

MachairWind Offshore Windfarm

Appendix 12 Outline Lighting and Marking Plan





MachairWind Offshore Windfarm Outline Lighting and Marking Plan

Prepared by Anatec Limited
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Abbreviations Table

Abbreviation	Definition
ACOMS	Airspace Co-ordination Obstacle Management Service
AIS	Automatic Identification System
AtoN	Aid to Navigation
CAA	Civil Aviation Authority
CAP	Civil Aviation Publication
cd	Candela
DECC	Department of Energy and Climate Change
FI	Flashing
HAT	Highest Astronomical Tide
IALA	International Organization of Marine Aids to Navigation
ID	Identification
IPS	Intermediate Peripheral Structure
IR	Infrared
K	Kelvin
km	Kilometre
LMP	Lighting and Marking Plan
m	Metre
MCA	Maritime and Coastguard Agency
MD-LOT	Marine Directorate Licensing Operations Team
MGN	Marine Guidance Note
mm	Millimetre
MOD	Ministry of Defence
NLB	Northern Lighthouse Board
nm	Nautical Mile
NOTAM	Notice to Airmen
NVIS	Night Vision Imaging System
O&M	Operation and Maintenance
OFCOM	Office of Communications

Abbreviation	Definition
OSP	Offshore Substation Platform
SAR	Search and Rescue
SCADA	Supervisory Control and Data Acquisition
SPS	Significant Peripheral Structure
UK	United Kingdom
UKHO	United Kingdom Hydrographic Office
VMPNSP	Vessel Management Plan and Navigational Safety Plan
WTG	Wind Turbine Generator
Y	Yellow

1 Introduction

1.1 Background

The MachairWind Offshore Windfarm (hereafter, 'the Project') is a proposed offshore windfarm developed by MachairWind Limited ('the Applicant') located approximately 6.7 nautical miles (nm) west of the island of Colonsay. The Windfarm Development Area (WDA) will contain Wind Turbine Generators (WTG), Offshore Substation Platforms (OSP), associated foundations, inter-array cables, OSP link cables, offshore export cables located therein, and cable protection. Consent for the installation and operation of the offshore export cable corridor infrastructure of the Project will be sought separately.

The Lighting and Marking Plan (LMP) will be informed by consultation with key stakeholders and will be based on the contents of this outline LMP. Key stakeholders will include the Northern Lighthouse Board (NLB), Maritime and Coastguard Agency (MCA), Civil Aviation Authority (CAA) and the Ministry of Defence (MOD).

This LMP will seek to discharge the consent decisions relating to lighting and marking, once known, as set out in **Table 1.1**. This will include reference to how and where the condition clauses have been addressed within the LMP.

Table 1.1 Consent Conditions to be Discharged by Lighting and Marking Plan

Condition Reference	Condition Text	Where Addressed in LMP
[Consent condition details to be added post-consent award]		

1.2 Linkages with Other Plans

The consent conditions require that the development of the LMP be consistent with a number of other consent plans and consent conditions. Details of the linkages and relevant cross references are set out in **Table 1.2**.

Table 1.2 Linkages with Other Plans

Plan	Details Contained in Plan	Reference
Vessel Management Plan and Navigational Safety Plan (VMPNSP)	Details vessel management and navigational safety during the construction and operation and maintenance (O&M) phases of the Project, in order to mitigate the impact of project vessels and the navigational risk to other legitimate users of the sea. Due to the overlap between the two in navigational safety measures presented they will be kept consistent as far as reasonably practicable, noting the	An Outline VMPNSP is provided in Appendix 13 Outline Vessel Management Plan and Navigational Safety Plan .

Plan	Details Contained in Plan	Reference
	typical wording of NSP conditions requires inclusion of lighting and marking details.	

1.3 Project Background

The final layout for the Project will be presented in **Figure 1.1** and will include the proposed Identification (ID) marking that will be implemented (adhering to relevant MCA guidance, including a clear site identifier followed by sequential lettering and numbering based on row and position in line with Search and Rescue (SAR) requirements).

[Figure showing final layout to be added post-consent]

Figure 1.1 Overview of Final Layout

In addition, **Appendix 13.1 Navigational Risk Assessment** has identified embedded mitigation measures. The mitigations identified relevant to lighting and marking are described in **Table 1.3**.

Table 1.3 Embedded Mitigation Measures Relevant to Lighting and Marking

Embedded Mitigation Measure	Description
Buoyed construction/ decommissioning area.	The WDA construction/decommissioning area will be marked by buoyage as required by NLB.
Compliance with Marine Guidance Note (MGN) 654 and its annexes.	The Project will be compliant with MGN 654 and its annexes (MCA, 2021). Includes MGN 654 SAR Annex 5.
Guard vessels as required under risk assessment.	A guard vessel(s) will be deployed where deemed appropriate by internal risk assessment undertaken by the Applicant.
Appropriate lighting and marking.	Marking and lighting of the site in agreement with NLB and in line with International Organization of Marine Aids to Navigation (IALA) O139 (IALA, 2021) and G1162 (IALA, 2022). As per standard NLB requirements Statutory Sanctions will be sought prior to the establishment, alteration or removal of any aid to navigation (AtoN).
Appropriate promulgation of information.	Local Notifications to Mariners and Kingfisher Bulletins will be updated and reissued at weekly intervals during construction and at least five days prior to planned maintenance works.
Marking of all offshore infrastructure on Admiralty charts.	All infrastructure associated with the Project (including subsea cables) will be shown on appropriately scaled United Kingdom Hydrographic Office (UKHO) Admiralty charts.

2 Guidance and Consultation

2.1 Marine

The marine navigation lighting and marking detailed in **Section 3** and **Section 4.1** complies with the requirements in the following guidance documents:

- IALA O-139 Recommendations on the Marking of Man-made Offshore Structures (IALA, 2021) and G1162 Guidance on the Marking of Man-made Offshore Structures (IALA, 2022);
- IALA R1001 – The IALA Maritime Buoyage System (IALA, 2023);
- MGN 654 and Annexes – Offshore Renewable Energy Installations (OREIs) – Guidance on United Kingdom (UK) Navigational Practice, Safety and Emergency Response (MCA, 2021).

Consideration has also been given to:

- Standard Marking Schedule for Offshore Installations (Department of Energy and Climate Change (DECC), 2011).

2.2 Aviation

The aviation lighting and marking detailed in **Section 4.2** complies with the requirements set out in the following guidance documents:

- CAA – The Air Navigation Order (ANO) (CAA, 2016) and Civil Aviation Publication (CAP) 393 (CAA, 2021 (b));
- CAA CAP 764 – Policy and Guidelines on Wind Turbines (CAA, 2025);
- CAA CAP 437 – Standards for Offshore Helicopter Landing Areas (CAA, 2021 (a));
- MGN 654 and Annexes – Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response (MCA, 2021);
- MOD Obstruction Lighting Guidance (MOD, 2020).

2.3 Consultation

In addition to consideration of relevant guidance, the Applicant will consult with relevant stakeholders on the contents of the LMP post-consent, including but not limited to the MCA, NLB, CAA, and MOD.

This general approach has been discussed with NLB for marine AtoN and CAA for aviation lighting as part of the EIA process.

3 Construction Phase Lighting and Marking Measures

3.1 Marine Measures

The marine lighting and marking to be implemented during the construction phase of the Project will be summarised in **Table 3.1**. This also lists the relevant guidance/stakeholder for each aspect of lighting and marking where appropriate, noting that the guidance provides the full technical specifications required by the relevant stakeholders.

Figure 3.1 will set out the positions of the construction buoyage, with the associated coordinates and specifications to be provided in **Table 3.2**. For clarity, an ID will be provided for each of the buoys presented in **Figure 3.1** and **Table 3.2**.

All buoyage for the construction phase will meet the following IALA specifications:

- Radar reflectors;
- Focal plane 3 metres (m) to 5 m above the waterline;
- Range of 5 nm; and
- Minimum of 3 m diameter at the waterline.

As required, the Applicant will seek statutory sanction from NLB prior to deployment of any AtoN. The construction buoyage will be deployed at least four weeks prior to the commencement of construction. See **Section 7.1** for procedures in cases of AtoN failure.

Lighting on structures will be controllable remotely via the Supervisory Control and Data Acquisition (SCADA) system. Any working lights (such as down lighting and access platforms), may be required to be switched on or off during SAR operations as per MGN 654 (MCA, 2021).

Table 3.1 Construction Phase Lighting and Marking Summary

Lighting and Marking Aspect	Relevant Structures	Specifications	Figure Illustration	Relevant Stakeholder Guidance or Requirement
Temporary construction lighting	All structures	- Flashing (Fl) Yellow (Y) 2.5 seconds (s). 360° visibility (multiple lights may be required). - At least 2 nm range.	N/A	Industry standard and IALA G1162
Temporary construction lighting removal	All structures	Temporary lighting removed once NLB have provided written approval of the operational lighting and marking on the structures.	N/A	IALA R1001
Construction buoyage	N/A	[Further specifications to be added post-consent (e.g., number/type of buoyage)] - Construction buoyage may need to be relocated, in consultation with NLB, when vessel types are confirmed. - Each buoy will be clearly identifiable via a physical name marking on the buoy that will include a clear reference to the Project. Any buoys transmitting via Automatic Identification System (AIS) will also include	Figure 3.1	IALA R1001/IALA G1162

Lighting and Marking Aspect	Relevant Structures	Specifications	Figure Illustration	Relevant Guidance or Stakeholder Requirement
		these names in the transmission.		
Construction buoyage removal	N/A	Construction buoyage removed once NLB have provided written approval of the operational lighting and marking on the structures.	N/A	IALA R1001/IALA G1162

[Figure showing construction buoyage relative to the Project to be added post-consent]

Figure 3.1 Construction Buoyage

Table 3.2 Construction Buoyage Details

Buoy	ID	Latitude	Longitude	Light and Topmark Specification
[Buoy details to be added post-consent]				

3.2 Aviation Measures

There will be no specific aviation lighting and marking implemented during the construction phase, however there will be promulgation of information and reporting required as detailed below. The transition to operational lighting and marking (**Section 4.2**) will be discussed with the CAA post-consent.

Relevant information relating to the Project will be promulgated to aviation stakeholders as required under the relevant CAA guidance (see **Section 2.2**) prior to and during the construction phase of the Project. This approach to aviation measures during the construction phase will be agreed with CAA and MOD post-consent.

The CAA requests that obstacles are reported even if they are below 60m, including temporary structures (e.g. cranes) or large construction vessels and meteorological masts, as this contributes to ongoing air safety initiatives for the protection of property, infrastructure and aviators. These should also be notified to the CAA using the Airspace Co-ordination Obstacle Management Service (ACOMS). This will enable the necessary Notice to Airmen (NOTAM) to be generated.

To expedite the dissemination of information during active aviation operations, the Applicant may also establish a direct communication method with aviation operators in the area. The information provided will be the same as the information provided in the NOTAM, and where possible, include a NOTAM reference.

4 Operation and Maintenance Phase Lighting and Marking Measures

4.1 Marine Measures

The marine lighting and marking to be implemented during the O&M phase will be detailed in **Table 4.1** (WTGs) and **Table 4.2** (OSPs). These include a guidance column, which lists the guidance relevant to each lighting and marking aspect where appropriate (see also **Section 2.1**).

The overarching marine lighting and marking scheme will then be presented in **Figure 4.1** relative to the approved layout.

As required, the Applicant will seek statutory sanction from NLB prior to deployment of any AtoNs. All O&M marine lighting will be controllable remotely via the SCADA system and with respect to any working lights (such as down lighting and access platforms). Consideration will be given to these being extinguished when not in use.

The process for the transition between construction phase and O&M phase marine lighting and marking measures will be agreed with NLB post-consent.

Table 4.1 Operational WTG Marine Lighting and Marking Summary

Lighting and Marking Aspect	Relevant Structures	Indicative Specifications	Figure Illustration	Relevant Guidance or Stakeholder Requirement
Significant Peripheral Structure (SPS) lighting	Selected periphery structures: [Structures to be added once final layout agreed]	- Marine light marking selected periphery WTGs as required under IALA. - Yellow 5 second flash (FL. Y. 5s). - At least 5 nm range. 360° visibility (multiple lights per structure may be required to achieve this). - All SPS should be synchronised. - Located not less than 6 m above Highest Astronomical Tide (HAT) and below the arc of the rotor blades. - At least IALA category 1 (> 99.8% availability).	Figure 4.1	IALA O-139/G1162 and standard requirement
Intermediate Peripheral Structure (IPS) lighting	Selected periphery structures: [Structures to be added once final layout agreed]	- If required by NLB, structures on the periphery of the layout other than SPS which require additional lighting. - Flashing yellow lights distinctly different from the SPS (typically Fl.Y.2.5s). - At least a 2 nm range.	Figure 4.1	IALA O-139/G1162 and standard requirement

Lighting and Marking Aspect	Relevant Structures	Indicative Specifications	Figure Illustration	Relevant Guidance or Stakeholder Requirement
		360° visibility (multiple lights per structure may be required to achieve this). - All IPS should be synchronised. - Located not less than 6 m above HAT and below the arc of the rotor blades. - IALA Category 2 (>99.0% availability).		
Sound signals	Selected periphery structures: [Structures to be added once final layout agreed]	- Foghorns must face outward into open sea and overall sound signal coverage must be unimpeded by structures. - IALA Category 3 (at least 97.0% availability) over a rolling three-year period. - Each WTG fitted with a sound signal will also have a visibility meter (see row below). Remote testing capability required.	Figure 4.1	IALA O-139/G1162 and standard requirement
Visibility meters	Selected periphery structures: [Structures to be added once final layout agreed]	- Change in visibility will trigger all fog signals across the entire array. - Signal to activate when visibility is less than 2 nm.	Figure 4.1	IALA O-139/G1162 and standard requirement

Lighting and Marking Aspect	Relevant Structures	Indicative Specifications	Figure Illustration	Relevant Guidance or Stakeholder Requirement
AIS	Selected periphery structures: [Structures to be added once final layout agreed]	- Availability of not less than 97.0% (IALA Category 3). - Office of Communications (OFCOM) Licence is required for the AIS transmission.	Figure 4.1	Regulator requirement and IALA G1162
ID marker boards	All WTGs	- IDs¹ shown on all structures must be lit via low-level baffled (5-10 candela (cd)/m²) lighting. - Uniformity factor better than 1:4. - Colour temperature should be between 2500 Kelvin (K) and 3500K. 360° visibility (multiple boards will be needed to achieve this). - A font which has good readability should be used for ID characters. - Black characters on yellow background. - IDs must be readable by an observer stationed 3m above	N/A	MGN 654

¹ ID numbering system will be agreed with MCA and NLB and will be as per MGN 654 and SAR Annexes.

Lighting and Marking Aspect	Relevant Structures	Indicative Specifications	Figure Illustration	Relevant Guidance or Stakeholder Requirement
		sea level at a distance of 150m.		
WTG colour	All WTGs	- Traffic yellow (RAL 1023) from HAT up to between [TBC] m above HAT); and - Light grey (RAL 7035) upwards of between [TBC] m above HAT.	N/A	IALA O-139/G1162 and standard requirement

Table 4.2 Operational OSP Marine Lighting and Marking Summary²

Lighting and Marking Aspect	Indicative Specifications	Relevant Guidance or Stakeholder Requirement
ID marker boards	- IDs³ shown on all structures must be lit via low-level baffled (5-10 cd/m²) lighting. - Uniformity factor better than 1:4. - Colour temperature should be between 2500 K and 3500 K. 360° visibility (multiple boards will be needed to achieve this). - A font which has good readability should be used for ID characters. - Black characters on yellow background.	MGN 654

² The specifications included for the OSPs are on the assumption that they will be internal within the WDA array. Additional requirements may apply if the OSP(s) are on the periphery.

³ ID numbering system will be agreed with MCA and NLB and will be as per MGN 654 and SAR Annexes.

Lighting and Marking Aspect	Indicative Specifications	Relevant Guidance or Stakeholder Requirement
	IDs must be readable by an observer stationed 3m above sea level at a distance of 150 m.	
OSP colour	- Traffic yellow (RAL 1023) from [TBC] m above HAT; and - Topside Light Grey (RAL 7035) or other non-reflective grey material excluding topside structures such as work cabins, cranes, ladders, and other working areas	IALA O-139/G1162 and standard requirement

[Figure showing operational marine lighting and marking scheme to be added post-consent]

Figure 4.1 Marine Operational Lighting and Marking

4.2 Aviation Measures

Aviation lighting and marking to be implemented during the O&M phase will be summarised in **Table 4.3** for the WTGs and **Table 4.4** for the OSPs. These include a guidance column, which lists the guidance relevant to each aviation lighting and marking aspect where appropriate (guidance is also detailed in **Section 2.2**).

The overarching aviation lighting and marking scheme will then be presented in **Figure 4.2**.

The process for the transition between construction phase and O&M phase aviation lighting and marking measures will be agreed with the CAA post-consent.

Table 4.3 Operational WTG Aviation Lighting and Marking Summary

Lighting and Marking Aspect	Relevant Structures	Indicative Specifications	Figure Illustration	Relevant Stakeholder Guidance or Requirement
Aviation warning lighting (dual purpose for warning lights and SAR lights)	All peripheral WTGs	- Red light capable of an intensity of 2,000 cd when visibility is ≤ 5 kilometres (km) dimmable to 200 cd when visibility is > 5 km in all directions. - Flashing Morse “W” and synchronised. 360° visibility (multiple lights per structure may be required to achieve this). - Compatible with Night Vision Imaging System (NVIS). - Mounted on top of each nacelle (or highest fixed point).	Figure 4.2	ANO (CAA, 2016), CAP 764 (CAA, 2025), MOD Obstruction Lighting Guidance 2020 and MGN 654 SAR Annex 5 (MCA, 2021)
SAR lights	All WTGs ⁴	- SAR light marking all internal structures (i.e., any structure not marked with a 2,000cd light). 200cd red light, steady (when in use).	Figure 4.2	MGN 654 SAR Annex 5

⁴ If the 2,000 cd aviation warning lights are able to be dimmed to 200 cd manually at MCA request, then separate SAR lights are not required on peripheral WTGs.

Lighting and Marking Aspect	Relevant Structures	Indicative Specifications	Figure Illustration	Relevant Stakeholder	Guidance or Requirement
		360° visibility (multiple lights per structure may be required to achieve this). - Compatible with NVIS. - Only on at request of MCA during a SAR operation (i.e., under typical operations it will be off).			
Green heli-hoist lights	All WTGs	- Green light capable of being off, flashing, or steady. - Only on during heli hoist operations i.e., under typical operations it will be off. 360° visibility (multiple lights per structure may be required to achieve this). - Intensity: +2 to +10° = 365cd or 115cd. - Intensity: >10 to +90° = 122cd or 38cd.	N/A		CAP 437
Blade markings	All WTGs	- Three red marks (preferably dots) at 10, 20, and 30 m intervals from the hub. - Marks to be placed near the trailing edge of the blade, allowing visibility when blades are feathered and parked at Y	N/A		MGN 654 SAR Annex 5

Lighting and Marking Aspect	Relevant Structures	Indicative Specifications	Figure Illustration	Relevant Guidance or Stakeholder Requirement
		or offset Y (one or two blades angled forward into the wind) positions, so the marks lie upwards in view of the helicopter pilot. - At least 600 millimetres (mm) in diameter. - Direct consultation will be undertaken with the MCA if a variation to this requirement is needed.		
Blade tip marking	All WTGs	- From blade tip to a point on the blade corresponding to approximately 2% of the blade length when measured from tip. In line with MGN 654 Annex 5, the final design will be confirmed with the MCA noting lightning protection may mean the tip and part of blade leading edge cannot be coloured. - Direct consultation will be undertaken with the MCA if a variation to this requirement is needed.	N/A	MGN 654 SAR Annex 5

Lighting and Marking Aspect	Relevant Structures	Indicative Specifications	Figure Illustration	Relevant Guidance or Stakeholder Requirement
ID marking	All WTGs	- ID numbers will be marked on the WTG nacelle roofs. - Not less than 1.5 m in height, with proportional width.	N/A	MGN 654 SAR Annex 5
Hoist area marking	Not covered within LMP, but should meet the standard set out in the following guidance documents, and in consultation with the appropriate authorities: - CAA CAP 764 – Policy and Guidelines on Wind Turbines (CAA, 2025) - CAA CAP 437 – Standards for Offshore Helicopter Landing Areas (CAA, 2021 (a))			

Table 4.4 Operational OSP Aviation Lighting and Marking Summary

Lighting and Marking Aspect	Indicative Specifications	Figure Illustration	Relevant Guidance or Stakeholder Requirement
SAR lights	- Red 200 cd /Infrared (IR) light. - Steady when in use at MCA request, switched off otherwise. 360° visibility. - Compatible with NVIS of IR wavelength between 800 nm and 900 nm.	Figure 4.2	MGN 654 SAR Annex 5
ID marking	- ID numbers will be marked on the OSP topside, such that it is visible to aircraft. - Not less than 1.5 m in height with proportional width.	N/A	MGN 654 SAR Annex 5 and CAP 764
Helipad/helihoist area marking	Not covered within LMP, but should meet the standard set out in the following guidance documents, and in consultation with the appropriate authorities:		

Lighting and Marking Aspect	Indicative Specifications	Figure Illustration	Relevant Guidance or Stakeholder Requirement
	- CAA CAP 764 – Policy and Guidelines on Wind Turbines (CAA, 2025) - CAA CAP 437 – Standards for Offshore Helicopter Landing Areas (CAA, 2021 (a))		

[Figure showing operational aviation lighting and marking scheme to be added post-consent]

Figure 4.2 Aviation Operational Lighting and Marking

5 Cumulative Marking

Cumulative overlap will be discussed with stakeholders (MCA, CAA and NLB) to determine any changes that may be required depending on construction schedules. However, due to the limited number of developments in proximity resulting in no cumulative concerns raised during the NRA process, it is unlikely that this will be necessary.

6 Maintenance of Aids to Navigation

The following subsections summarise the maintenance and management procedures associated with the AtoNs that will be installed at the Project.

6.1 Monitoring of Aids to Navigation on Structures

Monitoring of AtoNs on structures for both functionality and availability shall be undertaken throughout the construction and O&M phases. Downtime shall be monitored remotely during the O&M phase (via the SCADA system) and visually during the construction phase. From this, the overall availability shall be calculated (see **Section 6.4**).

Monitoring shall include visual inspections and general maintenance to ensure marine growth etc., does not impact functionality. All visual inspections and general and reactive maintenance will follow manufacturer guidelines.

6.2 Monitoring of Aids to Navigation on Buoyage

During construction, remote monitoring will alert the operative to the failure of a marine AtoN on a buoy and allow calculation of availability as per **Section 6.4**. Upon discovery of an extinguished AtoN, the emergency procedures outlined in **Section 7** will be initiated.

6.3 Testing

Following their commissioning, all marine AtoNs will be tested at least once per annum. They will be equipped with functionality whereby sound signals can be manually overridden in order to undertake annual testing.

6.4 Availability

A requirement of AtoN management within UK waters is to report navigational failures to NLB. Failure of Navigational aids shall also be reported to UKHO notifying the Source Data Receipt team via email at sdr@ukho.gov.uk. Once a failure is rectified, the UKHO should be notified of the repair, enabling the UKHO to cancel any navigation warnings issued. To assist in meeting the required IALA availability standards of any given marine AtoN, remote monitoring shall be used to ensure that any faults can be rectified as soon as possible.

The data collected through remote monitoring of AtoNs shall be used to calculate the overall availability of AtoNs to ensure that IALA availability standards are being adhered to. Availabilities will be reported to NLB via their AtoN Reporting Online Portal – <https://nlbhq.nlb.org.uk/latonsonline>. This is an online database administrated by NLB in order to assist wind farm operators (as the local authority for the wind farm AtoNs) to fulfil their responsibility to maintain records of AtoN availability and to provide summaries of these to NLB. This will be undertaken by the Applicant's Marine Co-ordination Centre in the event of any failures or loss of availability.

7 Emergency Procedures

As noted during consultation of the NRA process (see **Appendix 13.1 Navigational Risk Assessment**), concerns were raised by stakeholders regarding the potential for loss of an AtoN relating to the Project (particularly due to adverse weather conditions), and the interactions that may result from this. This section considers the emergency procedures to be initiated in the event of the loss of an AtoN, including the external protocol, trigger points for the deployment of a guard vessel and specific requirements associated with aviation lighting. In terms of external protocol, the Applicant's responsibilities in an emergency situation are generally associated with the MCA, NLB and UKHO, although the Marine Directorate Licensing Operations Team (MD-Lot) will be kept informed as the situation develops.

7.1 Loss of Aids to Navigation

Upon discovery of the loss of an AtoN which includes marine navigation lights, fog signals or buoys (or part thereof), the external protocol illustrated in **Figure 7.1** will be initiated.

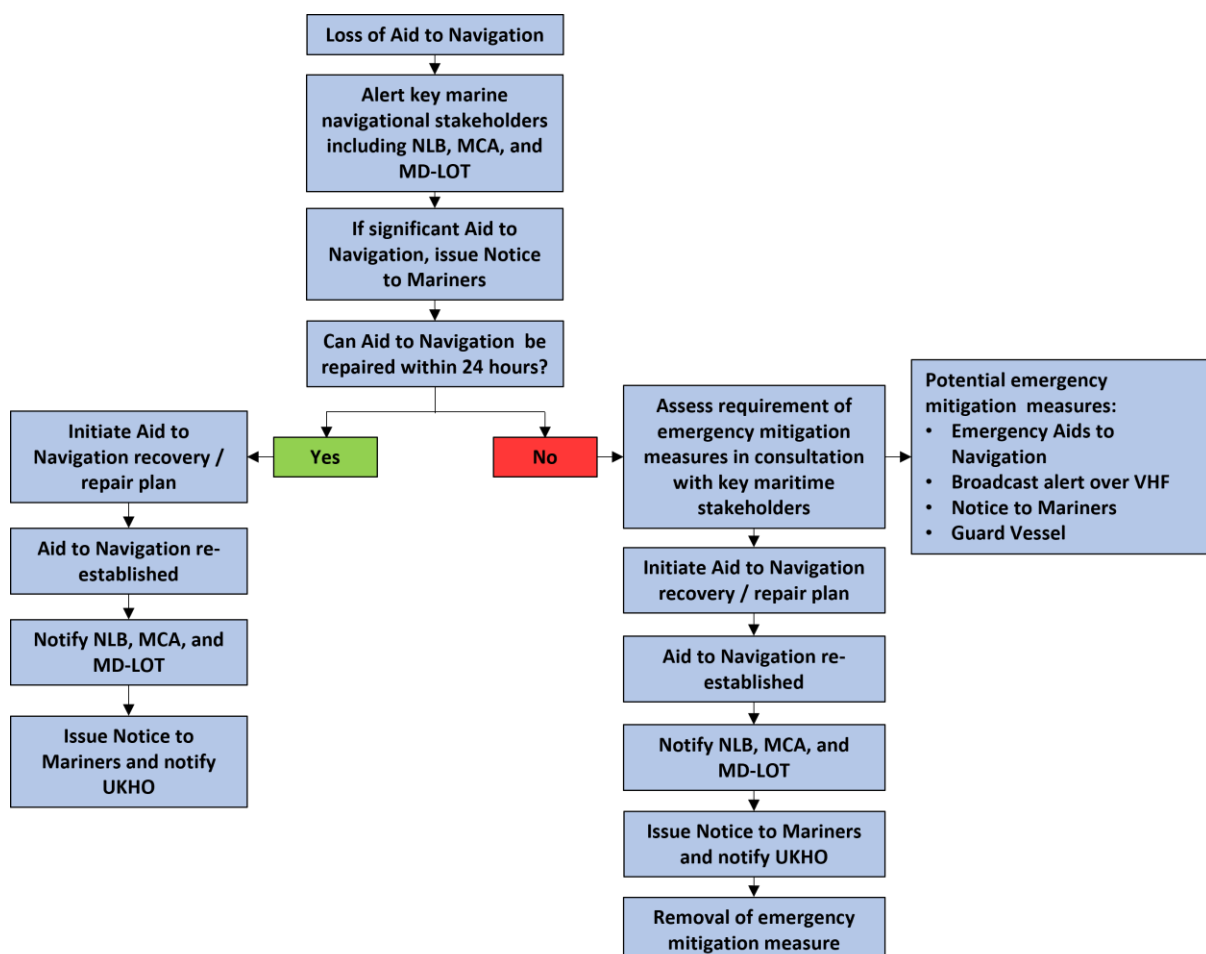


Figure 7.1 External Protocol for Loss of an Aid to Navigation

In the rare event of a significant loss of one or more AtoNs, a guard vessel may be required to maintain navigational safety. **Section 7.2** provides an indicative list of the trigger points that would require the Applicant to liaise with NLB and MCA, and potentially implement additional emergency response mitigations.

7.2 Guard Vessel Trigger Points

It is the responsibility of the operator to maintain the AtoN and provide any back-up solutions in the event of an AtoN failure. This will include:

- Repair of a broken AtoN;
- Replacement of lost AtoN; and
- Provision of a guard vessel if required in consultation with NLB and MCA.

Table 7.1 will summarise the emergency mitigation measure provisions that have been agreed. These measures will include identification of the party that will be responsible for the repair or replacement of AtoN (including those on structures and navigational buoys). The information presented within **Table 7.1** will be updated and confirmed pre-construction.

Project A4674
Client MachairWind Limited
Title MachairWind Offshore Windfarm Outline Lighting and Marking Plan

Table 7.1 Summary of Emergency Mitigation Measures

Emergency Measures	Mitigation	Organisation Responsible for Providing Mitigation	Relevant Contact Details			Service Provision
			Address	Phone	Email	
[Mitigations to be added post-consent]						

The following summarises the triggers for further consultation with NLB following the initial alert should a key navigational aid fail. These may require further mitigation:

- Loss of key navigational light (i.e. primary SPS) for a period of greater than 72 hours;
- Failure of sound signal for greater than 120 hours;
- Loss of station of cardinal navigational mark, including significant delay (greater than 72 hours) to it being restored;
- AtoN repeatedly failing to meet IALA availability standards;
- Deployment of an emergency buoy due to an unmarked hazard within the WDA (a guard vessel may be required to monitor vessel awareness of the buoy); and
- Throughout significant maintenance works where an increase in navigational risk is posed (i.e. should a key SPS light have to be removed due to WTG maintenance).

It should be noted that the above list is not considered to be exhaustive.

7.3 Aviation Lighting

The ANO states that “In the event of the failure of any light which is required by this article to be displayed by night, the person in charge must repair or replace the light as soon as reasonably practicable.”

It is accepted that there may be occasions when meteorological or sea conditions prohibit the safe transport of personnel for repair tasks. Furthermore, there may be fault conditions that are wider ranging and would take longer to diagnose or repair.

For any outage that is expected to be or is greater than 12 hours, the Applicant will request a NOTAM to be issued by informing the NOTAM section of the UK Aeronautical Information Service via telephone or email. The following information will be provided when requesting a NOTAM:

- Name of windfarm;
- Identifiers of affected lights or region of windfarm if fault is extensive;
- Expected date of reinstatement; and
- Contact telephone number.

If an outage is expected to last longer than 14 days, then the CAA will also be notified directly to discuss any issues that may arise, in addition to longer-term strategies.

8 Decommissioning

The lighting and marking requirements throughout the decommissioning phase have not yet been finalised, i.e., what navigational lights if any shall be employed. However, the required lighting and marking of the Project during and following decommissioning will be agreed in consultation with NLB and the CAA at least six months prior to the decommissioning works. It may be necessary to maintain marine or aviation lighting following decommissioning if a relevant hazard remains in place (noting this would be considered unlikely but could occur where infrastructure is left in situ and poses an allision, under keel clearance or snagging risk).

9 References

CAA. (2016). The Air Navigation Order 2016. Crawley, West Sussex, UK: CAA.

CAA. (2021 (a)). CAP 437 – Standards for Offshore Helicopter Landing Areas. Crawley, West Sussex, UK: CAA.

CAA. (2021 (b)). CAP 393 - Regulations made under powers in the Civil Aviation Act 1982 and the Air Navigation Order 2016. Crawley, West Sussex, UK: CAA.

CAA. (2025) CAP 764 – Policy and Guidelines on Wind Turbines. Crawley, West Sussex, UK: CAA.

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

IALA. (2021). IALA Recommendations O-139 on the Marking of Man-Made Offshore Structures. Edition 3.0. Saint Germain en Laye, France: IALA.

IALA. (2022). IALA Guideline G1162 on the marking of Offshore Man-Made Structures. Edition 1.1. Saint Germain en Laye, France: IALA.

IALA. (2023). IALA R1001 The IALA Maritime Buoyage System. Edition 2. Saint en Laye, France: IALA.

MCA. (2021). Marine Guidance Note (MGN) 654 and Annexes – Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response. Southampton: MCA.

MOD. (2020). Obstruction Lighting Guidance. Hampshire: MOD.