

Abbreviation	Definition
AIS	Automatic Identification System
ASAM	Aeronautical Services Advisory Memorandum
CAA	Civil Aviation Authority
CAP	Civil Aviation Publication
cd	Candela
CIL	Commissioners of Irish Lights
EU	European Union
HAT	Highest Astronomical Tide
IAA	Irish Aviation Authority
IALA	International Association of Marine Aids to Navigation and Lighthouse Authority
IPS	Intermediate Peripheral Structure
IRCG	Irish Coast Guard
LMP	Lighting and Marking Plan
m	Metre
MCA	Maritime and Coastguard Agency
MGN	Marine Guidance Note
MSO	Marine Survey Office
NISA	North Irish Sea Array
NVIS	Night Vision Imaging Systems
O&M	Operation and Maintenance
OREI	Offshore Renewable Energy Installation
OSP	Offshore Substation Platform
nm	Nautical Mile
s	Second
SAR	Search and Rescue
SI	Statutory Instrument
SPS	Significant Peripheral Structure
UK	United Kingdom
UPS	Uninterrupted Power Supply
WGS84	World Geodetic System 1984
WTG	Wind Turbine Generator

## 1 Introduction

1. This Lighting and Marking Plan (LMP) sets out proposed marine and aviation lighting and marking of the offshore aspects of the North Irish Sea Array (NISA) Offshore Wind Farm development (hereafter ‘the proposed development’), a proposed offshore wind farm located in Irish waters approximately 9.5 nautical miles (nm) off the coast of Drogheda. The marine and aviation lighting and marking schemes are based on the relevant guidance and recognised industry standards as set out in Section 2, with schemes proposed for Project Options for which consent is sought by the Developer. Further details of the associated Project Options are provided in **Volume 2, Chapter 6: Description of the Proposed Development – Offshore**. In summary, the Project Options consist of:

- **Project Option 1:** 49 Wind Turbine Generators (WTGs) with a rotor diameter of 250 metres (m) and one Offshore Substation Platform (OSP); and
- **Project Option 2:** 35 WTGs with a rotor diameter of 276m and one OSP.

## 2 Guidance

2. This section summarises guidance that has been adhered to in this LMP in relation to both marine and aviation aspects.
3. Primary guidance for marine lighting and marking is considered to be *International Association of Marine Aids to Navigation and Lighthouse Authority (IALA) G1162* (IALA, 2021). Primary guidance for aviation obstruction lighting is considered to be *Irish Aviation Authority (IAA) Guidance Material on Off-Shore Wind Farms, Aeronautical Services Advisory Memorandum (ASAM) No 18. Issue 2* (IAA, 2015). Consideration of relevant United Kingdom (UK) guidance where appropriate, notably Maritime and Coastguard Agency (MCA) Marine Guidance Note (MGN) 654 and Annexes (MCA, 2021) has also been made, noting that key stakeholders have indicated UK guidance should be applied in lieu of equivalent Irish guidance, which at the time of writing (May 2024) is undergoing public consultation with a final version to be published at a later date.
4. Industry standards of relevance to lighting and marking of offshore wind farms applied in the UK have also been considered and applied where necessary, noting the guidance detailed below has taken precedence.

### 2.1 Marine

5. The marine navigation lighting and marking detailed in Section 3.1 and Section 4.1 follows the following guidance documents:
  - *IALA Recommendations O-139 on the Marking of Man-Made Offshore Structures* (IALA, 2021) and *Guidance G1162 on the Marking of Man-Made Offshore Structures* (IALA, 2021);
  - *IALA R1001 – The IALA Maritime Buoyage System* (IALA, 2017); and
  - *MGN 654 Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response* (MCA, 2021).

### 2.2 Aviation

6. The aviation lighting and marking including in relation to Search and Rescue (SAR) detailed in Section 4.2 follows the requirements set out in the following guidance documents:
  - *CAP 437 – Standards for Offshore Helicopter Landing Areas* (Civil Aviation Authority (CAA), 2021);
  - *CAP 764 – Policy and Guidelines on Wind Turbines* (CAA, 2016);
  - *IAA Guidance Material on Off-Shore Wind Farms* (IAA, 2015);
  - *Statutory Instrument. (S.I.) No. 215/2005 - IAA (Obstacles To Aircraft in Flight) Order, 2005* (IAA, 2005); and

- MGN 654 Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response (MCA, 2021);
    - In particular, *SAR Annex 5: Offshore Renewable Energy Installations: Requirements, Guidance and Operational Considerations for SAR and Emergency Response* (MCA, 2024).
7. Civil Aviation Authority (CAA) guidance has also been referenced where relevant noting it is referenced within MGN 654 (MCA, 2021); the IAA guidance is applied on a primary basis.



### 3 Construction Phase

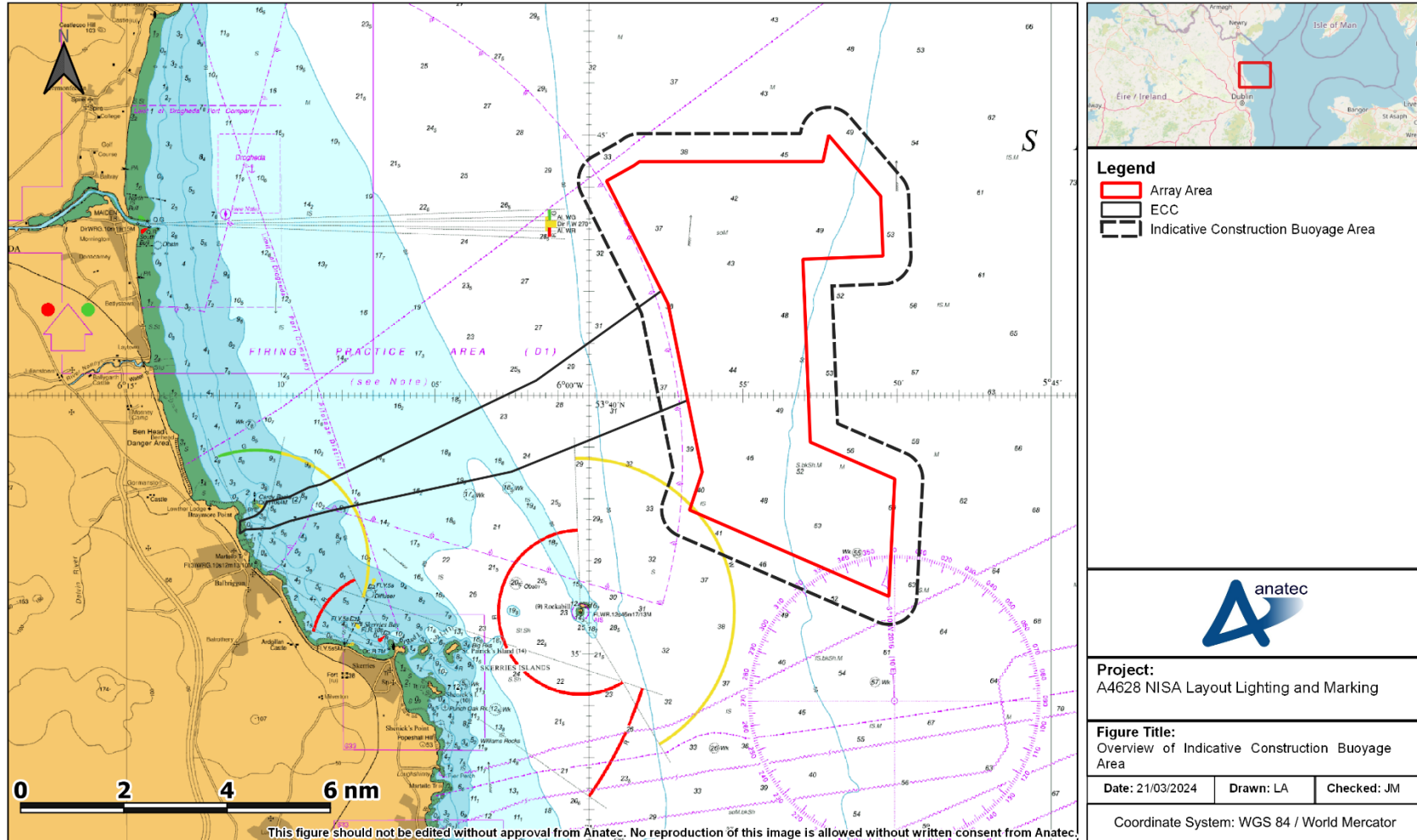
8. This section describes the marine (Section 3.1) and aviation (Section 3.2) lighting and marking to be implemented during the construction phase.

#### 3.1 Marine

9. The marine lighting and marking to be implemented during the construction phase is summarised in Table 3.1, which also includes a guidance column, listing the relevant guidance/ stakeholder for each lighting and marking aspect where appropriate, noting that the guidance provides the full proposed technical specifications.
10. Figure 3.1 sets out the extent of the indicative construction buoyage area for the proposed development. Construction buoyage shall be established eight weeks prior to the proposed development commencing construction to allow time for passing traffic to familiarise with the buoyed construction area, noting this is in accordance with best practice. It is anticipated there will be no more than 12 buoys deployed to mark the construction area. The buoyage shall remain in place until the operational marking requirements have been installed, then inspected and passed by Irish Lights. Precise buoyage locations will be as directed by Commissioners of Irish Lights (CIL), noting it is indicatively anticipated that may be located 1,000 metres (m) from the Array Area (see Figure 3.1), outside of the proposed development.
11. The Developer will seek statutory sanction from CIL in advance of the establishment, alteration, or removal of any Aid to Navigation (AtoN).

**Table 3.1 Construction Phase Marine Lighting and Marking**

Lighting and Marking Aspect	Relevant Structures	Specifications	Relevant Guidance or Stakeholder Requirements
Temporary construction lighting	All structures	All surface piercing structures will be marked with a temporary light during construction and until operational lighting is commissioned. The temporary construction lights will have the following specification: <ul style="list-style-type: none"> <li>▪ Yellow 2.5 second (s) flash;</li> <li>▪ At least 2 nautical mile (nm) range; and</li> <li>▪ 360° visibility.</li> </ul>	Industry standard
Construction buoyage	Marking periphery of array area (anticipated no more than 12 buoys required)	The array construction area will be marked with a mixture of cardinal and special marks, as directed by CIL. The construction buoyage will have the following specification: <ul style="list-style-type: none"> <li>▪ Lighting colour and sequence as per standard buoy requirements;</li> <li>▪ At least 5nm range;</li> <li>▪ Some buoys may require Automatic Identification System (AIS) transmitters; and</li> <li>▪ Buoys will be located as directed by Irish Lights but anticipated to be within 1,000m of the array area.</li> </ul>	<ul style="list-style-type: none"> <li>▪ UK industry standard</li> <li>▪ <i>IALA R1001 – The IALA Maritime Buoyage System</i> (IALA, 2017)</li> </ul>



**Figure 3.1 Overview of Indicative Construction Buoyage Area**

## 3.2 Aviation

12. There will be no specific aviation lighting and marking implemented during the construction phase; however, relevant information on the proposed development will be provided to aviation stakeholders. In particular, as required under S.I.215 (IAA, 2005), the IAA will be notified of any enroute obstacles (including mobile cranes) above 45m in height, giving at least 30 days' notice.
13. The following details will be provided:
  - Geographic latitude;
  - Geographic longitude;
  - Elevation; and
  - Height.
14. In line with ASAM No 18 (IAA, 2015), at least three months in advance of the installation of structures, the following information will be supplied to the IAA:
  - Positional data representing the estimated position of each machine or structure (WTGs and OSP) to be erected. The geodetic datum to which all obstructions shall be referred is the World Geodetic System 1984 (WGS84). Coordinates will be provided in degrees, minutes, seconds and decimals of a second, as appropriate;
  - The estimated maximum elevation of each structure (WTG and OSP) in feet and metres;
  - Proposed lighting details for each structure;
  - Proposed marking details for each structure;
  - Whether it is proposed that a Radar enhancer/ transponder/ reflector or Radar/ AIS is fitted;
  - Minimum and maximum spacing between structures (WTGs and OSP);
  - Planned earliest date of erection; and
  - Any other information considered relevant for air navigation.

## 4 Operation and Maintenance Phase

15. This section presents the marine (Section 4.1) and aviation (Section 4.2) lighting and marking to be implemented during the operation and maintenance (O&M) phase.

### 4.1 Marine

16. The marine operational lighting and marking to be implemented are summarised in Table 4.1. These include a guidance column listing the relevant guidance/stakeholder for each lighting and marking aspect where appropriate, noting that this guidance provides the full technical specifications required by the relevant stakeholders. The proposed marine lighting and marking is then illustrated for Project Option 1 and Project Option 2 in Figure 4.1 and Figure 4.2, respectively.
17. Since the OSP is located on the periphery it may be deemed a Significant Peripheral Structure (SPS) or Intermediate Peripheral Structure (IPS) and will be subject to the same requirements detailed in Table 4.1 as for any WTG selected as an SPS or IPS. For Project Option 1 the OSP is proposed to be an IPS. For Project Option 2 the OSP does not require a light given the number and spacing of structures.
18. The Developer will seek statutory sanction from CIL in advance of the establishment, alteration, or removal of any AtoN.

#### 4.1.1 Failure of Marine Lighting

19. The Developer will ensure that appropriate redundancy and/ or back up capability is utilised to ensure the appropriate IALA availability categories as set out in Table 4.1 are met. In the event of a significant loss of an AtoN such that a significant risk to navigation is considered likely to occur, consultation shall be undertaken with Commissioner of Irish Lights (CIL), Irish Coast Guard (IRCG), and the Marine Survey Office (MSO) to determine the need for any additional mitigation which may include promulgation of navigational warnings, deployment of temporary AtoNs or use of a guard vessel.

**Table 4.1 O&M Phase Marine Lighting and Marking Summary**

Lighting and Marking Aspect	Relevant Structures	Specifications	Relevant Guidance or Stakeholder Requirements
SPSs	Selected peripheral structures, noting not all peripheral structures will carry marine AtoN	Marine lights marking selected periphery WTGs as required under IALA. The SPSs will have the following specification: <ul style="list-style-type: none"> <li>▪ Yellow 5s flash <i>*Not specified in IALA but UK best practice</i>;</li> <li>▪ At least 5nm range;</li> <li>▪ 360° visibility;</li> <li>▪ Synchronised;</li> <li>▪ Located not less than 6m and not more than 30m above Highest Astronomical Tide (HAT) and below the lowest point of any arc of rotor blades;</li> <li>▪ At least IALA Category 2; and</li> <li>▪ At least 96 hours back up/ Uninterrupted Power Supply (UPS) capability.</li> </ul>	IALA G1162 (IALA, 2021).
IPSS	Selected peripheral structures not already marked as SPSs, noting not all peripheral structures will carry marine AtoN	Marine lights marking selected periphery WTGs as required under IALA. The IPSSs will have the following specification: <ul style="list-style-type: none"> <li>▪ Yellow 2.5s flash <i>*Not specified in IALA but UK best practice</i>;</li> <li>▪ At least a 2nm range;</li> <li>▪ 360° visibility;</li> <li>▪ Synchronised;</li> <li>▪ Located not less than 6m and not more than 30m above HAT and below the lowest point of any arc of rotor blades;</li> <li>▪ IALA Category 2; and</li> <li>▪ At least 96 hours back up/ UPS capability.</li> </ul>	IALA G1162 (IALA, 2021).

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Title North Irish Sea Array Offshore Wind Farm Lighting and Marking Plan

Lighting and Marking Aspect	Relevant Structures	Specifications	Relevant Guidance or Stakeholder Requirements
Sound signals	Selected SPSs	<p>The sound signals will have the following specification:</p> <ul style="list-style-type: none"><li>▪ Blast every 30s lasting 2s;</li><li>▪ At least 2nm range;</li><li>▪ 360° audibility;</li><li>▪ Each WTG with a sound signal installed will also have to have a visibility meter / detector;</li><li>▪ Located not less than 6m and not more than 30m above HAT; and</li><li>▪ IALA Category 3.</li></ul>	<ul style="list-style-type: none"><li>▪ IALA G1162 (IALA, 2021); and;</li><li>▪ Use as directed by Irish Lights.</li></ul>
AIS	Selected SPSs	At least IALA Category 3.	IALA G1162 (IALA, 2021).
ID marker boards	All structures	<p>ID system will be agreed with Irish Lights and IRCG, under IALA requirements:</p> <ul style="list-style-type: none"><li>▪ ID panels with black letters on yellow background;</li><li>▪ Letters 1m high;</li><li>▪ Visibility in all directions; and</li><li>▪ Use of either illumination or retroreflective material, noting any illumination will be hooded/ baffled to avoid confusion with AtoN.</li></ul>	IALA G1162 (IALA, 2021).
WTG paint	All WTGs	<ul style="list-style-type: none"><li>▪ Foundations painted yellow (RAL 1023) all round from HAT to a height of at least 15m above HAT; and</li><li>▪ Remainder of structures painted light grey (RAL 7035).</li></ul>	<ul style="list-style-type: none"><li>▪ IALA G1162 (IALA, 2021); and;</li><li>▪ Industry standard.</li></ul>

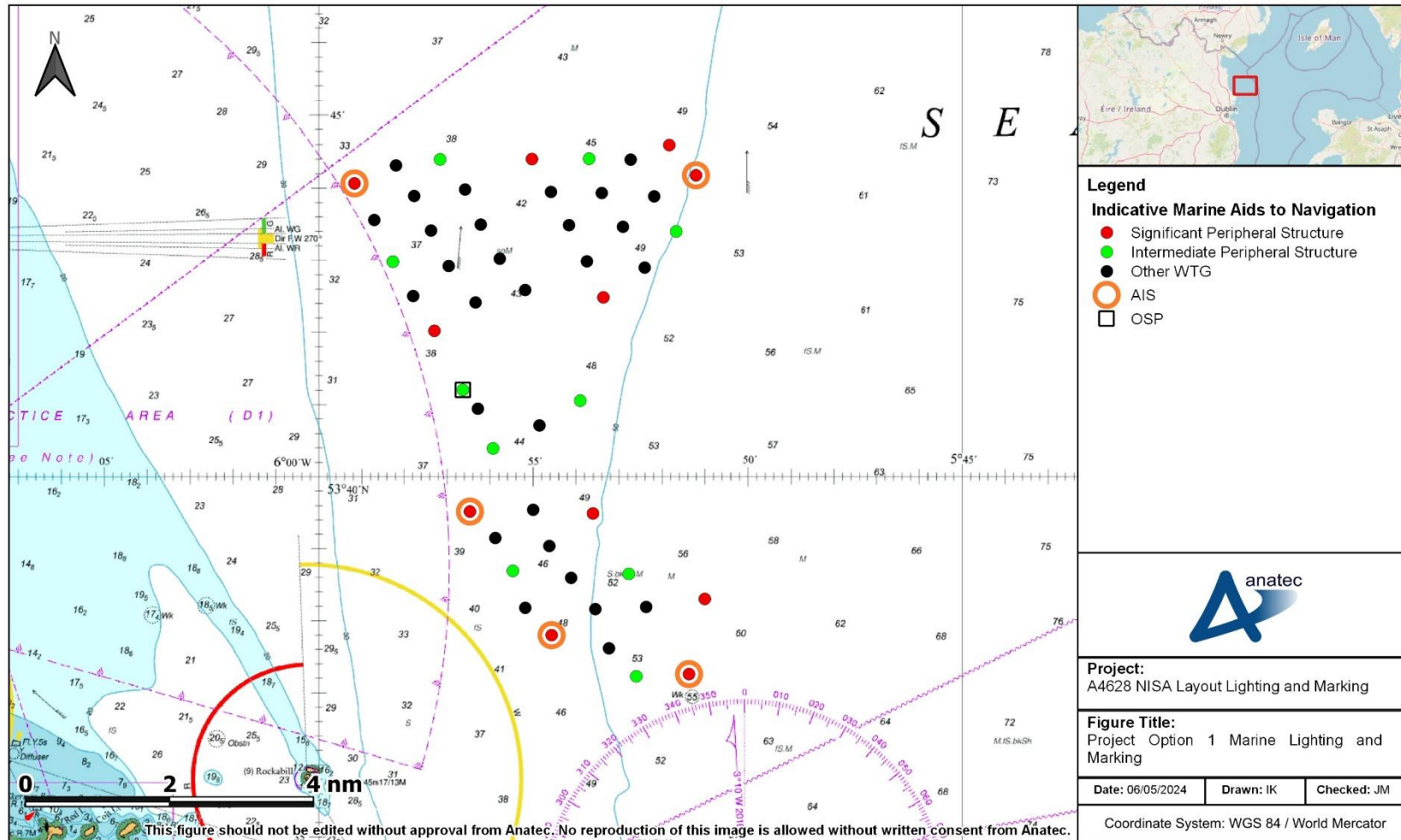
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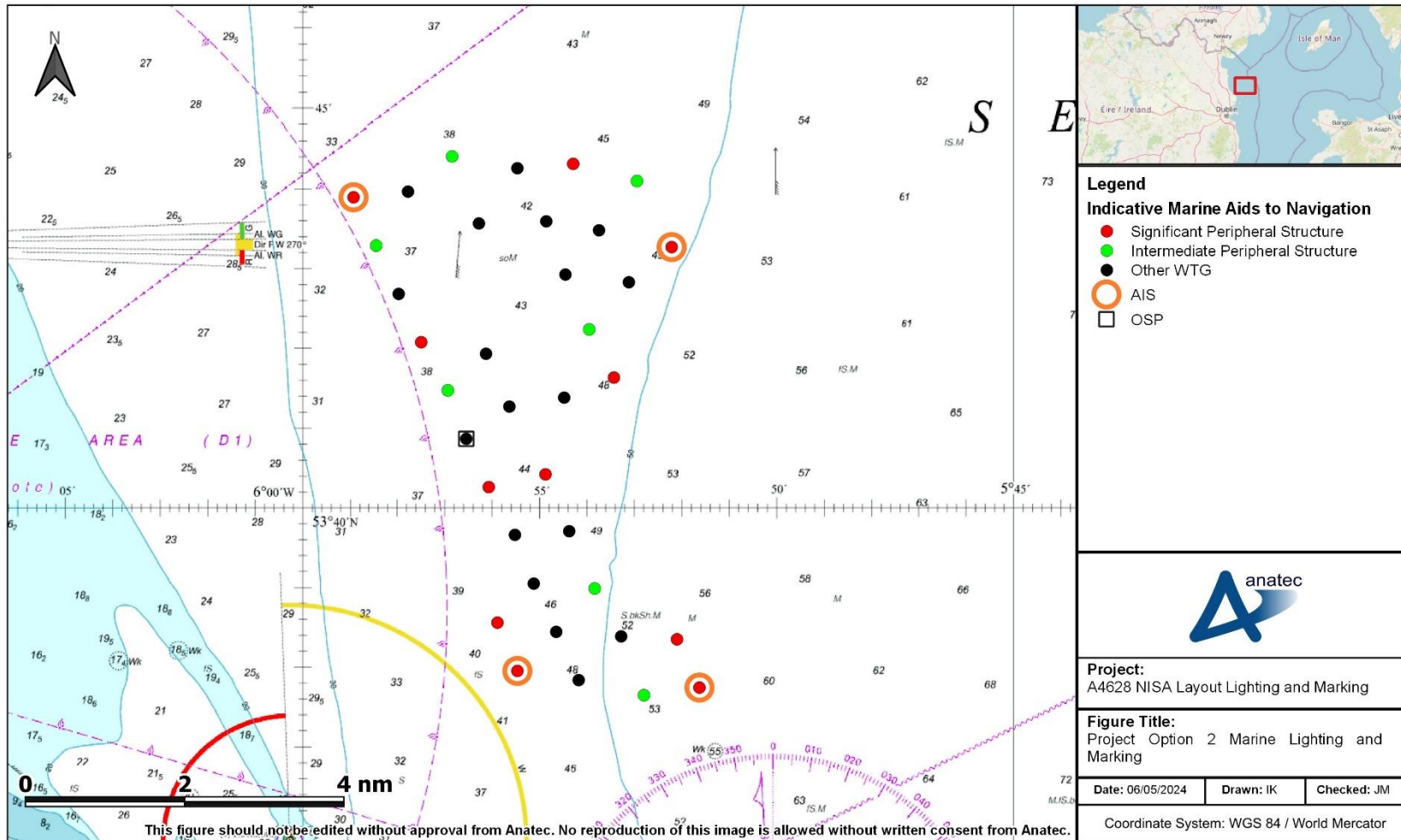
**Title** North Irish Sea Array Offshore Wind Farm Lighting and Marking Plan

Lighting and Marking Aspect	Relevant Structures	Specifications	Relevant Guidance or Stakeholder Requirements
OSP paint	OSP	<ul style="list-style-type: none"><li>▪ Foundations painted yellow (RAL 1023 or similar) all round from HAT to a height of at least 15m above HAT; and</li><li>▪ Remainder of structures painted light grey (RAL 7035 or similar) excluding topside structures such as work cabins, cranes, etc.</li></ul>	<ul style="list-style-type: none"><li>▪ IALA G1162 (IALA, 2021); and;</li><li>▪ Industry standard.</li></ul>





**Figure 4.1 Project Option 1 Marine Lighting and Marking**



**Figure 4.2 Project Option 2 Marine Lighting and Marking**

## 4.2 Aviation

20. The aviation operational lighting and marking to be implemented are summarised in Table 4.2. These include a guidance column listing the relevant guidance/ stakeholder for each lighting and marking aspect where appropriate, noting that this guidance provides the full technical specifications required by the relevant stakeholders. The proposed aviation lighting and marking is then illustrated for Project Option 1 and Project Option 2 in Figure 4.3 and Figure 4.4, respectively.
21. Since the OSP is located on the periphery it may be subject to the same requirements detailed in Table 4.1 as for any WTG on the periphery.
22. The key applicable IAA guidance is ASAM No 18 (IAA, 2015) which provides aviation lighting requirements for offshore wind farms.

### 4.2.1 Failure of Aviation Lighting

23. ASAM No 18 (IAA, 2015) states that *“any light which fails shall be repaired or replaced as soon as is reasonably practicable. An alerting system for light failure will be put in place, such as remote monitoring or other suitable method agreeable to the IAA”*. Appropriate maintenance and reporting procedures will therefore be discussed and agreed with the IAA.

**Table 4.2 O&M Phase Aviation Lighting and Marking Summary**

Lighting and Marking Aspect	Relevant Structures	Specification	Relevant Guidance or Stakeholder Requirements
Hazard warning lights	All peripheral structures	<p>In accordance with the International Civil Aviation Organisation Annex 14 standards, on a 24-hour basis, for High Intensity Type A lighting will be required. The hazard warning lights will have the following specification:</p> <ul style="list-style-type: none"> <li>▪ Mounted on the highest point practicable of the structure;</li> <li>▪ White with flash rate of 40-60 flashes per minute;</li> <li>▪ Effective intensity of:               <ul style="list-style-type: none"> <li>▪ 200,000 candela (cd) ± 25% when background luminance above 500cd per square metre (m<sup>2</sup>);</li> <li>▪ 20,000cd ± 25% when background luminance between 50 and 500cd/m<sup>2</sup>; and</li> <li>▪ At least 2,000 cd when background luminance below 50cd/m<sup>2</sup>.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>▪ ASAM No 18 (IAA, 2015)</li> <li>▪ IAA have indicated that there are potential intentions to align with the approach taken in the wider European Union (EU) or in the UK. Given that the upcoming guidance is understood to closely resemble MGN 654 (MCA, 2021) as detailed in Section 2, UK requirements for aviation lighting under Civil Aviation Authority (CAA) Civil Aviation Publication (CAP) 764 (CAA, 2016) are provided for reference in Appendix A.</li> </ul>

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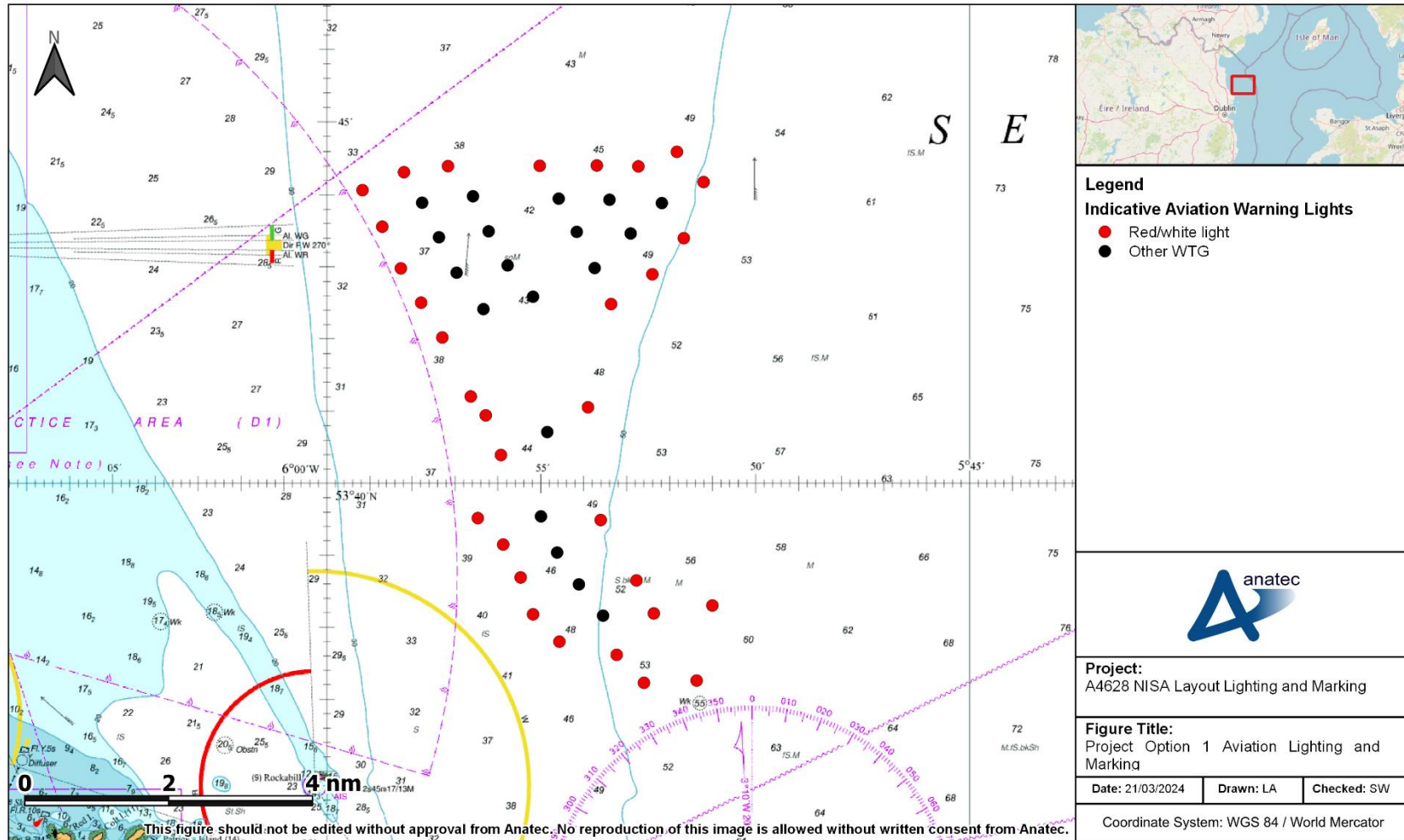
Lighting and Marking Aspect	Relevant Structures	Specification	Relevant Stakeholder Guidance or Requirements
		<ul style="list-style-type: none"><li>Light fittings baffled so that practically no light will be emitted below the horizontal, or as otherwise agreed with the IAA;</li><li>All lights across the array should flash in synchronisation and reductions in light intensity should occur simultaneously if practicable; and</li><li>Visible through 360° in azimuth.</li></ul>	
SAR lights	All structures	<p>SAR lighting is an MCA requirement for UK projects under MGN 654. Specifications shown as per MGN 654:</p> <ul style="list-style-type: none"><li>200cd red light, steady when in use off otherwise;</li><li>360° visibility; and</li><li>Compatible with NVIS.</li></ul>	MGN 654 (MCA, 2021)
SAR blade markings	All WTGs	<p>Specification under MGN 654:</p> <ul style="list-style-type: none"><li>Red marks (preferably dots) at 10, 20 and 30m from hub end;</li><li>Displayed near trailing edge of blades;</li></ul>	MGN 654 (MCA, 2021)

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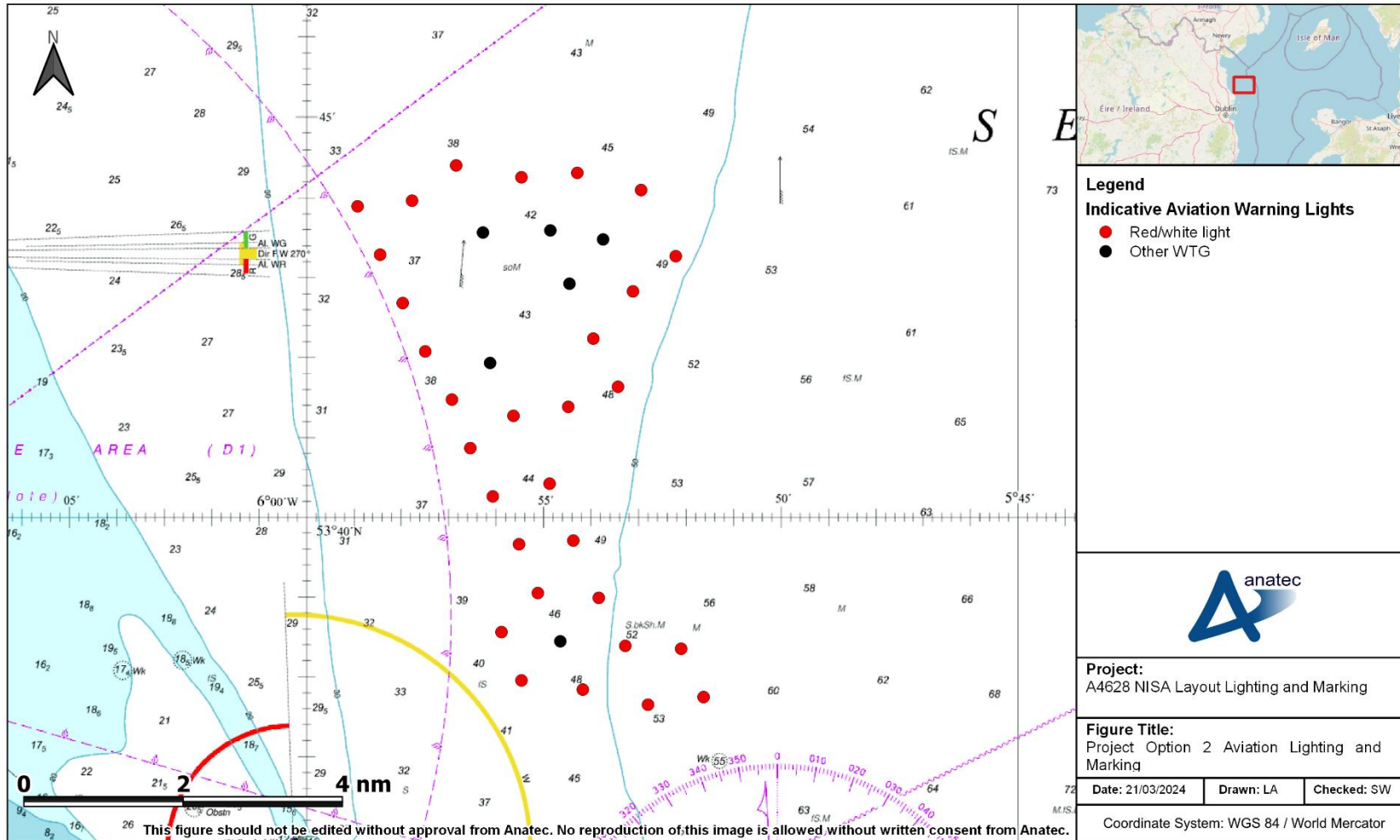
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Lighting and Marking Aspect	Relevant Structures	Specification	Relevant Guidance or Stakeholder Requirements
		<ul style="list-style-type: none"><li>▪ Contrasting colour to blades, recommended red (RAL 3020);</li><li>▪ Minimum 600 millimetres (mm) in diameter however may need to be larger dependent on overall size, shape of turbine and blades; and</li><li>▪ Blade tip also marked in red (RAL 3020), approximately 2% of blade length.</li></ul>	
Marine identification panels	All structures	Specification under MGN 654: <ul style="list-style-type: none"><li>▪ ID numbers will be marked on the WTG nacelle roofs;</li><li>▪ ID system will be agreed with CIL and IRCG; and</li><li>▪ Not less than 1.5m height, with proportional width.</li></ul>	MGN 654 (MCA, 2021)
Hoist area markings	Intended that UL standards under CAP 437 (CAA, 2023) will be applied, if agreed with IAA.		



**Figure 4.3 Project Option 1 Aviation Lighting and Marking**



**Figure 4.4** Project Option 2 Aviation Lighting and Marking



## 5 References

CAA (2016). *The Air Navigation Order*.

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

CAA (2023). *CAP 437. Standards for Offshore Helicopter Landing Areas*.

IAA (2005). *S.I. No. 215/2005 - IAA (Obstacles To Aircraft in Flight) Order, 2005*.

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IALA (2021). *Guidance G1162 on the Marking of Man-Made Offshore Structures*.

MCA (2021). *MGN 654 (M+F) Offshore Renewable Energy Installations safety response*. Southampton: MCA.

MCA (2024). *MGN 654 SAR Annex 5: Offshore Renewable Energy Installations: Requirements, guidance and operational considerations for SAR and Emergency Response*. Southampton: MCA.

## Appendix A UK CAA Aviation Hazard Lighting Requirements

24. Given that Irish offshore wind farm guidance closely resembles MGN 654 (MCA, 2021) as detailed in Section 2, but is not yet finalised, a summary of UK requirements for aviation hazard lighting under CAA CAP 764 (CAA, 2016) is detailed as follows:

- Red 2,000 cd light displayed at night<sup>1</sup>.
- Dimmable to 200cd when visibility is greater than 5km at night.
- Off during the day.
- Synchronised flashing Morse 'W'<sup>2</sup>.
- 360° visibility.
- Compatibility with NVIS.
- If agreed with CAA, lights located only on periphery structures. Such lighting, where achievable, shall be spaced at longitudinal intervals not exceeding 900m.
- UPS of eight hours required to maintain all aviation warning lights<sup>3</sup>

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<sup>1</sup> Definition of night / day as per Air Navigation Order (CAA, 2016).

<sup>2</sup> Industry standard, from CAP 764: *"To resolve concerns from the maritime community, work has been undertaken to develop an aviation warning lighting standard which is clearly distinguishable from maritime lighting. Where it is evident that the default aviation warning lighting standard (article 220) may generate issues for the maritime community, a developer can make a case, that is likely to receive CAA approval, for the use of a flashing red Morse Code Letter 'W' instead"*.

<sup>3</sup> Not specified in CAP 764, but recognised as the industry standard and a CAA requirement.