Culzean Floating Wind

*A semi-submersible pilot project*

# Project Environmental Monitoring Plan (PEMP)

# GB-CZT-00-TOTA-000011

| Rev. | Date | Issued by | Checked by | Approved by |
|---|---|---|---|---|
| 002 | 02/09/2025 | Claire MacDonald | Magali Collin | Charles Howorth |

## TABLE OF REVISIONS

| Revision | Modification |
|---|---|
| 00A | Draft |
| 001 | Revision addressing comments received from MD-LOT 20/02/2025 |
| 002 | Revision addressing consultation comments received from MD-LOT 03/06/2025 |
| | |
| | |

## DETAILED CHANGE LOG

| Date | Rev. Status | References | Description of changes |
|---|---|---|---|
| 16/04/2025 | Resubmission to MD-LOT for review | | Table 1-1 – updated to reflect why diadromous fish are deemed out of scope.<br>Section 1.4 has been updated with a link to the Marine Directorate website.<br>Section 1.6 has been updated to include a commitment to submit written reports on the environmental monitoring to MD-LOT (as per condition 3.2.13 of the Marine License).<br>Sections 5.2 – updated to include information regarding the monitoring during construction and installation. |
| 02/09/2025 | Resubmission to MD-LOT for review addressing consultation comments | NatureScot comments on PEMP consultation | As per Comment 2 from NatureScot, Table 1.2 has been updated to reference the Cable Plan. |
| | | | As per Comment 3 from NatureScot, Section 1.2 has been updated to include the reason why EMF has been deemed out of scope. |
| | | | As per Comment 4 from NatureScot, Section 3.1 has been updated to confirm the bird monitoring cameras. |
| | | | As per Comment 5 from NatureScot, Section 4.3 with further information regarding the hydrophones. |

## DISTRIBUTION

| Stakeholder No. | Document Recipient | Date Issued |
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## ACRONYMS, ABBREVIATIONS and DEFINITIONS

| | |
|---|---|
| AHTSV | Anchor Handling Tug Supply Vessel |
| AIS | Automatic Identification System |
| AtoN | Aid to Navigation |
| COLREGs | International Convention of the Prevention of Collisions at Sea |
| CAA | Civil Aviation Authority |
| CaP | Cable Plan |
| CLV | Cable Laying Vessels |
| CMS | Company Management System |
| CMS | Construction Method Statement |
| CNS | Central North Sea |
| CPF | Central Processing Facility |
| CSV | Construction Support Vessel |
| DGC | Defence Geographic Centre |
| DoL | Depth of Lowering |
| DP | Dynamic Positioning |
| EEZ | Exclusive Economic Zone |
| EIA | Environmental Impact Assessment |
| EMF | Electromagnetic Field |
| EMP | Environmental Management Plan |
| ERCoP | Emergency Response Cooperation Plan |
| ERRV | Emergency Response Rescue Vessel |
| FLO | Fisheries Liaison Officer |
| FSO | Floating Storage and Offloading |
| HMCG | His Majesty's Coastguard |
| HRA | Habitats Regulations Assessment |
| IAC | Inter-Array Cable |
| IMO | International Maritime Organisation |
| KIS-ORCA | Kingfisher Information Service – Offshore Renewables & Cable Awareness |
| LAT | Lowest Astronomical Tide |
| LMP | Lighting and Marking Plan |
| LNtM | Local Notices to Mariners |
| MAIB | Marine Accident Investigation Branch |
| MCA | Maritime and Coastguard Agency |
| MD-LOT | Marine Directorate Licensing Operations Team |
| MGN | Marine Guidance Note |
| MRCC | Maritime Rescue Coordination Centre |
| NLB | Northern Lighthouse Board |
| NMCC | National Maritime Coastguard Centre |
| NOTAM | Notice to Airmen |
| NSP | Navigational Safety Plan |
| NSVMP | Navigational Safety and Vessel Management Plan |
| NtM | Notice to Mariners |

| | |
|---|---|
| O&M | Operations and Maintenance |
| OfCom | Office of Communications |
| OIM | Offshore Installation Manager |
| OREI | Offshore Renewable Energy Installation |
| PEMP | Project Environmental Monitoring Plan |
| RIAA | Report to inform Appropriate Assessment |
| ROV | Remotely Operated Underwater Vehicle |
| RYA | Royal Yachting Association |
| SFF | Scottish Fishermen's Federation |
| SOV | Service Operations Vesse |
| TEPNSUK | TotalEnergies E&P North Sea UK Limited |
| UKCS | United Kingdom Continental Shelf |
| UKHO | United Kingdom Hydrographic Office |
| VHF | Very High Frequency |
| VMP | Vessel Management Plan |
| ULQ | Living Quarters and Utility Platform |
| WHP | Wellhead Platform |
| WNoO | Weekly Notice of Operations |
| WTG | Wind Turbine Generator |

# 1. INTRODUCTION

## 1.1 Purpose of the Document

This Project Environmental Monitoring Programme (PEMP) document has been prepared to address the specific requirements of the relevant conditions attached to the Marine Licences (the 'offshore consent') issued to TotalEnergies E&P North Sea UK Limited (hereafter referred to as TEPNSUK) for the Culzean Floating Offshore Wind Turbine Pilot project. The overall objective of the PEMP is to outline and define the approach TEPNSUK will take with respect to the environmental monitoring of the Culzean Floating Wind project.

## 1.2 Scope and Objectives

The PEMP provides

- details on the environmental monitoring proposed for the pre-construction, construction and post-construction (if considered appropriate by Scottish Ministers) monitoring or data collection of the Culzean Floating Wind project of the following receptors:
  - birds;
  - fish and shellfish
  - diadromous fish – deemed to be out of scope for the project
  - marine mammals
  - benthic communities
  - Lincensee's contribution to data collection or monitoring of wider strategic relevance, including in relation to diadromous fish and EMF, as identified and agreed by the Licensing Authority – deemed to be out of scope for the project.
- evidence of consultation on and approval of monitoring approach and surveys methodology; and
- the programme for proposed monitoring surveys and reporting

Diadromous fish are deemed out of scope following consultation on the Habitats Regulation Assessment (HRA) screening approach. A meeting was held with NatureScot on 29th January 2024 and with their comments being received on 6th February 2024.

In summary NatureScot confirmed that due to the scale of the proposed development along with the lack of evidence in spatial and temporal distribution as well as uncertainty around migration routes, no further assessment was required for diadromous fish. For further details please see the HRA Report including HRA Screening and RIAA document.

Electromagnetic field (EMF) is deemed out of scope due to the cable being buried at 0.6m deep, and buried by concrete mattresses at either end of the cable (See Cable Plan – Section 4.1), therefore the EMF impact is deemed minimal and would not affect marine life.

### 1.2.1 Consent Compliance

The PEMP fulfils the consent conditions for the preparation of a Project Environmental Monitoring Programme.

Table 1.1 includes reference to how and where the condition clauses have been addressed within the PEMP.

**Table 1.1 Consent conditions to be discharged by this PEMP**

| Condition reference | Condition | Relevant section |
|---|---|---|

| | | |
|---|---|---|
| 3.2.13 Project Environmental Monitoring Programme | The Licensee must, no later than six months prior to the Commencement of the Licensed Activity, submit a PEMP, in writing, to the Licensing Authority for its written approval. Commencement of the Licensed Activity cannot take place until such approval is granted. Such approval may only be granted following consultation by the Licensing Authority with NatureScot, RSPB Scotland, SFF and any other environmental advisors or organisations as required at the discretion of the Licensing Authority. The PEMP must be in accordance with the Application as it relates to environmental monitoring.<br><br>The PEMP must set out measures by which the Licensee must monitor the environmental impacts of the Works. Monitoring is required throughout the lifespan of the Works where this is deemed necessary by the Licensing Authority. Lifespan in this context includes pre-construction, construction, operational and decommissioning phases.<br><br>The Licensing Authority must approve all initial methodologies for the monitoring, in writing and, where appropriate, in consultation with NatureScot and any other environmental advisors or organisations as required at the discretion of the Licensing Authority.<br><br>Monitoring must be done in such a way so as to ensure that the data which is collected allows useful and valid comparisons between different phases of the Works. Monitoring may also serve the purpose of verifying key predictions in the Application. In the event that further potential adverse environmental effects are identified, for which no predictions were made in the Application, the Licensing Authority may require the Licensee to undertake additional monitoring. | |
| | The PEMP must cover, but not be limited to, the following matters: Pre-construction, construction (if considered appropriate by the Licensing Authority) and post-construction monitoring or data collection as relevant in terms of the Application, and any subsequent monitoring or data collection for: | c) & f) are deemed out of scope for this project (see Section 1.2) |

| | | |
|---|---|---|
| | a) Birds;<br>b) Fish and shellfish;<br>c) Diadromous Fish;<br>d) Marine mammals; and<br>e) Benthic Communities; and<br>f) The Licensee's contribution to data collection or monitoring of wider strategic relevance, including in relation to diadromous fish and EMF, as identified and agreed by the Licensing Authority. | |
| | Due consideration must be given to the Scottish Marine Energy Research ("ScotMER") programme, or any successor programme formed to facilitate these research interests.<br><br>Any monitoring or data collection carried out by the Licensee to address any of the above issues may be used in part to discharge this condition subject to the written approval of the Licensing Authority.<br><br>The Licensing Authority may require the Licensee to amend the PEMP and submit such an amended PEMP, in writing, to the Licensing Authority, for its written approval. Such approval may only be granted following consultation with NatureScot and any other environmental advisers, or such other advisors as may be required at the discretion of the Licensing Authority.<br><br>The Licensee must submit written reports and associated raw and processed data of such monitoring or data collection to the Licensing Authority at timescales to be determined by them. Consideration should be given to data storage, analysis and reporting and be to Marine Environmental Data and Information Network standards.<br><br>Subject to any legal restrictions regarding the treatment of the information, the Licensing Authority, or any such other party appointed at the Licensing Authority's discretion, may make the results publicly available. The Licensing Authority may agree, in writing, that monitoring | Section 1.6 |

| | | |
|---|---|---|
| | may be reduced or ceased before the end of the lifespan of the Works.<br><br>Should any advisory groups be established for advice from stakeholders, the Licensee must participate as directed by the Licensing Authority. | |

## 1.3 Linkages with other Consent Plans

This PEMP details the environmental monitoring proposed for the pre-construction, construction and post-construction, forming part of a set of approved documents (including other mitigation plans required under the Marine Licence). Table 1.2 lists the Consent Plans with linkages to this PEMP.

Table 1.2 Consent Plans with linkages to this PEMP

| Other Consent Plans and Documents | Linkage with PEMP |
|---|---|
| Environmental Management Plan | The EMP is the overarching framework for environmental management and monitoring during the construction and operation of the Culzean Floating Offshore Wind Turbine Pilot Project |
| Cable Plan | The Cable Plan considers all environmental and navigational concerns for the location and construction of the Inter-Array Cable (IAC). |

## 1.4 Plan Audience

The PEMP is intended to be referred to by personnel involved in the pre-construction, construction and operation of the Culzean floating wind project, including TEPNSUK personnel and contractors.

This PEMP is intended to summarise TEPNSUK's environmental monitoring programme for stakeholders and the Licensing Authority. Compliance with this PEMP will be monitored by the Culzean floating wind project team, and Marine Directorate Licensing Operations Team (MD-LOT).

The latest version of this PEMP can be obtained from TEPNSUK document management system (CMS) and from the Marine Directorate website[1]. Copies are also to be held in the following locations:

- TotalEnergies Aberdeen office

## 1.5 Updates and Amendments

It is acknowledged that there may be a requirement for the PEMP to be revised and updated on occasion as the project progresses to ensure the information is kept up to date.

This PEMP is a 'live document' and will be revised as relevant to ensure the information is kept up to date with any revisions being notified to the Scottish Ministers as soon as practicable and any proposed material revisions being subject to prior approval by the Scottish Ministers.

Linkages exist between a number of offshore consent plans as highlighted in Section 1.3 (Table 1-2). As plans are updated, there will be a review of inter-linkages with other consent plans to ensure these are also updated as relevant.

[1] Weblink https://marine.gov.scot/ml/culzean-floating-offshore-wind-turbine-pilot-project

## 1.6 ScotMER

The Marine Directorate has developed the Scottish Marine Energy Research (ScotMER) Programme in order to improve understanding and assess the impact that offshore renewable developments have on natural environment, socioeconomics and the other sea users. New information fed into the ScotMER programme will help with planning, licensing and consenting processes for new developments.

The ScotMER programme involved various collaborations with environmental non-governmental organisations (NGOs), Statutory Nature Conservation Bodies (SNCBs), academic experts and the Scottish Government. By identifying data gaps, they can then target research to allow these gaps to be filled for future decision making.

The Culzean Floating Wind project environmental monitoring will feed into this where possible and applicable, as well as submitting written reports regarding the environmental monitoring to MD-LOT.

# 2. INTRODUCTION

## 2.1 Project Description

The Culzean Floating Wind project is located in the central North Sea (CNS), approximately 222 kilometres (km) east of Aberdeen in the UK Continental Shelf (UKCS) Block 22/25a. The Culzean Floating Wind project will deploy one floating wind turbine generator (WTG) with a capacity of 3 MW with test floater and mooring system technologies for offshore floating wind. This is a pilot project which aims to; i) test and qualify the floater technology designed by Ocergy, and ii) perform a hybridisation showcase for TotalEnergies to demonstrate the feasibility of platform electrification in an offshore environment.

The Culzean Floating Wind project will be installed approximately 2 km west of the Culzean oil and gas platform, linked via an export cable to the Culzean Central Processing Facility (CPF) (Figure 2-1). The wind turbine will be connected to the plant power management system to allow the export of the produced electricity to the site. The Culzean facility is a stand-alone development involving three bridge linked platforms including a Wellhead Platform (WHP), Central Processing Facility (CPF) with flare tower, and separate Living Quarters and Utility Platform (ULQ).

The Project does not require a grid connection to shore and will be entirely within the offshore region between 12 nautical miles (nm) and the Exclusive Economic Zone (EEZ) boundary.

The floating WTG will be connected to the Culzean facilities via an existing J-tube on the platform. The key components include:

- One WTG;
- One floating substructure;
- Up to six mooring lines
- Up to six drag anchors;
- One 2.5 km long export cable; and
- Associated scour and cable protection (if required).

The design life for the WTG is 10 years.

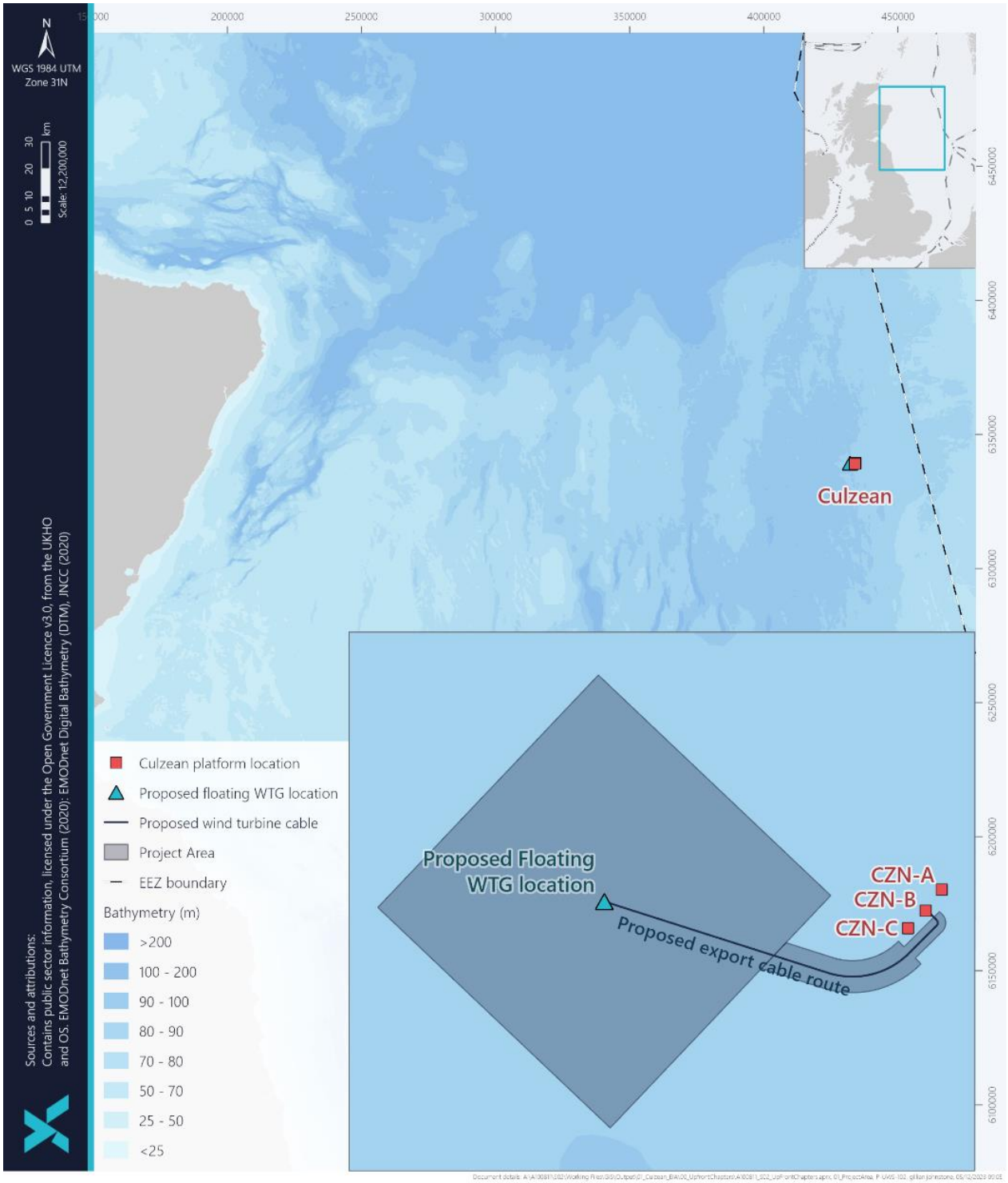



*Figure 2-1 Culzean Floating Wind Project Area*

# 3. BIRDS

## 3.1 Pre-Construction Monitoring

A one-year digital aerial survey (DAS) was undertaken by APEM on behalf of the Culzean floating wind project site (carried out October 2022 to September 2023). The purpose of the DAS study was to provide baseline information on the abundance, distribution and behaviour of birds and marine mammals to inform the environmental impact assessment (EIA) report.

No further pre-construction monitoring is required for birds than that already undertaken for the EIA however TEPNSUK plan to install cameras on the Culzean oil and gas Installation to cover the future location of the turbine. This is proposed to be on location pre-construction (Q4 2025) and be on location during offshore construction and during operation as long as reasonably practicable.

### 3.1.1 Methodology

The camera system captured abutting imagery along 10 survey flight lines spaced approximately 1.5 km apart within the Survey Area (Figure 3-1). The total Survey Area was 134.25 km$^2$. The aircraft collected the data at an altitude of approximately 1,300 ft (395 m) and a speed of approximately 120 knots. Images were collected continuously along the survey flight lines achieving a total captured coverage of 48% and 10% coverage of the sea surface analysed (APEM, 2024).

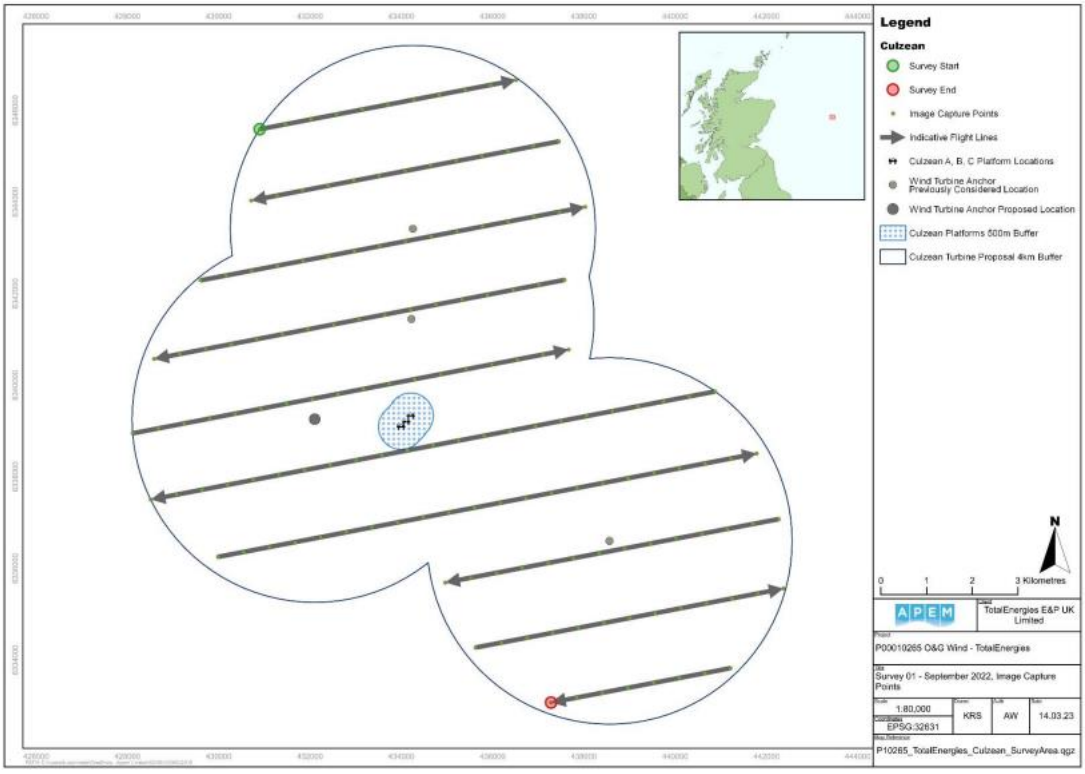



Figure 3-1 Flight lines and image capture points for the Survey Area

The DAS monitoring methodology was developed in consultation with NatureScot.

### 3.2 Construction

The construction activities on site will be limited to the installation of the floating WTG and its moorings. Installation activities are expected to take around 1 month (including tow to site, pre-lay of mooring and hook up to moorings, cable laying and floating WTG commissioning), and therefore, monitoring during construction and installation is not considered necessary as agreed during consultation with NatureScot and RSPB. Cameras are however planned to be installed on the Culzean oil and gas platform which would monitor birds during construction.

### 3.3 Post-Construction

The EIA report concluded that impacts to ornithological receptors were negligible and that given the negligible magnitude of potential disturbance/displacement and collision impacts to ornithological features cumulative impacts are not plausible and therefore cumulative regional disturbance effects on bird receptors was not considered further.

As part of the HRA (Habitats Regulations Assessment) process, a RIAA (Report to inform Appropriate Assessment) has been undertaken to provide information to allow the Licensing Authority to ascertain whether the Culzean floating wind project would adversely affect the integrity of a European Site. The conclusions of the ornithology assessments undertaken concluded that there are no adverse effects either from the Project alone, or in-combination with other plans or projects, on the site integrity of the SPAs screened.

Where possible, monitoring during the operational phase (post-construction) is planned to improve the understanding of seabird interactions with offshore windfarms, and particularly floating offshore windfarms which are located further offshore. Cameras are proposed to be installed on the nearby Culzean oil and gas platform and the floater WTG to monitor bird usage of the area. There will be no monitoring post-decommissioning.

### 3.4 Reporting

Following completion of the DAS, reports were issued to NatureScot and findings were detailed within the EIA report.

The project intends, subject to successful installation and function of cameras, to provide annual reports summarising the bird utilisation of the area will be submitted to MD-LOT, NatureScot and RSPB.

## 4. MARINE MAMMALS

### 4.1 Pre-Construction Monitoring

A one-year digital aerial survey (DAS) was undertaken by APEM on behalf of the Culzean floating wind project site (carried out between October 2022 and October 2023). The purpose of the DAS study was to provide baseline information on the abundance, distribution and behaviour of birds and marine mammals so as to inform the environmental impact assessment (EIA) report.

A hydrophone has been placed on the seabed (September 2024) at the Culzean floating wind project site. The purpose of the measurements is to provide good quality, reliable measurements of the baseline underwater noise to determine the pre-existing acoustic environment prior to the installation of the turbine.

### 4.2 Construction

The construction activities on site will be limited to the installation of the floating WTG and its moorings. Installation activities are expected to take around 1 month (including tow to site, pre-lay of mooring and hook up to moorings, cable laying and floating WTG commissioning.

The hydrophone will remain in place during the construction phase to continue to monitor the noise levels during the construction phase.

### 4.3 Post-Construction

Potential impacts on basking sharks, and marine mammals (harbour porpoise, bottlenose dolphin, Atlantic-white sided dolphin, minke whale, grey seal, and harbour seal) from the Culzean floating wind project were assessed within the EIA report.

The EIA report identified potential injury and disturbance to marine mammals and other megafauna from noise related impacts associated with construction and decommissioning activities from the project. The potential activities resulting in underwater noise for the project were limited to vessel activities, cable laying, and preconstruction surveys using ultra-short baseline positioning equipment to ensure precise subsea locations. Due to the low levels of noise associated with these activities, and the short timeline of the construction phase, impacts are assessed as not resulting in any significant effects.

The HRA screening concluded there was no potential for Likely Significant Effect (LSE) on any Special Areas of Conservation (SAC) assessed. As such, no further assessment was required, as agreed with NatureScot during consultation.

As there were no impacts identified during the post-construction (operational) phase, the primary aim of any monitoring is to improve the understanding of the noise profile from floating windfarms. As such hydrophones are planned to be placed on the basket, which is attached underwater to the base of the central column of the floater. Data from the hydrophones will be interpreted and analysed and if relevant findings are identified, the appropriate communications will be defined.

### 4.4 Reporting

Following completion of the baseline date collection, reports were issued to NatureScot and findings were detailed within the EIA report.

## 5. BENTHIC COMMUNITIES

### 5.1 Pre-Construction Monitoring

An environmental baseline and habitat assessment survey was completed in 2023 of the Culzean floating wind project site. This included geophysical survey (Multibeam Echosounder (MBES) and Side-Scan Sonar (SSS)) as well as environmental sampling. The baseline survey data was used to inform the EIA report.

The EIA report identified potential impacts associated with all phases of the Culzean floating wind project. The impacts were identified as temporary habitat disturbance, temporary increase in suspended sediment and sediment deposition, long-term loss and/or damage to benthic habitats and species, disturbance of contaminated sediments, colonisation of hard structures, and removal of artificial hard structures during decommissioning.

The embedded mitigation measures within the EIA report (including micro-siting of the WTG and its moorings, and following best practice to reduce localised habitat loss). The EIA report concluded that given the small-scale of the work associated with the project, all associated impacts are expected to be minor or negligible and therefore not significant. It was concluded that no significant change to the cumulative effects on benthic ecology are expected to result from the works.

No further pre-construction monitoring is required for benthic communities than that already undertaken for the EIA however TEPNSUK mobilised underwater drones during May – June 2025. Further details included in Appendix 1.

### 5.2 Construction

The construction activities on site will be limited to the installation of the floating WTG and its moorings. Installation activities are expected to take around 1 month (including tow to site, pre-lay of mooring and hook up to moorings, cable laying and floating WTG commissioning), and therefore, monitoring during construction and installation is not considered necessary as agreed during consultation (on the Marine License) with NatureScot.

### 5.3 Post-Construction

TEPNSUK plan to mobilise underwater drones, during May – June 2026 which, if successful, will monitor impacts after one year. Further details included in Appendix 1.

## 6. FISH AND SHELLFISH

### 6.1 Pre-Construction Monitoring

An environmental baseline and habitat assessment survey was completed in 2023 of the Culzean floating wind project site. This included geophysical survey (Multibeam Echosounder (MBES) and Side-Scan Sonar (SSS)) as well as environmental sampling. The baseline survey data was used to inform the EIA report.

The EIA report concluded no significant effects on the receptors identified due to the small-scale of the Culzean floating wind project works. The EIA report concluded any potential impacts from the project works would be localised and temporary, therefore there is no expected cumulative effects associated with the project.

No further pre-construction monitoring is required for benthic communities than that already undertaken for the EIA. However, TEPNSUK mobilised underwater drones during May – June 2025. Further details included in Appendix 1.

### 6.2 Construction

The construction activities on site will be limited to the installation of the floating WTG and its moorings. Installation activities are expected to take around 1 month (including tow to site, pre-lay of mooring and hook up to moorings, cable laying and floating WTG commissioning), and therefore, monitoring during construction and installation is not considered necessary as agreed during consultation with NatureScot and RSPB.

## 6.3 Post-Construction

TEPNSUK plan to mobilise underwater drones, during May – June 2026 which, if successful, will monitor impacts after one year. Further details included in Appendix 1.

# APPENDIX 1: PROPOSED RESEARCH AND DEVELOPMENT

Below is the proposed Research and Development programme, based on current plans and feasibility studies are to be conducted around drone deployment and associated environmental data analysis.

Table 1 and Figure 1 & 2, give the details of the subsea drone campaigns as mentioned in Sections 5 & 6.

**Table 1: Details of the Proposed Subsea Drones**

| | |
|---|---|
| Two Slocum gliders and two Sailbuoys for two field campaigns, one in 2025 and one in 2026. These ocean observers will ensure comprehensive data collection and biodiversity monitoring in the marine environment, maintaining a high standard of data integrity and reliability. Sensor details for the ocean observers are listed below. | |
| Slocum - eDNA | eDNA (Environmental DNA) will collect eDNA samples to provide detailed biological monitoring, including species identification and biodiversity change detection. It will also be rigged with an underwater camera for sea floor pictures.<br>• Dartmouth Ocean Technologies, eDNA sampler<br>• Underwater camera |
| Slocum - UVP | Slocum - UVP (Underwater Vision Profiler) will operate with a sensor package customized to collect hydrographic data such as temperature, salinity, oxygen, and fluorescence in addition to optical zooplankton data.<br>• CTD (Conductivity, temperature, Depth)<br>• Hydroptics, UVP6 |
| Sailbuoy – EK | The Sailbuoy will monitor biomass through the water column using the echosounder EK80 + physical ocean parameters while also gathering weather data for additional environmental insights.<br>• Kongsberg Discovery, EK80w/ 200 KHz transducer<br>• Gill, MaxiMet GMX 560 (weather monitoring)<br>• NBOSI, CTD (ocean sensors)<br>• Anderaa, Optode 4831 (Oxygen Optode)<br>• WET Labs, ECO Triplet |
| Sailbuoy – ADCP | The Sailbuoy will monitor ocean currents, water physical characteristics, and record presence of bats. |

Figure 1: Sailbuoy

*Table 1* **Offshore Sensing AS - Sailbuoy**

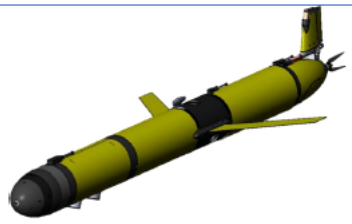

**Description**

Sailbuoy is an exceptionally versatile autonomous sailboat equipped with solar panels, ensuring continuous power supply to its array of sensors. Its straightforward design renders it one of the most resilient Unmanned Surface Vehicles (USVs) available. Striking an optimal equilibrium between payload capacity and operational convenience, its size proves to be ideal for various mission requirements.

- Long endurance - capable of navigating for several months at sea
- Modular payload accommodating a large variety of sensors
- Real-time remote desktop piloting
- A compact, robust vessel, length: 2m
- User friendly in deployment, recovery and control
- Navigable wind speed range: 2 - 20 m/s
- Maximum mission duration: 12 months
- Method of communication: Iridium
- Operable in all sea states
- Presents little risk to exiting installations and vessels.

Figure 2: Slocum underwater drone.

*Table 2* **Teledyne Webb Research – Slocum G3**



**Description**

Slocum glider is an autonomous underwater vehicle that employs a variable buoyancy drive for propulsion and therefore is far more efficient than a traditional propeller driven AUV. Gliders offer a great range and endurance depending on the sensor suite in use.

- Versatile, deployment with 1-2 people.
- Battery options: Alkaline (A) / Rechargeable (Li) / Lithium (L)
- Range: 350-1200km/ 700-3000km/ 3000-13000km
- Endurance: 15-50 days/ 1-4 months/ 4-18 months
- Depth options: 200m (coastal) and 1000m (deep)
- Navigation: GPS, Pressure Sensor, Altimeter, Dead Reckoning
- Communication: RF Modem, Iridium (RUDICS), ARGOS, Acoustic Modem
- Horizontal speed: Buoyancy Engine: 0.35 m/s (0.68 knot) Average, up to 0.5 m/s (1 knots) with full drive. Thruster: Up to 1 m/s (2 knots)
- Mass: 55 - 70kgs (dependent upon configuration)
- Dimensions: Vehicle Length: 1.5 meters; Hull Diameter 22 cm
- Operable in all sea states