

<b>Project Title</b>	Seagreen Wind Energy Ltd
<b>Document Reference Number</b>	LF000009-CST-OF-PRG-0003

# Seagreen Alpha and Seagreen Bravo Offshore Wind Farms Project Environmental Monitoring Programme

Section 36 Consents Condition 26

OTA Marine Licence MS-00010467 Condition 3.2.1.1

Marine Licence MS-00010567 Condition 3.1.1

For the approval of Scottish Ministers

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Rev	Date	Reason for Issue	Originator	ECoW	Approver
07	01/02/2024	Post-construction update. For approval	[Redacted]		

**Table of Contents**

Consent Plan Overview .....	4
1. Introduction .....	6
1.1 Consents and Licences .....	6
1.2 Project Description .....	6
1.3 Consent and Licence Requirements.....	7
1.4 Linkages with other consent plans .....	13
1.5 Construction Management .....	15
1.6 Updates and Amendments .....	15
2. Scope and Objectives of the PEMP .....	16
2.1 Structure of this Document .....	16
3. Ornithology Monitoring.....	17
3.1 Introduction .....	17
3.2 Consent Requirements .....	17
3.3 Consultation.....	18
3.4 Aims and Objectives.....	19
3.5 Proposed Monitoring Strategy.....	19
3.6 Reporting .....	21
3.7 Programme .....	22
4. Sandeels, Marine Fish and Diadromous Fish Monitoring.....	23
4.1 Introduction .....	23
4.2 Consent Requirements .....	23
4.3 Consultation.....	24
4.4 Proposed Monitoring Strategy.....	26
4.5 Reporting .....	27
4.6 Programme .....	27
5. Benthic Communities Monitoring .....	28
5.1 Introduction .....	28
5.2 Consent Requirements .....	28
5.3 Consultation.....	28

5.4	Aims and Objectives.....	30
5.5	Monitoring Strategy.....	31
5.6	Reporting .....	32
5.7	Programme .....	32
6.	Scour and Local Sediment Deposition Monitoring.....	33
6.1	Introduction .....	33
6.2	Consent Requirements .....	33
6.3	Proposed Monitoring Strategy – Development of Scour.....	34
6.4	Proposed Monitoring Strategy – Local Sediment Deposition.....	35
6.5	Proposed Monitoring Strategy – OTA Monitoring to assess cable exposure .....	35
6.6	Summary .....	36
7.	Marine Mammals Monitoring .....	37
7.1	Introduction .....	37
7.2	Consent Conditions .....	37
7.3	Approach to Monitoring of Marine Mammals.....	38
7.4	Marine Mammal Monitoring Programme .....	40
7.5	Reporting .....	42
7.6	Programme .....	44
8.	Compliance with the Environmental Statement .....	45
8.1	Compliance with Methods Assessed in the ES and Addendum.....	45
8.2	Delivery of Mitigation and Monitoring Proposed in the ES and Addendum .....	45
9.	References .....	46
	Appendix A – PEMP List of Abbreviations and Definitions.....	47
	Appendix B – Change Management Procedure .....	50
	Appendix C – Seagreen Environmental Statement (ES) and ES Addendum Commitments.....	51
	Appendix D – Annex 1 Reef Habitats.....	53

## Consent Plan Overview

### Purpose of the Project Environmental Monitoring Programme

This Project Environmental Monitoring Programme (PEMP) has been prepared to address the specific requirements of the relevant conditions attached to the Section 36 (S36) Consents and Offshore Transmission Assets and Alternative Landfall Cable Installation Methodology Marine Licence (collectively referred to as the consents), issued to Seagreen Wind Energy Limited (hereafter referred to as Seagreen) for the Seagreen Alpha and Seagreen Bravo Offshore Wind Farms (OWFs) and the associated Offshore Transmission Assets (OTA).

Seagreen Alpha and Seagreen Bravo OWFs and OTA are collectively referred to as 'the Seagreen Project'. This PEMP has been prepared to discharge consent conditions for the Seagreen Project simultaneously.

The overall aims and objectives of the PEMP are to outline and define the approach Seagreen, its survey contractors and advisors will take with respect to environmental monitoring during the pre-construction, construction and post-construction phases of the project.

It should be noted that the PEMP is a 'live' document and will be regularly reviewed and updated in consultation with the Licensing Authority with FTRAG, to reflect the status of the Seagreen project monitoring requirements and to identify the appropriateness of ongoing monitoring.

Following the transfer of the OTA to an OFTO, Seagreen will no longer be responsible for the environmental monitoring requirements of the OTA Marine Licence. The OFTO will be responsible for agreeing any post-construction monitoring commitments in relation to the OTA with the Licensing Authority. This PEMP will be further updated following the OFTO transfer.

### Scope of the PEMP

The scope of the PEMP is to set out the plans for pre-construction, during construction (if required) and post-construction monitoring activities taking place seaward of Mean High Water Springs (MHWS) in relation to:

1. Birds;
2. Sandeels;
3. Marine fish;
4. Diadromous fish;
5. Benthic communities;
6. Seabed scour and local sediment deposition; and
7. Marine mammals.

### Structure of the PEMP

The PEMP is structured as follows:

- |           |   |
|-----------|---|
| Section 1 | Provides an overview of the project and the consent requirements in relation to the PEMP and describes the process for updating the PEMP. |
| Section 2 | Sets out the purpose, scope and objectives of the PEMP.   |
| Section 3 | Describes the measures for ornithology monitoring.  |
| Section 4 | Describes the measures for sandeels, marine fish and diadromous fish monitoring.  |
| Section 5 | Describes the measures for monitoring benthic communities.  |
| Section 6 | Describes the measures for monitoring scour and local sediment deposition.  |
| Section 7 | Describes the measures for monitoring marine mammals.   |
| Section 8 | Demonstrates compliance with the original application and the commitments made.   |

### PEMP Audience

The PEMP will be submitted to the Scottish Ministers/Licensing Authority for approval, in consultation with the relevant stakeholders, as required by the relevant consent conditions.

Compliance with this PEMP will be monitored in line with Seagreen's consents compliance management framework. The key roles responsible for monitoring compliance with the PEMP include Seagreen's Ecological Clerk of Works (ECOW) (during the construction phase) and Seagreen's O&M Environmental Manager. All survey contractors will be required to adhere to the requirements of the PEMP in carrying out monitoring surveys, data analysis and reporting.

Copies of the PEMP are to be held in the following locations:

- Seagreen's head office;
- Seagreen's construction office, O&M base and Marine Coordination Centre; and
- at the premises of any Contractor (as appropriate), including the Seagreen ECoW (during their appointment), acting on behalf of Seagreen.

## **1. Introduction**

### **1.1 Consents and Licences**

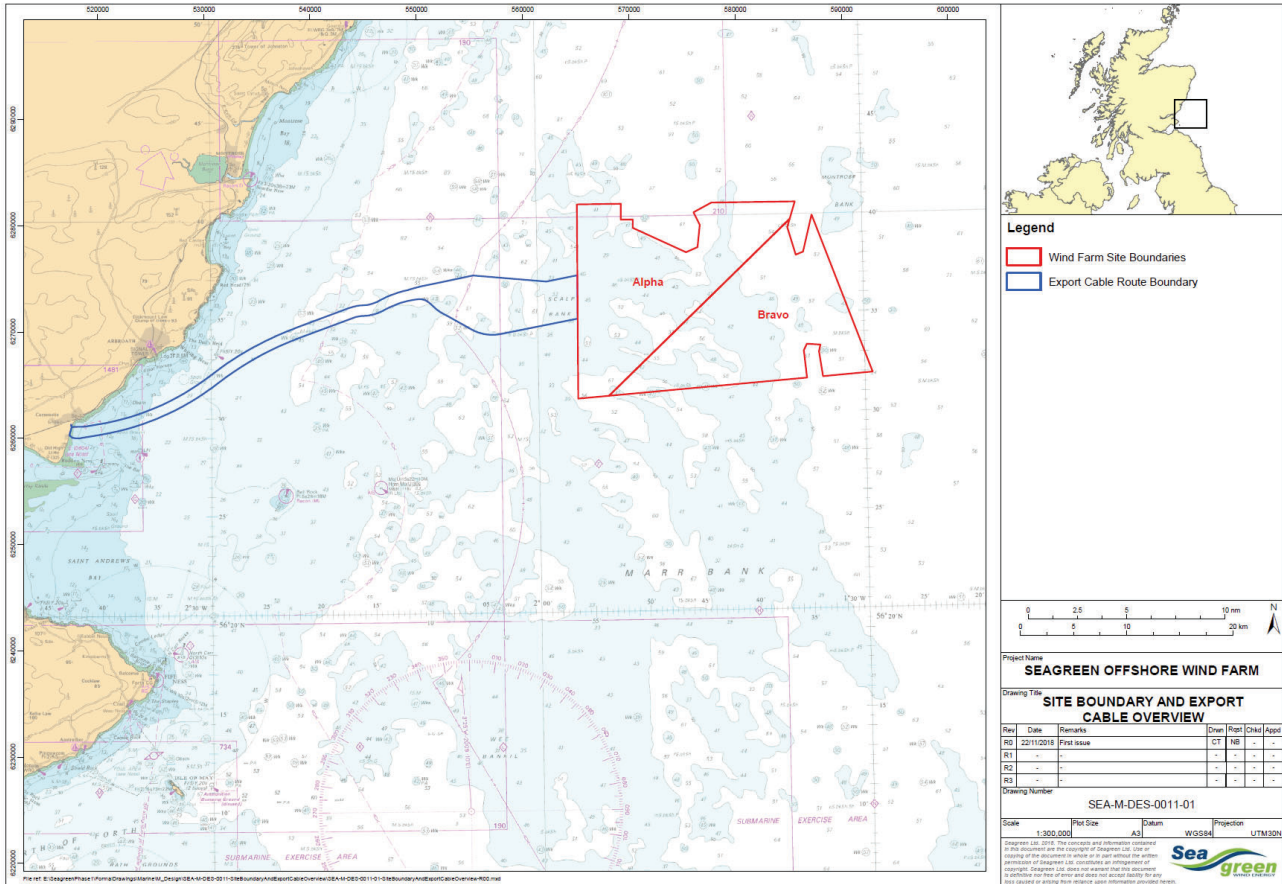
Seagreen Wind Energy Limited (hereafter referred to as 'Seagreen') was awarded Section 36 Consents (S36 Consents) under the Electricity Act 1989 by Scottish Ministers in October 2014 for Seagreen Alpha and Seagreen Bravo Offshore Wind Farms (OWFs). Marine Licences for Seagreen Alpha OWF, Seagreen Bravo OWF and the Offshore Transmission Asset (OTA) were also awarded by the Scottish Ministers in October 2014 under the Marine (Scotland) Act 2010 and the Marine and Coastal Access Act 2009. Together the wind farms Seagreen Alpha and Seagreen Bravo and the OTA collectively comprise 'the Seagreen Project'. All Section 36 Consents and Marine Licences have subsequently been varied on application by Seagreen.

In November 2019, a further Marine Licence was granted to Seagreen (subsequently varied) to permit an alternative landfall cable installation method (Alternative Cable Installation Methodology Marine Licence). In 2019, the Bravo Marine Licence was transferred from the name of Seagreen Bravo Wind Energy Limited (SBWEL) into the name of Seagreen Alpha Wind Energy Limited (SAWEL).

### **1.2 Project Description**

The Seagreen Project is located in the North Sea, in the outer Firth of Forth and Firth of Tay region and comprises the OWFs (the WTGs, their foundations and associated array cabling), together with associated infrastructure of the OTA (Offshore Substation Platforms (OSPs), their foundations and the offshore export cables), to facilitate the export of renewable energy to the national electricity transmission grid. The location of the Seagreen Project is shown in Figure 1.1.

Figure 1.1 - Project Location



### 1.3 Consent and Licence Requirements

The Seagreen Project benefits from the following consents:

- the S36 Consents;
- the OWF Marine Licences;
- the OTA Marine Licence; and
- the Alternative Landfall Cable Installation Methodology Marine Licence

This PEMP has been prepared to satisfy the criteria of the S36 Consent condition 26 and OTA Marine Licence condition 3.2.1.1 and Alternative Landfall Cable Installation Methodology Marine Licence condition 3.1.1 as set out in Table 1.1. The PEMP describes the completed pre-construction and construction phase monitoring activities and sets-out the proposed operational (post-construction) monitoring activities for consultation and approval by Scottish Ministers. This PEMP does not address monitoring during the decommissioning phase as this will be subject to a separate assessment at an appropriate time which will inform any requirements for monitoring.

This PEMP has been prepared to discharge consent conditions for Seagreen Alpha and Seagreen Bravo, as well as the discharge of the OWF, OTA and Alternative Landfall Cable Installation Methodology Marine

Licence (until its expiry) conditions simultaneously. It should be noted that this PEMP, revision 6, is intended to provide full details to demonstrate compliance with the relevant S36 Consent conditions and the discharge of the OWF, OTA and Alternative Landfall Cable Installation Methodology Marine Licence conditions including in relation to post-construction monitoring

*Table 1.1 - Consent Conditions to be discharged by the PEMP*

<b>Consent Condition Reference</b>	<b>Condition Text</b>	<b>Reference to relevant Section of this PEMP</b>
S36 Consents, Condition 26	The Company must, no later than 6 months prior to the Commencement of the Development, submit a Project Environmental Monitoring Programme (PEMP), in writing, to the Scottish Ministers for their written approval. Such approval may only be granted following consultation by the Scottish Ministers with the JNCC, SNH, RSPB Scotland, WDC, ASFB and any other ecological advisors or organisations as required at the discretion of the Scottish Ministers.	The pre-construction PEMP was submitted in July 2019 and approved in November 2019 (as Rev02)
	The PEMP must be in accordance with the Application as it related to environmental monitoring.	See section 8 and Appendix C
	The PEMP must set out measures by which the Company must monitor the environmental impacts of the Development. Monitoring is required throughout the lifespan of the Development where this is deemed necessary by the Scottish Ministers. Lifespan in this context includes pre-construction, construction, operational and decommissioning phases.	This PEMP (Rev06) presents the planned monitoring  See technical sections 3 to 7
	Monitoring must be done in such a way as to ensure that the data which is collected allows useful and valid comparisons between different phases of the Development.	See technical sections 3 to 7
	Monitoring may also serve the purpose of verifying key predictions in the Application.	See technical sections 3 to 7 and section 8
	In the event that further potential adverse environmental effects are identified, for which no predictions were made in the Application, the Scottish Ministers may require the Company to undertake additional monitoring.  The Scottish Ministers may agree that monitoring may be reduced or ceased before the end of the lifespan of the Development.	N/A
	The PEMP must cover, but not be limited to the following matters:  a. Pre-construction, construction (if considered appropriate by the Scottish Ministers) and post-construction monitoring surveys for:	This PEMP (Rev06) presents the completed and planned monitoring



Consent Condition Reference	Condition Text	Reference to relevant Section of this PEMP
	<ol style="list-style-type: none"> <li>1. Birds;</li> <li>2. Sandeels;</li> <li>3. Marine fish;</li> <li>4. Diadromous fish;</li> <li>5. Benthic communities; and</li> <li>6. Seabed scour and local sediment deposition.</li> </ol> <p>b. The participation by the Company in surveys to be carried out in relation to marine mammals as set out in the Marine Mammal Monitoring Programme (“MMMP”); and</p> <p>c. The participation by the Company in a National Strategic Bird Monitoring Framework (“NSBMF”) and surveys to be carried out in relation to regional and / or strategic bird monitoring including but not necessarily limited to:</p> <ol style="list-style-type: none"> <li>1. the avoidance behaviour of breeding seabirds around turbines;</li> <li>2. flight height distributions of seabirds at wind farm sites;</li> <li>3. displacement of kittiwake, puffin and other auks from wind farm sites; and</li> <li>4. effects on survival and productivity at relevant breeding colonies</li> </ol>	<p>For Birds, including participation in regional or national strategic monitoring see Section 3</p> <p>For Sandeels, Marine fish and Diadromous fish see section 4</p> <p>For Benthic communities see section 5</p> <p>For Seabed scour and local sediment deposition see section 6</p> <p>For Marine Mammals see section 7</p>
	<p>All initial methodologies for the above monitoring must be approved, in writing, by the Scottish Ministers and, where appropriate, in consultation with the Forth and Tay Regional Advisory Group (“FTRAG”) referred to in condition 27 of this consent.</p>	<p>Methodologies have been discussed and agreed with Marine Scotland. FTRAG have been consulted on all methodologies.</p> <p>See technical sections 3 to 7</p>
	<p>Any pre-consent surveys carried out by the Company to address any of the above species may be used in part to discharge this condition subject to the written approval by the Scottish Ministers.</p>	<p>See technical sections 3 to 7 and section 8</p>
	<p>The PEMP is a live document and must be regularly reviewed by the Scottish Ministers, at timescales to be determined by the Scottish Ministers, in consultation with the FTRAG to identify the appropriateness of on-going monitoring. Following such reviews, the Scottish Ministers may, in consultation with the FTRAG, require the Company to amend the PEMP and</p>	<p>Section 1.6 and Appendix B</p> <p><i>Following approval of the pre-construction PEMP (Rev02), it was subsequently updated</i></p>

Consent Condition Reference	Condition Text	Reference to relevant Section of this PEMP
	submit such an amended PEMP, in writing, to the Scottish Ministers, for their written approval. Such approval may only be granted following consultation with FTRAG and any other ecological, or such other advisors as may be required at the discretion of the Scottish Ministers. The PEMP, as amended from time to time, must be fully implemented by the Company at all times.	<i>for the construction phase (Rev05 approved July 2023). This update includes the confirmed post-construction monitoring arrangements</i>
	The Company must submit written reports and associated raw data of such monitoring surveys to the Scottish Ministers at timescales to be determined by the Scottish Ministers in consultation with the FTRAG. Subject to any legal restrictions regarding the treatment of the information, the results are to be made publicly available by the Scottish Ministers, or by such other party appointed at their discretion.	Planned reporting of monitoring outcomes is set out in technical sections 3 to 7
OTA Marine Licence, Condition 3.2.1.1	The Licensee must, no later than 6 months prior to the Commencement of the Works, submit a PEMP, in writing, to the Licensing Authority for their written approval. Such approval may only be granted following consultation by the Licensing Authority with the Joint Nature Conservation Committee (“JNCC”), Scottish Natural Heritage (“SNH”), the Royal Society for the Protection of Birds Scotland (RSPB Scotland) Whale and Dolphin Conservation (“WDC”), the Association of Salmon Fishery Boards (“ASFB”) and any other ecological advisors as required at the discretion of the Licensing Authority.	The pre-construction PEMP (Rev02) was submitted in July 2019 and approved in November 2019
	The PEMP must be in accordance with the Application as it relates to environmental monitoring.	See section 8 and Appendix C
	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 and specifically, monitoring for cable exposure, as specified in condition 3.2.2.10 parts f and g. Lifespan in this context includes pre-construction, construction, operational and decommissioning phases.	See technical sections 3 to 7. For cable exposure monitoring see section 6
	Monitoring should be done in such a way as to ensure that the data which is collected allows useful and valid comparisons as between different phases of the Works.	See technical sections 3 to 7 and section 8
	Monitoring may also serve the purpose of verifying key predictions in the Application.	See technical sections 3 to 7 and section 8

Consent Condition Reference	Condition Text	Reference to relevant Section of this PEMP
	<p>Additional monitoring may be required in the event that further potential adverse environmental effects are identified for which no predictions were made in the Application.</p> <p>The Licensing Authority may agree that monitoring may cease before the end of the lifespan of the Works.</p>	N/A
	<p>The PEMP must cover, but not be limited to the following matters:</p> <p>a. Pre-construction, construction (if considered appropriate by the Licensing Authority) and post-construction monitoring surveys as relevant in terms of the Application and any subsequent surveys for:</p> <ol style="list-style-type: none"> <li>1. Diadromous fish;</li> <li>2. Benthic communities;</li> <li>3. Seabed scour and local sediment deposition; and</li> <li>4. Sandeels (if using Gravity Bases).</li> </ol> <p>b. The participation by the Licensee in surveys to be carried out the in relation to marine mammals as set out in the Marine Mammal Monitoring Programme.</p>	<p>This PEMP (Rev06) presents the completed and planned monitoring</p> <p>For Diadromous fish and Sandeels see section 4</p> <p>For Benthic communities see section 5</p> <p>For Seabed scour and local sediment deposition see section 6</p> <p>For Marine mammals, including participation in surveys as set out in the MMMP see section 7</p>
	<p>All the initial methodologies for the above monitoring must be approved, in writing, by the Licensing Authority and, where appropriate, in consultation with the Forth and Tay Regional Advisory Group (“FTRAG”), referred to in conditions 3.2.2.18 and 3.2.3.10 of this licence.</p>	<p>Methodologies have been discussed and agreed with Marine Scotland. FTRAG have been consulted on the agreed methodologies.</p> <p>See technical sections 3 to 7</p>
	<p>Any pre-consent surveys carried out by the Licensee to address any of the above species may be used in part to discharge this condition.</p>	<p>See technical sections 3 to 7 and section 8</p>
	<p>The PEMP is a live document and must be regularly reviewed by the Licensing Authority, at timescales to be determined by the Licensing Authority, in consultation with the FTRAG to identify the appropriateness of on-going monitoring. Following such reviews, the Licensing Authority may, in consultation with</p>	<p>See section 1.6 and Appendix B</p> <p><i>Following approval of the pre-construction PEMP (Rev02), it was</i></p>

Consent Condition Reference	Condition Text	Reference to relevant Section of this PEMP
	<p>the FTRAG, require the Licensee to amend the PEMP and submit such an amended PEMP, in writing, to the Licensing Authority for their written approval. Such approval may only be granted following consultation with FTRAG and any other ecological, or such other advisors as may be required at the discretion of the Licensing Authority. The PEMP, as amended from time to time, must be fully implemented by the Licensee at all times.</p> <p>The Licensee must submit written reports of such monitoring surveys to the Licensing Authority at timescales to be determined by the Licensing Authority in consultation with the FTRAG. Subject to any legal restrictions regarding the treatment of the information, the results are to be made publicly available by the Licensing Authority, or by such other party appointed at their discretion.</p>	<p><i>subsequently updated for the construction phase (Rev05 approved July 2023). This update includes the confirmed post-construction monitoring arrangements</i></p> <p>Planned reporting of monitoring outcomes is set out in technical sections 3 to 7</p>
<p>Alternative Landfall Cable Installation Marine Licence, Condition 3.1.1</p>	<p>{...} The Licensee must ensure that, where the Works authorised by the licence are carried on as an alternative to nearshore cable laying operations under marine licence number 04678/14/0, that the works authorised by the licence are appropriately covered in the plans submitted under marine licence number 04678/14/0. Such plans are PEMP, EMP, DP, CoP, CMS, VMP, NSP, CaP, OMP, LMP and PS, as required by conditions 3.2.1.1, 3.2.1.2, 3.2.1.7, 3.2.2.3, 3.2.2.4, 3.2.2.8, 3.2.2.9, 3.2.2.10, 3.2.3.2, 3.2.2.14, and 3.2.2.5 of marine licence number 04678/14/0.</p> <p>[Note: Marine Licence 04678/14/0 has been replaced (current reference MS-00010467) but the effect of this condition is unchanged]</p>	<p>The monitoring requirements outlined in the PEMP document are applicable irrespective whether works are being undertaken under the Alternative Landfall Cable Installation ML or the OTA ML</p>

#### 1.4 Linkages with other consent plans

A number of other consent conditions and consent plans have linkages with this document. These are set out in Table 1.2 with details of the linkages presented and cross referenced as appropriate.

Table 1.2: Linkages with other consent plans and relevant conditions

Reference	Linkage with the PEMP	Cross-reference in this PEMP
<b>Consent Plans</b>		
S36 Consents, Condition 11 OTA Marine Licence, Condition 3.2.2.5	The <b>Piling Strategy (PS)</b> must include: c. Details of any mitigation and monitoring to be employed during pile-driving, as agreed by the Scottish Ministers The PS must, so far as is reasonably practical, be consistent with the EMP, PEMP and the CMS <i>Note the PS does not apply post-construction</i>	See section 4 (Marine Fish Monitoring) See section 7 (Marine mammals monitoring)
S36 Consents, Condition 14	The <b>Environmental Management Plan (EMP)</b> must include: a. Mitigation measures to prevent significant adverse impacts to environmental interest, as identified in the ES and pre-consents and pre-construction surveys. The EMP must be informed, so far as is reasonably practical, by the baseline surveys undertaken as part of the Application and the PEMP. <i>Note the construction phase EMP will be replaced by an operations phase EMP upon the completion of construction</i>	The EMP is informed by baseline environmental surveys
OTA Marine Licence, Condition 3.2.1.2	The <b>Environmental Management Plan (EMP)</b> must include: a. Mitigation measures to prevent significant adverse impacts to environmental interests, as identified in the Application and pre-consent and pre-construction surveys and include the relevant parts of the Construction Method Statement (CMS). The EMP must be informed, so far as is reasonably practical, by the baseline surveys undertaken as part of the Application and the PEMP.	The EMP is informed by baseline environmental surveys
S36 Consents, Condition 15 Seagreen OTA Marine Licence, Condition 3.2.2.8	The <b>Vessel Management Plan (VMP)</b> must, so far as is reasonably practicable, be consistent with the CMS, the EMP, the PEMP, the NSP, and the LMP. <i>Note the relevant post-construction content of the VMP will be migrated to Annex 1 of the OMP</i>	The VMP will, as far as reasonably practicable, be consistent with the PEMP

Reference	Linkage with the PEMP	Cross-reference in this PEMP
S36 Consents, Condition 16 OTA Marine Licence, Condition 3.2.3.2	The <b>Operation and Maintenance Programme (OMP)</b> must, so far as is reasonably practicable, be consistent with the EMP, the PEMP, the VMP, the NSP, the CaP, and the LMP.	The OMP will, as far as reasonably practicable, be consistent with the PEMP
OTA Marine Licence, Condition 3.2.2.10	The <b>Cable Plan (CaP)</b> must include: g. Measures to address exposure of any cables. <i>Note the relevant content of the CaP will be migrated to Annex 6 of the OMP</i>	See section 6 (Scour and local sediment deposition monitoring)
<b>Other Relevant Conditions</b>		
S36 Consents, Condition 27	The Company must participate in any <b>Forth and Tay Regional Advisory Group ("FTRAG")</b> established by the Scottish Ministers for the purpose of advising the Scottish Ministers on research, monitoring and mitigation programmes for, but not limited to, ornithology, diadromous fish, marine mammals and commercial fish. Should a Scottish Strategic Marine Environment Group ("SSMEG") be established (refer to condition 28), the responsibilities and obligations being delivered by the FTRAG will be subsumed by the SSMEG at a timescale to be determined by the Scottish Ministers.	See sections 3 to 7 (All technical sections)
OTA Marine Licence, Condition 3.2.2.18, 3.2.3.10	The Licensee must participate in any <b>FTRAG</b> established by the Licensing Authority for the purpose of advising the Licensing Authority on research, monitoring and mitigation programmes for, but not limited to, diadromous fish, marine mammals and commercial fish. Should a Scottish Strategic Marine Environment Group ("SSMEG") be established (refer to condition 5.2.2.19 and 5.2.3.11), the responsibilities and obligations being delivered by the FTRAG will be subsumed by the SSMEG at a timescale to be determined by the Licensing Authority	See sections 3 to 7 (All technical sections)
S36 Consents, Condition 28 Seagreen OTA Marine Licence, Condition 3.2.2.19, 3.2.3.11	The Company must participate in any <b>Scottish Strategic Marine Environment Group ("SSMEG")</b> established by the Scottish Ministers for the purposes of advising the Scottish Ministers on research, monitoring and mitigation programmes for, but not limited to, ornithology, diadromous fish, marine mammals and commercial fish.	SSMEG has not been established

Reference	Linkage with the PEMP	Cross-reference in this PEMP
S36 Consents, Condition 29 Seagreen OTA Marine Licence, Condition 3.2.2.12	The <b>Ecological Clerk of Works (ECoW)</b> responsibilities include:  b. Provide advice to the Company on compliance with consent conditions, including the conditions relating to the CMS, the EMP, the PEMP, the OPS (if required), the CaP and the VMP.  c. Monitor compliance with the CMS, the EMP, the PEMP, the PS (if required), the CaP and the VMP  <i>Note that the requirement for an ECoW ceases at the end of the construction phase</i>	Consent plan overview and EMP
S36 Consents, Condition 30 Seagreen OTA Marine Licence, Condition 3.2.1.3	The Company must, to the satisfaction of the Scottish Ministers, participate in the monitoring requirements as laid out in the ' <b>National Research and Monitoring Strategy for Diadromous Fish</b> ' so far as they apply at a local level. The extent and nature of the Company's participation is to be agreed by the Scottish Ministers in consultation with the FTRAG.	See section 4 (Diadromous fish monitoring)

### 1.5 Construction Management

Design embedded measures and adherence to good practice and guidance were implemented throughout construction of the Seagreen Project. The implementation of such measures was managed by the Contractor Environmental Advisors (CEAs), appointed by each key contractor throughout the duration of the construction period. The relevant CEA provided progress reports to the Seagreen Ecological Clerk of Works (ECoW).

The ECoW reviewed and approved consent plans and oversaw and monitored compliance with consent conditions. The ECoW was an independent party and provided regular reporting on compliance monitoring, good practice and mitigation measures, both to Seagreen and to MS-LOT throughout pre-construction and construction phases of the Seagreen Project.

Full details of the construction management procedures, including environmental compliance, monitoring and reporting and roles and responsibilities were provided in the Offshore Construction Environmental Management Plan (Offshore CEMP). Environmental management, monitoring and reporting measures for the operational phase are set out in the Operations Environmental Management Plan (OEMP) and will be responsibility of Seagreen's Contractors and the O&M Environmental Advisor.

### 1.6 Updates and Amendments

Should any further updates to the PEMP become necessary, the change management process as outlined in Appendix B shall be followed.



## 2. Scope and Objectives of the PEMP

The overall objective of this PEMP is to collate and describe the approaches to environmental monitoring, to satisfy the requirements of the S36 and Marine Licence consent conditions. This PEMP generally cross references the detailed monitoring plans prepared by Seagreen and agreed with Scottish Ministers and stakeholders' post-consent, and their subsequent outputs when available, for each required topic or receptor.

This PEMP therefore provides an overall description of the environmental monitoring programme to be undertaken by Seagreen. Further details regarding specific topics or receptors can be obtained through reference to the relevant Seagreen documents that are identified in the PEMP.

All Seagreen personnel and Seagreen's Contractors (including their Sub-Contractors) involved in the Seagreen Project were and will continue to be required to comply, as a minimum, with the PEMP, where appropriate.

### 2.1 Structure of this Document

The remainder of this document presents the information required to fulfil the criteria set out in the conditions of the S36 Consents and Marine Licences, as detailed in Section 1.2. The PEMP has been structured accordingly as follows:

- Section 3 - Provides a summary description of the agreed ornithology monitoring strategy and references to the detailed description of the strategy;
- Section 4 - Provides a summary description of the monitoring strategy for fish and references to detailed description of the justification where it has been agreed that no monitoring is required;
- Section 5 - Provides a summary description of the monitoring strategy for benthic communities and references to the detailed description of this;
- Section 6 - Provides a summary description of the monitoring strategy for seabed scour and local sediment deposition and references to the detailed description of the justification where it has been agreed that no monitoring is required;
- Section 7 - Provides a summary description of the agreed marine mammals monitoring strategy and references to the detailed description of this; and
- Section 8 - Demonstrates compliance with the original application, the 2012 Offshore Environmental Statement (ES) and Addendum and commitments made, with reference to Appendix C.



### 3. Ornithology Monitoring

#### 3.1 Introduction

The Ornithology Monitoring Strategy (OMS), report LF000009-CST-OF-REP-0016 (Seagreen, 2019a) set out the proposed monitoring which will be carried out for seabirds for the Seagreen Alpha and Seagreen Bravo wind farm sites. This is based on the FTRAG Ornithology (FTRAG-O) sub-group’s determination of bird monitoring priorities for the Forth and Tay offshore wind farms (FTRAG-O, 2016), and the ES and ES Addendum (Seagreen, 2012; Seagreen 2013). The OMS was updated and replaced by the Construction Phase Ornithology Monitoring Strategy, report LF000009-CST-OF-SUR-REP-0007 (Seagreen, 2021b) which includes strategies for monitoring in the construction and post-construction phases.

#### 3.2 Consent Requirements

Consent conditions relevant to seabird monitoring are summarised in Table 3.1.

*Table 3.1: Consent Conditions relevant to monitoring seabirds.*

Condition	Condition	Status
S36 Consents, Condition 26	The PEMP must cover, but not be limited to: a. Pre-construction, construction (if considered appropriate by the Scottish Ministers) and post-construction monitoring surveys for 1. <i>birds...</i>	The OMS (LF000009-CST-OF-REP-0016) describes the planned ornithology monitoring by Seagreen. This was issued to FTRAG-O and discussed at a meeting on 2 <sup>nd</sup> July 2019. An updated OMS for the construction and post-construction phases was provided to FTRAG-O in August 2021. See section 3.5.
S36 Consents, Condition 26	The PEMP must cover, but not be limited to the following matters: c. The participation by the Company in a National Strategic Bird Monitoring Framework (“NSBMF”) and surveys to be carried out in relation to regional and / or strategic bird monitoring including but not necessarily limited to: 1. <i>the avoidance behaviour of breeding seabirds around turbines;</i> 2. <i>flight height distributions of seabirds at wind farm sites;</i> 3. <i>displacement of kittiwake, puffin and other auks from wind farm sites; and</i> 4. <i>effects on survival and productivity at relevant breeding colonies</i>	The NSBMF has been superseded by the Scottish Marine Energy Research (ScotMER) Programme which includes an ornithology specialist research group. Currently the ScotMER Ornithology Evidence Map identifies potential research gaps. Seagreen continues to engage in potential strategic studies to further understanding of the interaction of priority seabirds with offshore wind farms and has provided support in principle for studies under the OWEC programme.

Condition	Condition	Status
S36 Consents, Condition 27	The Company must participate in any Forth and Tay Regional Advisory Group (“FTRAG”) established by the Scottish Ministers for the purpose of advising the Scottish Ministers on research, monitoring and mitigation programmes for, but not limited to, ornithology,	The Company is a member of FTRAG and the monitoring strategy for birds was presented to and approved by FTRAG-O. Seagreen will continue to provide regular updates to FTRAG-O on ornithological monitoring.
S36 Consents, Condition 28	The Company must participate in any Scottish Strategic Marine Environment Group (“SSMEG”) established by the Scottish Ministers for the purposes of advising the Scottish Ministers on research, monitoring and mitigation programmes for, but not limited to, ornithology,	SSMEG has not been established.

### 3.3 Consultation

Stakeholder engagement was carried out with Marine Scotland (MS) (now Marine Directorate – MD), Scottish Natural Heritage (SNH) (now NatureScot) and RSPB, and between the Forth of Tay offshore wind farm developers, all within the framework agreed by FTRAG-Ornithology subgroup in 2016 (see Section 3.5).

Initial discussions at FTRAG-O were focused on developing a shared approach to pre-construction surveys over the April 2019 to March 2020 monitoring period. An outcome of these discussions was a joint note (dated 28<sup>th</sup> February 2019) to combine aerial surveys over the Forth and Tay wind farm projects, Seagreen, Neart na Goaithe (NNG) and Inch Cape (ICOL), to provide consistent data collection and sampling. Following circulation of the joint note, the responses from SNH, MS and RSPB were supportive of the coordination attempts (SNH 14<sup>th</sup> March, MS 13<sup>th</sup> March and RSPB 6<sup>th</sup> March, respectively). The Forth and Tay developers have therefore continued to liaise over monitoring, to ensure, as far as is practical, that aerial survey coverage is coordinated.

The drafting of the pre-construction OMS took account of these informal discussions and was formally presented at the FTRAG Ornithology subgroup meeting on 2nd July 2019 and informed the PEMP which was approved on 4<sup>th</sup> September 2019. This previous OMS contained no commitments in terms of construction monitoring. In terms of post-construction monitoring, the approved pre-construction OMS includes a commitment to continue aerial surveys and tagging studies (which provide insights into displacement effects) and states a proposal to continue monthly aerial surveys once Seagreen is operational, for two years for the April to September period (the key periods identified by FTRAG-O).

Further discussions at FTRAG-O and consultation meetings focussed on the construction and post-construction monitoring requirements over the 2021 to 2025 monitoring period. An outcome of these discussions was a briefing note (dated 17<sup>th</sup> December 2020) outlining the proposed construction and post-

construction methodology. The Construction Phase OMS (which included methodologies for the post-construction phase) took account of these informal discussions and responses from NatureScot, MS and RSPB to the briefing note. The Construction Phase OMS was submitted with the construction phase update to the PEMP, which was approved in June 2023.

### 3.4 Aims and Objectives

The aims and objectives of pre-construction, construction and post-construction ornithology monitoring surveys are focused on the operational period and on key species, as previously discussed and agreed through the FTRAG Ornithology subgroup (FTRAG-O, 2016), to:

- Determine the extent of displacement or barrier effects around the WTGs for kittiwake, puffin and razorbill;
- Determine flight heights, avoidance behaviour and collision risk to gannet and kittiwake;
- Monitor seabird colonies (number of birds, and productivity) to assess if there are detectable changes in productivity or population attributable to effects of Seagreen Phase 1 from displacement, barrier effects or collision: and
- Compile an up-to-date pre-construction baseline against which post construction monitoring can be compared, to test the predictions within the Environmental Statement, and to identify any detectable changes.

### 3.5 Proposed Monitoring Strategy

The ornithology subgroup of FTRAG (FTRAG-O) was established to agree appropriate bird monitoring for the Firth of Forth and Tay OWFs. Through a series of meetings following the grant of consent in 2014, agreement was reached on key species, SPAs and potential impacts that needed to be the focus for monitoring programmes (FTRAG-O, 2016). The relative importance of each SPA for each OWF was agreed between stakeholders, as were the potential effects that would need to be monitored (collision, displacement, barrier effects and resulting population effects). The FTRAG-O output gives clear guidance on the monitoring objectives appropriate to each Forth and Tay OWF, for the bird monitoring conditions to be met. The Seagreen OMS has applied these priorities to the Seagreen Alpha and Seagreen Bravo wind farm projects.

The Seagreen Construction Phase OMS details the agreed construction and post-construction monitoring.

#### 3.5.1 Pre-construction monitoring (completed)

Seagreen has achieved substantial progress in the delivery of pre-construction monitoring commitments, comprising:

- Aerial surveys spanning two breeding seasons and one winter season (March 2019 to September 2020). In addition to adding a second breeding season to the pre-construction survey, Seagreen (and NNG) agreed to share additional costs to ensure survey coverage was maintained over the 2020 breeding season, when ICOL withdrew its funding of all aerial survey work from March 2020 onwards;

- Colony monitoring at the Isle of May, with NNG and Seagreen agreeing to share additional costs to ensure this was supported for the 2020 season (following the withdrawal of ICOL);
- Colony monitoring at the Bass Rock, with NNG and Seagreen agreeing to share additional costs, to ensure this was supported for the 2020 season (following the withdrawal of ICOL);
- The comprehensive compilation of historical colony data from Fowlsheugh and St. Abb's RSPB and National Trust for Scotland Reserves (respectively), improving the availability of long-term productivity and population data, to inform assessment of any construction and post construction effects and enabling detailed understanding of colony distribution changes over time; and
- A unique degree of collaboration to secure consistent data collection and information sharing between developers in support of the effective functioning of FTRAG-O to help meet its objectives (including Berwick Bank and Marr Bank<sup>1</sup>).

Colony-based monitoring and seabird tagging at Fowlsheugh and St. Abb's Head had to be postponed to 2021 due to COVID restrictions in 2020.

In respect of delivery against pre-construction monitoring commitments, Seagreen has gone beyond its consent condition requirements. This has been in the interests of ensuring there is a comprehensive and well-coordinated updated baseline on seabird distribution, and that there is long term colony monitoring and ranging studies that will be fundamental to understanding operational effects of the Seagreen, NNG and Inch Cape projects.

The key area of uncertainty in predicting effects of OWFs on seabirds is in relation to collision and displacement effects during operation. Therefore, resources will be targeted on ensuring these are monitored collectively, through continuation of the close cooperation developed between the Forth and Tay developers and stakeholders.

### 3.5.2 Construction monitoring (completed)

Following agreement with NatureScot and MS, the updated construction phase ornithological survey approach is set out below.

For the Seagreen construction period (October 2021 to December 2023), the ornithology monitoring comprises:

- Continued annual breeding season colony monitoring and tagging at the Isle of May;
- Colony annual breeding season monitoring and tagging at Fowlsheugh and St. Abb's; and
- Continued annual breeding season colour ringing and monitoring at Grassholm and the Bass Rock.

As agreed with NatureScot and MS via the OMS, aerial surveys are not considered necessary during the construction period. The power to detect and isolate changes in seabird distribution or abundance as a result of construction effects would be negligible (given the typical spatial and temporal variation in seabird

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<sup>1</sup> These projects are now being developed as a single project, known as 'Berwick Bank'

distribution resulting from other factors). There is also no longer any risk that construction of the Inch Cape and Seagreen OWFs will overlap, therefore there is no need to monitor for any possible cumulative effects (NNG is sufficiently distant to ensure no such effects would occur during the overlapping years of their construction). In addition, it is considered that sufficient pre-construction survey is now available, covering the Seagreen project site and buffer to comprehensively update the 2009-2011 and 2017 baselines.

Note that the 2022 ornithology monitoring was impacted by the avian influenza outbreak. No tagging was carried out at any of the colonies. Enhanced colony monitoring was instead undertaken where possible at each site, as acknowledged and accepted by MS and NatureScot (FTRAG-O meeting, November 2022). Additional protocols were agreed between the monitoring contractors and the regulators/site owners in advance of the 2023 monitoring work in case of a further outbreak at the colonies, however a full programme of tagging (and colony monitoring) was successfully completed.

### 3.5.3 Post-construction monitoring

The post-construction ornithology monitoring will be carried out for two years (2024 and 2025) and will comprise:

- Continued annual breeding season colony monitoring and tagging at the Isle of May to complete the agreed five-year programme;
- Continued annual breeding season colony monitoring and tagging at Fowlsheugh and St. Abb's to complete the agreed five-year programme;
- Continued annual breeding season colour ringing and monitoring at Grassholm and the Bass Rock to complete the agreed five-year programme; and
- Monthly breeding season (April to September) aerial surveys of the Seagreen site during 2024 and 2025, in cooperation with NNG (and potentially ICOL), to maintain the same coverage as pre-construction aerial surveys; and
- Contribution to deployment of the radar and camera bird tracking system at the NnG OWF. This system is to monitor flight activity and interaction of gannet and kittiwake in proximity to turbines during the first two full breeding seasons of NnG operations. The collaborative effort helps to rapidly improve knowledge of bird/turbine interactions, reducing uncertainty for this impact pathway.

Post-construction monitoring will extend for two years of operation, after which the results of the agreed studies will be discussed with the FTRAG. Any evidence-based requirements for further monitoring will be discussed and agreed via the FTRAG ornithology subgroup.

### 3.6 Reporting

Following completion of each ornithology monitoring stage a report will be produced and submitted to FTRAG for discussion, primarily on an annual basis.

The reporting approach for each phase was and will be determined in liaison with MD, NatureScot, RSPB and FTRAG-O at the time.

The focus and timing of the reporting during each phase was and is expected to be as follows:

Pre-construction

- Isle of May tagging and colony monitoring 2020 breeding season report – Q3 2021
- Gannet ringing and monitoring 2021 breeding season reports, Bass Rock and Grassholm – Q3 2021
- Aerial survey report with summary results and species distributions – Q1 2022
- Isle of May, Fowlsheugh and St.Abbs tagging and colony monitoring 2021 breeding season report – Q2/3 2022

Construction

- Isle of May, Fowlsheugh and St. Abbs tagging and colony monitoring reports – 2022<sup>2</sup>, 2023
- Gannet ringing and monitoring annual reports, Bass Rock and Grassholm – 2022, 2023

Post construction

- Aerial survey reports – 2024, 2025
- Isle of May, Fowlsheugh and St. Abbs tagging and colony monitoring reports – 2024, 2025
- Gannet ringing and monitoring annual reports, Bass Rock and Grassholm – 2024, 2025

Additional analysis and reporting may be submitted in response to discussions at FTRAG, if required.

**3.7 Programme**

Details of the bird monitoring survey programme are summarised in Table 3.2.

*Table 3.2: Programme of monitoring for birds*

Development Stage	Monitoring	Type of Data
Pre-construction	Distribution. Foraging	Aerial surveys. Tracking
Construction	Foraging	Tracking
Post-construction	Distribution. Collision risk	Aerial surveys. Tracking

<sup>2</sup> No tagging was ultimately conducted in 2022 due to HPAI. This is described further in section 3.5.2 of this document and in the 2022 report

## 4. Sandeels, Marine Fish and Diadromous Fish Monitoring

### 4.1 Introduction

The monitoring approach for sandeels, marine fish, and diadromous fish is set out in the Seagreen Fish Monitoring Plan (FMP), report LF000009-CST-OF-REP-0025 (Seagreen, 2019b). This report considers the key species identified within the ES (Seagreen, 2012), namely herring, sandeels and Atlantic salmon. It has been informed by a comprehensive review of monitoring requirements, undertaken by RPS on behalf of Seagreen, as well as feedback received from consultees as summarised in Section 4.3 and Table 4.2. The following sections summarising the consent requirements, consultation carried out to date, monitoring strategy, reporting and programme.

### 4.2 Consent Requirements

Consent conditions relevant to monitoring sandeels, marine fish and diadromous fish are summarised in Table 4.1, together with an overview of status of each requirement.

Table 4.1: Consent conditions relevant to monitoring sandeels, marine fish and diadromous fish

Condition Reference	Condition	Status
S36 Consents, Condition 26	The PEMP must cover, but not be limited to: a. Pre-construction, construction (if considered appropriate by the Scottish Ministers) and postconstruction monitoring surveys for ... 2. <i>sandeels</i> 3. <i>marine fish</i> 4. <i>diadromous fish</i> .	The monitoring plan for sandeels, marine fish, and diadromous fish has been agreed with MS-LOT, MSS, SNH and with FTRAG (see Table 4.2) See Section 4.4.1 for marine fish See Section 4.4.2 for sandeels See Section 4.4.3 for diadromous fish
S36 Consents, Condition 30	Seagreen must: <i>...to the satisfaction of the Scottish Ministers, participate in the monitoring requirements as laid out in the 'National Research and Monitoring Strategy for Diadromous Fish' so far as they apply at a local level. The extent and nature of the Company's participation is to be agreed by the Scottish Ministers in consultation with the FTRAG.</i>	The NRMSDF has been superseded by the Scottish Marine Energy Research (ScotMER) Programme which includes a specialist research group in relation to diadromous fish. The ScotMER Diadromous Fish Evidence Map was published on 5 <sup>th</sup> June 2019. Seagreen will investigate with Marine Scotland the potential for participation in relevant strategic studies to contribute to the ScotMER programme.



Condition Reference	Condition	Status
OTA Marine Licence, Condition 3.2.1.1	<p>The PEMP must cover but not be limited to:</p> <p><i>a) Pre-construction, construction (if considered appropriate by the Scottish Ministers) and postconstruction monitoring surveys as relevant in terms of the Application and any subsequent surveys</i></p> <p>for:</p> <p>1. <i>diadromous fish</i></p> <p>....</p> <p>4. <i>sandeels (if using Gravity Bases).</i></p>	<p>The monitoring plan for sandeels, marine fish, and diadromous fish has been agreed with MS-LOT, MSS, SNH and with FTRAG (see Table 4.2)</p> <p>See Section 4.4.1 for marine fish</p> <p>See Section 4.4.2 for sandeels</p> <p>See Section 4.4.3 for diadromous fish</p>

### 4.3 Consultation

A summary of the consultation carried out in relation to the development of the monitoring strategy for sandeels, marine fish and diadromous fish, including key stakeholder engagement meetings, is presented in Table 4.2.

Table 4.2: Summary of consultation.

Date	Stakeholder	Summary of discussion	Reference
21/03/2019	MS-LOT, MSS	Marine and Migratory Fish monitoring strategy post-consent consultation meeting and presentation on approach to marine fish monitoring. Strategy agreed by MSS.	Seagreen Marine and Migratory Fish Monitoring Strategy LF000009-CST-OF-REP-0019
21/03/2019	SNH	Email from SNH confirming that the overall approach to monitoring of marine fish, sandeels and migratory fish is appropriate, and they are content with what is proposed. SNH agree that contributing to the ScotMer Evidence Map priorities for migratory species will be important.	Email from SNH to Seagreen received 21 <sup>st</sup> March 2019
27/03/2019	FTRAG, MSS	Issue of the Marine and Migratory Fish Monitoring Strategy report.	Seagreen Marine and Migratory Fish Monitoring Strategy LF000009-CST-OF-REP-0019
15/04/2019	FTRAG, MSS	Acceptance of the strategy by FTRAG and MSS via e-mail 15 <sup>th</sup> April 2019.	Seagreen Marine and Migratory Fish Monitoring Strategy LF000009-CST-OF-REP-0019



Date	Stakeholder	Summary of discussion	Reference
24/06/2019	FTRAG	Discussion and agreement of marine and migratory fish monitoring plan at FTRAG meeting on 24 <sup>th</sup> June 2019.	Meeting minute LF000009-CST-OF-MOM-0020
10/03/2021	MSS	Email from MSS describing details of smolt genetics study seeking support for Phase 2 of study to follow Phase 1 completion and success.	Email received from MSS 10 <sup>th</sup> March 2021
19/07/2021	MSS	Email from MSS updating on Phase 1 progress and indicating expected late 2021 expected timescale for Phase 2 of the study.	Email received from MSS 19 <sup>th</sup> July 2021
21/03/2019	MS-LOT, MSS	Marine and Migratory Fish monitoring strategy post-consent consultation meeting and presentation on approach to marine fish monitoring. Strategy agreed by MSS.	Seagreen Marine and Migratory Fish Monitoring Strategy LF000009-CST-OF-REP-0019
21/04/2022	MS-LOT	Email from MS-LOT confirming that based on the Phase 1 work, Phase 2 would not be going ahead and suggesting that Seagreen contribute to a salmon smolt tracking study in the Moray Firth in order to meet its diadromous fish monitoring commitment	Email received from MS-LOT 21 <sup>st</sup> April 2022
May - October 2022	MS-LOT	Discussions between MS-LOT and Seagreen in relation to the appropriateness of the Moray Firth salmon smolt tracking study to the Seagreen Project	<i>Emails and meetings May - October 2022</i>
03/11/2022	MS-LOT	Email from MS-LOT confirming that funding had been secured for the smolt tracking study and advising that a commitment for Seagreen to contribute to it (or another project should it not go ahead) be included in the Seagreen PEMP	Email received from MS-LOT 3 <sup>rd</sup> November 2022
November 2022 - June 2023	MS-LOT	Further discussions between MS-LOT and Seagreen in relation to the appropriateness of the Moray Firth salmon smolt tracking study. Agreement to update PEMP to investigate potential participation in appropriate studies to contribute to gaps identified in the ScotMER evidence map, not limited to the Forth and Tay area	<i>Emails and meetings November 2022 – June 2023</i>

#### 4.4 Proposed Monitoring Strategy

##### 4.4.1 Marine fish

Due to the available evidence and the current good understanding within the offshore wind industry of potential impacts in relation to marine fish, generic pre- and post-construction monitoring is not proposed for the Seagreen Project. There is a high degree of confidence that potential impacts from underwater noise on marine fish will not be significant. Full justification for this approach is detailed in Section 3.4.1 of the FMP and this has been agreed by MS, NatureScot and FTRAG as noted within Table 4.2.

Instead, Seagreen intends to draw on the data collected as part of the marine mammal monitoring plan (Section 7), which will include underwater noise monitoring through extension of the East Coast Marine Mammal Acoustic Study (ECOMMAS) acoustic arrays to provide site specific data. The data collected will provide insights into the actual noise produced during the installation of foundations and will be compared with predicted noise levels from the 2012 Offshore ES and updated baseline data gathered post consent and noise modelling studies for herring and salmon.

##### 4.4.2 Sandeels

The ES (Seagreen, 2012) concluded no significant impacts on sandeel populations, with a high degree of confidence in this assessment. Combined with the available evidence and the current good understanding within the offshore wind industry of the limited potential impacts and the potential for sandeel populations to recover, generic pre- and post-construction monitoring for sandeels is not proposed for the Seagreen Project. Full justification for this approach is detailed in Section 3.4.2 of the FMP and this has been agreed by MS, NatureScot and FTRAG as noted within Table 4.2.

It should also be noted that the gravity base foundation option was not considered for the project final design. This was considered to be the worst case for impacts on sandeels within the ES. Therefore, issues regarding potential habitat loss in this context are significantly reduced and no longer relevant in respect of monitoring requirements.

##### 4.4.3 Diadromous fish

The 2012 Offshore ES concluded no significant impacts on migratory fish populations, including Atlantic salmon populations, with a high degree of confidence. In combination with the available evidence and the improved understanding within the offshore wind industry, generic pre- and post-construction monitoring for migratory fish is not proposed for the Seagreen Project. Full justification for this approach is detailed in Section 3.4.3 of the FMP and this has been agreed by MS, NatureScot and FTRAG as noted within Table 4.2.

The NRMSDF cited under Condition 30 of the Section 36 consents has been superseded by the ScotMER programme which includes a specialist research group in relation to diadromous fish. The ScotMER Diadromous Fish Evidence Map was published by MS on 5<sup>th</sup> June 2019<sup>3</sup>. The available evidence does indicate the possible presence of migrating Atlantic salmon smolts or returning adults within the site.

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<sup>3</sup> <https://www2.gov.scot/Topics/marine/marineenergy/mre/research/diadromous/EvMap>

Seagreen commits to continuing to investigate with the MD the potential for participation in appropriate and relevant strategic studies to contribute to evidence gaps identified in the ScotMER evidence map, with the aim of furthering understanding of the ecology and behaviour of Atlantic salmon and other migratory species, (e.g. sea trout, lamprey species) in relation to offshore wind farm construction and operation.

#### 4.5 Reporting

##### 4.5.1 Marine fish

The results of any comparison between predicted and observed construction noise levels will be reported to MS-LOT following construction.

##### 4.5.2 Sandeels

No monitoring is proposed.

##### 4.5.3 Diadromous fish

No monitoring is proposed.

#### 4.6 Programme

##### 4.6.1 Marine fish

The monitoring programme for marine fish is summarised in Table 4.3.

Table 4.3: Programme – Marine Fish

Phase	Monitoring	Type of Data
Pre-construction	None Required	n/a
Construction	Underwater noise monitoring (ECOMMAS extension)	Noise measurements recorded during construction
Post-construction	None Required	n/a

##### 4.6.2 Sandeels

No monitoring is proposed.

##### 4.6.3 Migratory fish

No specific monitoring is proposed. Potential Seagreen participation in relevant strategic studies is to be confirmed through investigation with MD.

## 5. Benthic Communities Monitoring

### 5.1 Introduction

The monitoring approach for benthic communities is set out in report LF000009-CST-OF-REP-0026, Seagreen Benthic Monitoring Plan (Seagreen, 2019c) (BMP). Seagreen has committed to a benthic monitoring strategy which has been designed to specifically target potential impacts to key benthic habitats which were identified in the ES as having the highest sensitivity to construction impacts and which have the potential to be present within the Seagreen Alpha and Seagreen Bravo OWFs and OTA prior to construction (i.e. Annex 1 biogenic and geogenic reef habitats). The following sections summarise the consent requirements, consultation, aims and objectives, methodology, reporting and programme in relation to benthic communities monitoring.

### 5.2 Consent Requirements

Consent conditions relevant to benthic monitoring are summarised in Table 5.1 below together with an overview of status of each requirement.

Table 5.1: Consent conditions relevant to monitoring Benthic Communities.

Condition Reference	Condition	Status
S36 Consents, Condition 26	The PEMP must cover, but not be limited to: <i>a. Pre-construction, construction (if considered appropriate by the Scottish Ministers) and post construction monitoring surveys for</i> .... <i>5. benthic communities</i>	The benthic monitoring plan has been agreed with MS-LOT, MSS, SNH and with FTRAG (see Table 5.2). Seagreen have completed an Annex I reef survey, targeting areas of potential reef habitat identified through predictive modelling. Three areas of potential geogenic Annex I reef habitat were identified
OTA Marine Licence, Condition 3.2.1.1	The PEMP must cover but not be limited to: <i>a) Pre-construction, construction (if considered appropriate by the Scottish Ministers) and postconstruction monitoring surveys as relevant in terms of the Application and any subsequent surveys for:</i> <i>1. benthic communities</i>	The benthic monitoring plan has been agreed with MS-LOT, MSS, SNH and with FTRAG (see Table 5.2). Seagreen have completed an Annex I reef survey, targeting areas of potential reef habitat identified through predictive modelling. Three areas of potential geogenic Annex I reef habitat were identified

### 5.3 Consultation

The benthic monitoring strategy has been informed by a comprehensive review of monitoring requirements across the Seagreen Project which was undertaken by RPS, on behalf of Seagreen.

The approach to benthic monitoring was presented to and discussed with MS, Marine Scotland Science (MSS) and SNH and agreed in subsequent meetings and correspondence. A summary of the consultation carried out in relation to the development of the monitoring strategy for benthic communities, including key stakeholder engagement meetings, is presented in Table 5.2 below.

Table 5.2: Summary of consultation

Date	Stakeholder	Summary of discussion	Reference
22/02/2019	MS-LOT, SNH	Seagreen Benthic Monitoring Strategy document issued to stakeholders via email for review.	Seagreen Benthic Monitoring Strategy: LF000009-CST-OF-REP 0017
01/03/2019	SNH	Email from SNH confirming that the overall approach to benthic monitoring is appropriate and that there is no requirement for generic pre and post-construction monitoring and requesting confirmation that Modiolus reefs will also be considered.	Email from SNH to Seagreen received 1 <sup>st</sup> March 2019
05/03/2019	MSS, MS-LOT	Meeting (teleconference) to present and discuss the proposed benthic monitoring strategy.	Note of meeting in email from Seagreen to MS-LOT/MSS issued 5 <sup>th</sup> March 2019
18/03/2019	MSS	Email from MSS confirming that they are content with the benthic monitoring strategy on the basis that Modiolus beds are specifically added to the strategy.	Email from MSS to Seagreen received 18 <sup>th</sup> March 2019
18/03/2019	FTRAG	Seagreen Benthic Monitoring Strategy document issued to members of the FTRAG via email for review.	Seagreen Benthic Monitoring Strategy: LF000009-CST-OF-REP 0017
01/04/2019	MSS	Survey reports from the EIA benthic characterisation surveys issued to MSS, following request from MSS.	Email from Seagreen to MSS received 1 <sup>st</sup> April 2019
17/04/2019	MSS	MSS advice regarding the benthic monitoring strategy.	Letter received 17 <sup>th</sup> April 2019
06/05/2019	MSS	Seagreen response to MSS advice on benthic monitoring strategy.	Seagreen letter to MSS LF000009-CST-OFF-LET-0030

Date	Stakeholder	Summary of discussion	Reference
21/05/2019	MSS	Email from MSS confirming that they are content with the benthic monitoring strategy on the basis that the locations of drop-down video ground truthing locations and the final pre-construction survey report are provided to MS-LOT/MSS.	Email from MS-LOT to Seagreen received 21 <sup>st</sup> May 2019
24/06/2019	FTRAG	Discussion and agreement of benthic monitoring plan at FTRAG meeting on 24 <sup>th</sup> June 2019.	Meeting minute LF000009-CST-OF-MOM-0020
04/09/2019	MS-LOT, MSS, SNH	Discussion of predictive habitat modelling for potential reef and subsequent survey strategy.	Presentation of LF000009-CST-OF-PPP-0006 Seagreen benthic strategy
18/09/2019	MSLOT, MSS	Response from MSS on proposed Annex I reef survey approach advising additional survey locations.	Email from MSLOT 18 <sup>th</sup> Sep 2019
10/10/2019	MSLOT, MSS	Seagreen response to MSS comments.	Letter LF000009-CST-OF-LET-0048
04/11/2019	MSLOT, MSS	Further response from MSS regarding sample locations.	Email from MSLOT 4 <sup>th</sup> November 2019
08/11/2019	MSLOT, MSS	Seagreen email confirming addition of 4 further sample locations.	Email to MSLOT 8 <sup>th</sup> November 2019
13/08/2020	MSLOT, MSS	Seagreen email confirming adjustment of sample locations.	Email to MSLOT, MSS 13 <sup>th</sup> August 2020
02/08/2021	FTRAG	Submission of Annex I reef survey	LF000009-CST-OF-SUR-REP-0006 <i>Seagreen DDV Survey 26.03.2020 Final Report</i>

#### 5.4 Aims and Objectives

The aims and objectives of the benthic monitoring surveys are to:

- Identify and delineate any Annex 1 biogenic (*Sabellaria* or *Modiolus*) or geogenic reefs present within the Seagreen Alpha and Seagreen Bravo OWF sites and OTA export cable corridor in order to ensure that direct impacts to reef habitats, if present, are avoided wherever reasonably practicable during construction; and
- Establish whether the location, nature and/or extent of reef features, if identified as present during the pre-construction surveys, changes following construction.

## 5.5 Monitoring Strategy

The ES concluded no significant impacts on benthic communities. Combined with available evidence and the current detailed understanding within the offshore wind industry of the limited potential impacts, generic pre- and post-construction monitoring is not being undertaken for the Seagreen Project. Full justification for this approach is detailed in Section 3.4.2 of the Seagreen BMP.

The strategy for benthic monitoring within the Seagreen Alpha and Seagreen Bravo OWF sites and along the OTA has, instead, been designed to specifically target impacts to key potentially sensitive benthic habitats which were identified in the ES. Justification for this is detailed in Section 3.4.1 of the Seagreen BMP. The following sections set out the targeted monitoring strategy for the pre-construction and post-construction phases.

### 5.5.1 Pre-construction monitoring (completed)

Areas of potential Annex I reef habitat in the Seagreen Alpha and Bravo OWF area and OTA cable corridor were identified using a predictive modelling exercise (Seagreen Wind Energy, 2019). Data from geophysical and ground-truthing surveys completed in 2011 (cable route) and 2018 (offshore array) along with multibeam echosounder (MBES) and side-scan sonar (SSS) outputs were used to produce the predictor variables for the models. Ground-truth data from drop-down video (DDV) transect surveys, grab surveys, geotechnical sampling, and biotope maps derived from the previous surveys were used to train the models and evaluate model accuracy. The modelling outputs were then used to inform the location of target survey transects for the Annex I reef survey.

The pre-construction Annex I reef survey utilised remote sampling techniques (drop-down video) at 15 locations across the OWF site and OTA cable corridor, to establish the presence or absence of any reef features, and where present to determine their extent.

Subsequent laboratory analysis of digital stills and video footage was conducted to supplement notes recorded in the field. All taxa were quantified using the SACFOR scale of abundance and the resulting data were compared with substrate information to assign biotope classifications. Where potential Annex I reef habitats were noted, reef assessments were undertaken using appropriate guidance notes.

Analysis of video footage and associated stills from the 15 Annex I target locations found no indication of biogenic reef at any of the sites. Geogenic reef, in the form of stony reef, was identified at 7 of the 15 target locations. Three of these sites (ST04, ST05 and ST07) had areas of seabed that were considered to meet all four of the criteria for medium resemblance stony reef and are likely to represent Annex I reef habitat. At these sites, the substrate comprises more than 40% cobbles and boulders supporting a biota dominated by dense aggregations of the brittlestars *O. fragilis* and *O. nigra* over larger cobbles and boulders.

### 5.5.2 Construction monitoring

It has been confirmed and agreed that there is no requirement for benthic monitoring during construction.



### 5.5.3 Post-construction monitoring

Seagreen committed to undertaking a single post-construction Annex 1 reef survey in the event that both of the following criteria are met:

- Annex 1 reef habitats are recorded within the Seagreen Alpha and Seagreen Bravo OWFs and/or along the OTA corridor during the pre-construction survey; and
- If construction activity has occurred within any of the areas confirmed as reef habitat.

The pre-construction survey identified three areas of Annex 1 reef habitat (transect reference numbers ST04, ST05 and ST07) – see report referenced in section 5.6 below. Following the completion of construction, these areas were mapped against the locations of the installed assets (WTG and OSP foundations) and the footprints of jack-up vessels used for construction (see Appendix D). This exercise confirmed that no construction activity took place at or within 200m of the areas of Annex 1 reef habitat. No post-construction benthic monitoring is therefore required.

## 5.6 Reporting

Seagreen submitted to, and discussed with, MS-LOT the results of the initial review of geophysical data and the location of any targets identified as requiring further investigation, via drop down video.

The results of the pre-construction survey are presented in the *Seagreen DDV Benthic Monitoring and Annex 1 Reef Survey* report (LF000009-CST-OF-SUR-REP-0006), as provided to MS-LOT in August 2021.

Appendix D shows the identified Annex 1 reef habitats mapped against the installed assets, confirming that the installation of the Seagreen Project avoided all such habitats.

## 5.7 Programme

Details of the benthic monitoring survey programme are summarised in Table 5.3.

Table 5.3: Programme – Benthic Communities

Phase	Monitoring	Type of Data
Pre-construction	In the event that an Annex 1 reef seabed imagery survey is required, this survey will be undertaken no more than two years before the commencement of the offshore construction activities. (Annex 1 reef survey completed September 2020).	Geophysical survey outputs and DDV video sampling
Construction	None required	n/a
Post-construction	None required	n/a



## 6. Scour and Local Sediment Deposition Monitoring

### 6.1 Introduction

Two main principles underpin the strategy for the monitoring of scour, that is proposed to fulfil licence conditions. The first is that scour is primarily an engineering issue and the second is that scour is an issue where an adaptive monitoring approach is appropriate where there will necessarily be cross-over between outcomes from engineering required monitoring and any environmental monitoring required by licence conditions.

Initial development of a scour and local sediment deposition monitoring strategy for inclusion within the PEMP included a thorough review of the baseline environment relevant to this subject (drawing on datasets and analysis available from project development to date), relevant industry guidance and monitoring commitments. In addition, careful consideration was given to the availability of existing data of relevance to scour and sediment deposition and existing baseline data. On this basis no preconstruction monitoring was or is considered necessary.

Given the important linkages between the engineering aspects of the development and scour monitoring, a scour monitoring strategy for the construction and post construction phases has been developed in the context of the PEMP requirements following the completion of detailed engineering design. This strategy includes the design of measures in relation to the potential for scour around installed structures and is summarised in the following sections.

### 6.2 Consent Requirements

Consent conditions relevant to monitoring seabed morphology and scour are summarised in Table 6.1.

*Table 6.1: Consent conditions relevant to monitoring Scour and Sediment Deposition.*

Condition Reference	Condition	Status
S36 Consents, Condition 26	<p>The PEMP must cover, but not be limited to:</p> <p><i>a. Pre-construction, construction (if considered appropriate by the Scottish Ministers) and postconstruction monitoring surveys for</i></p> <p>....</p> <p><i>6. Seabed scour and local sediment deposition.</i></p> <p>Condition 26 also notes that:</p> <p><i>Any pre-consent surveys carried out by the Company to address any of the above species may be used in part to discharge this condition subject to the written approval by the Scottish Ministers.</i></p>	<p>The proposed approach to monitoring for scour was discussed and agreed with FTRAG on 24<sup>th</sup> June 2019. (LF000009-CST-OF-MOM-0020).</p> <p>The monitoring strategy is summarised in section 6.3 and 6.4 below.</p>

Condition Reference	Condition	Status
	<i>The PEMP must be in accordance with the Application as it related to environmental monitoring</i>	
OTA Marine Licence, Condition 3.2.1.1	<p>The PEMP must cover but not be limited to:</p> <p><i>Pre-construction, construction (if considered appropriate by the Licensing Authority) and post-construction monitoring surveys as relevant in terms of the Application and any subsequent surveys for</i></p> <p><i>3. Seabed Scour and Local Sediment Deposition</i></p> <p><i>Monitoring should be done in such a way as to ensure that the data which is collected allows useful and valid comparisons as between different phases of the Works. Monitoring may also serve the purpose of verifying key predictions in the Application; and</i></p> <p><i>Any pre-consent surveys carried out by the Licensee to address any of the above species may be used in part to discharge this condition.</i></p> <p><i>Monitoring is required throughout the lifespan of the Works where this is deemed necessary by the Licensing Authority and specifically, monitoring for cable exposure as specified in condition 3.2.2.10 parts f and g.</i></p>	<p>The proposed approach to monitoring for scour was discussed and agreed with FTRAG on 24<sup>th</sup> June 2019. (LF000009-CST-OF-MOM-0020).</p> <p>The monitoring strategy is summarised in section 6.3 and 6.4 below.</p>

### 6.3 Proposed Monitoring Strategy – Development of Scour

#### 6.3.1 Pre-construction

Several pre-existing bathymetric data sets across the Seagreen Alpha and Seagreen Bravo OWF sites are available, including the GEMS (2010) geophysical survey, the MMT (2018) geophysical survey and sediment particle size data from a 2011 benthic survey.

Given the availability of bathymetric data across the site, and particularly the recent 2018 survey, there is considered to be a thorough and robust pre-construction baseline available with respect to scour monitoring and no further pre-construction surveys are proposed.

#### 6.3.2 Construction

No survey or monitoring is required. Scour protection will be installed around the suction caisson foundations as per design requirements. The requirement for any scour protection around jacket foundations will be confirmed. As such no during construction monitoring is required and this process is more appropriately considered for monitoring during the post construction phase.

### 6.3.3 Post-construction

A post installation survey strategy will be developed that is aligned with the engineering requirements of the project. A post installation survey undertaken as part of engineering requirements will be evaluated from a scour perspective. This assessment will be used to understand the morphological and bathymetric conditions, magnitude and extent of any scour that occurs, the requirements for and timing of any future monitoring and the need for any rectification measures. Detailed methodologies for the post-installation survey and any ongoing O&M phase survey activities shall be developed and presented in the project Operation & Maintenance Manual.

### 6.4 Proposed Monitoring Strategy – Local Sediment Deposition

Based on a review of available information characterising the site, alongside the assessment of potential impacts presented in the ES and industry practice completed as part of developing this approach, no monitoring of local sediment deposition is proposed to be undertaken, over and above any monitoring associated with scour itself required for engineering purposes.

It is also highlighted that the gravity base foundation option is not being taken forward. This was considered to be the worst case for sediment disturbance within the ES (Seagreen, 2012). The foundations for the project will now comprise jackets with suction piles and jackets with driven pin piles.

### 6.5 Proposed Monitoring Strategy – OTA Monitoring to assess cable exposure

#### 6.5.1 Pre-construction

Several pre-existing bathymetric data sets across the Seagreen Alpha and Seagreen Bravo OTA are available, including the Osiris (2011) bathymetry survey and 2006 UKHO data<sup>4</sup>. Based on this data coverage, which will provide the pre-construction baseline for monitoring cable exposure post-construction, further pre-construction surveys along the OTA route are not proposed.

#### 6.5.2 Construction

No survey or monitoring is required. The effects of local sediment deposition in relation to installed cables and other OTA Infrastructure will take a period of time to develop following construction. As such no during construction monitoring is required and this process is more appropriately monitored during the post construction phase.

#### 6.5.3 Post construction

Approximately one year following cable installation, a survey will be undertaken to ensure that that cable remains as installed and to identify areas of cable at potential risk of exposure in the future. Monitoring will focus on any 'at-risk' areas identified. Subject to the findings of the surveys, the frequency of ongoing monitoring will be adapted to the appropriate level of exposure risk.

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<sup>4</sup> 2006 Wee Bankie to Gourdon bathymetry survey published by the UKHO available from the Admiralty Data Portal: <https://data.admiralty.co.uk/portal/apps/webappviewer/index.html?id=02dfdb1d1dd64ff9ba9109b3c3f1d7e1>

Further provision for post-construction cable exposure monitoring is made in the Offshore Transmission Asset Cable Plan (ref. LF000009-CST-OF-PLN-0009) and Offshore Transmission Assets Operation and Maintenance Programme (ref. LF000009-CST-OF-PRG-0004).

## 6.6 Summary

A thorough review of available data (for example bathymetric data) relevant to the Seagreen Alpha and Seagreen Bravo OWF sites and OTA route concluded that no further pre-construction monitoring for scour or local sediment deposition is required.

Scour is primarily an engineering issue and, as such, associated monitoring is closely linked to the engineering design aspects of the project. Scour protection will be installed around suction caisson foundations and no construction phase monitoring is deemed necessary. A post-construction monitoring strategy for scour, sediment deposition and cable exposure, based on engineering requirements, will be defined following completion of the installation works.

## 7. Marine Mammals Monitoring

### 7.1 Introduction

This section of the PEMP outlines Seagreen’s approach to monitoring of marine mammals in relation to the Development. Seagreen has committed to undertake pre-, during and post-construction marine mammal monitoring surveys to better understand the effect of construction activities associated with the Development on marine mammal populations in the vicinity of the Development, and validate assumptions made within the ES and RIAA.

### 7.2 Consent Conditions

Consent conditions relevant to marine mammal monitoring are summarised in Table 7.1 below. Condition 11c of the S36 consent for Alpha and Bravo and Condition 3.2.2.5 of the OTA Marine Licence requires the development of Piling Strategy (PS) to minimise the risk of injury to marine mammals. The PS was developed separately and is not discussed further in this PEMP.

Table 7.1: Consent conditions requiring marine mammal monitoring

Reference	Condition Summary	Status
<b>S36 Consent Alpha and Bravo</b>		
Condition 26 PEMP	The PEMP must cover, but not be limited to the following matters:  b. The participation by the Company in surveys to be carried out in relation to marine mammals as set out in the Marine Mammal Monitoring Programme (“MMMP”);	The Seagreen pre-construction MMMP has been submitted to MS-LOT and agreed with Statutory Consultees and the FTRAG MM sub-group. The approach to the pre-construction MMMP is summarised in Section 7.4.2.  The approach to the construction MMMP is detailed in Section 7.4.5. The approach to the post-construction MMMP is described in Section 7.4.6.
Condition 27 FTRAG	The Company must participate in any Forth and Tay Regional Advisory Group (“FTRAG”) established by the Scottish Ministers for the purpose of advising the Scottish Ministers on research, monitoring and mitigation programmes for, but not limited to, ornithology, diadromous fish, <b>marine mammals</b> and commercial fish.	Seagreen are represented on the Marine Mammal Subgroup of the FTRAG. A pre-construction Marine Mammal Monitoring Strategy document describing the proposed approach was submitted to and approved by the FTRAG Marine Mammal sub-group. A construction phase MMMP was provided to FTRAG-MM in August 2021.

Reference	Condition Summary	Status
Condition 28 SSMEG	The Company must participate in any Scottish Strategic Marine Environment Group (“SSMEG”) established by the Scottish Ministers for the purposes of advising the Scottish Ministers on research, monitoring and mitigation programmes for, but not limited to, ornithology, diadromous fish, marine mammals and commercial fish.	SSMEG has not been established.
<b>Marine Licence – Transmission Asset</b>		
Condition 3.2.1.1.b PEMP	The PEMP must cover, but not be limited to the following matters:  b) The participation by the Company in surveys to be carried out in relation to marine mammals as set out in the MMMP	The Seagreen pre-construction MMMP has been submitted to MS-LOT and agreed with Statutory Consultees and the FTRAG MM sub group. The approach to the pre-construction MMMP is summarised in Section 7.4.2.  The approach to the construction MMMP is detailed in Section 7.4.5.  The approach to the post-construction MMMP is detailed in Section 7.4.6.
Condition 3.2.2.18 FTRAG	The Licensee must participate in any FTRAG established by the Licensing Authority for the purpose of advising the Licensing Authority on research, monitoring and mitigation programmes for, but not limited to, diadromous fish, marine mammals and commercial fish.	Seagreen are represented on the Marine Mammal Subgroup of the FTRAG. A pre-construction Marine Mammal Monitoring Strategy was submitted to and approved by the FTRAG Marine Mammal Subgroup A construction phase MMMP was provided to FTRAG-MM in August 2021.
Condition 3.2.2.19 SSMEG	The Licensee must participate in any SSMEG established by the Licensing Authority for the purpose of advising the Licensing Authority on research, monitoring and mitigation programmes for, but not limited to, diadromous fish, marine mammals and commercial fish.	SSMEG has not been established.

### 7.3 Approach to Monitoring of Marine Mammals

Seagreen have agreed a Marine Mammal Monitoring Programme, report LF000009-CST-OF-REP-0024 (Seagreen 2019d) that augments the existing MSS ECOMMAS programme. ECOMMAS is an ongoing deployment of arrays of acoustic monitoring equipment at stations along the east coast of Scotland to record marine mammal presence. The scope and objectives of both the pre-construction MMMP and the construction MMMP were developed by SMRU Consulting and agreed in consultation with MS, MSS and

SNH. The Construction Phase MMMP was submitted with the construction phase update to the PEMP, which was approved in June 2023.

The pre-construction MMMP was submitted to the FTRAG marine mammal subgroup. The following organisations (and their successors) are represented on the FTRAG-MM: MS-LOT, MSS, SNH, Joint Nature Conservation Committee (JNCC) and Whale and Dolphin Conservation (WDC), Seagreen, Neart na Gaoithe and Inch Cape. The contents of the pre-construction MMMP were accepted by the FTRAG-MM at a meeting on 2<sup>nd</sup> July 2019 and subsequently formally approved by MS-LOT.

Acoustic monitoring commenced in March 2019 and will continue into and through the construction phase. Bottlenose dolphin photo ID surveys (conducted as part of a study led by the University of St Andrews and the University of Aberdeen) commenced in July 2020 and will similarly continue through the construction phase.

A summary of the process by which the pre-construction MMMP has been agreed and approved is presented in Table 14.2 below. Agreement has been reached primarily via discussions with MSS, MS-LOT and SNH. Meeting agendas and minutes referred to in Table 7.2 can be obtained on the Scottish Government website at: <https://www2.gov.scot/Topics/marine/Licensing/marine/scoping/ftrag>.

*Table 7.2. Summary of key consultation meetings and agreements for marine mammal monitoring.*

Date	Summary of discussion and agreements	Reference
25/01/2019	Pre-construction Marine Mammal Monitoring Strategy document issued to MS-LOT and stakeholders (MSS, SNH) for consultation.	Report LF000009-CST-OF-REP-0013
30/01/2019	Stakeholders respond to the pre-construction Marine Mammal Monitoring Strategy document	Email from SNH to Seagreen and MS-LOT
05/02/2019	Meeting to discuss the proposed pre-construction Marine Mammal Monitoring Strategy. Proposed Strategy agreed by stakeholders	Minutes LF000009-CST-OF-MOM-0011
18/03/2019	Pre-construction Marine Mammal Monitoring Strategy issued to FTRAG Marine Mammals subgroup for consultation	Email from Seagreen to FTRAG MM subgroup
18/06/2019	Pre-construction Marine Mammal Monitoring Plan issued to FTRAG MM subgroup for formal agreement	Report LF000009-CST-OF-REP-0024
02/07/2019	Pre-construction Marine Mammal Monitoring Plan presented at FTRAG MM subgroup meeting and formal agreement reached with all members	Minutes NNG-NNG-ECF-MOM-0005
30/01/2020	FTRAG-MM discussion of ongoing acoustic monitoring and potential support for bottlenose dolphin photo identification surveys	Minutes IC01-EC-OFC-005-RRP-MOM-002



Date	Summary of discussion and agreements	Reference
27/05/2020	Email update to FTRAG-MM and briefing note on PAM monitoring analysis approach	Email P. Tarrant (NNG) to FTRAG-MM 27 <sup>th</sup> May 2020
08/12/2020	FTRAG-MM update on 2020 monitoring and initial analysis of outputs	Minutes NNG-NNG-ECF-MOM-0027 REV 02
27/04/2021	PAM monitoring briefing note issued to FTRAG-MM members	Email P. Tarrant to FTRAG-MM 27 <sup>th</sup> April 2021
02/08/2021	Submission of construction phase MMMP	LF000009-CST-OF-DIS-REP-0001 Seagreen construction phase MMMP
21/03/2023	FTRAG-MM meeting – discussion on the continuation of acoustic monitoring post-construction	FTRAG-MM Minutes_21032023
21/04/2023	Email update to FTRAG-MM on the position of MSS on dolphin whistle analysis and the continuation of contracts with NNG and Seagreen to collect acoustic data after the completion of the installation phase	Email G. Holland (MD-LOT) to FTRAG-MM 21 <sup>st</sup> April 2023
01/06/2023	Circulation of position paper setting out position of NNG and Seagreen in relation to post-construction marine mammal monitoring and continuation of acoustic data collection	LF000009-CST-OF-LIC-NTE-0003 Position Note – Post-Construction Marine Mammal Monitoring
23/06/2023	Email response from MD-LOT and NatureScot to Position Note confirming regulators' requirement for one year of post-construction acoustic monitoring and data analysis	Email G. Holland (MD-LOT) to FTRAG-MM 23 <sup>rd</sup> June 2023
28/06/2023	Email correspondence between Seagreen/NNG and MSS to confirm the definition of 'cessation of noisy construction activities' and therefore the start of the post-construction phase	Email J. Onoufriou (MSS) to FTRAG-MM 28 <sup>th</sup> June 2023

## 7.4 Marine Mammal Monitoring Programme

### 7.4.1 Overall objectives

The approach to pre-construction monitoring was developed on the assumption that pile driving to install foundations will form part of the final construction design and baseline data collection has been progressed on this basis. Through discussion with MSS and SNH it was agreed that the primary focus for monitoring during the pre-construction and construction phases should be the cumulative effects of noise from foundation installation at all Forth and Tay development sites on the bottlenose dolphin population using the east coast of Scotland. In addition, potential effects on other cetaceans (harbour porpoises, other



dolphin species and minke whales) across the region and at the wind farm site are also of interest. Pre-construction monitoring therefore focusses on collecting baseline data against which to monitor change.

#### 7.4.2 Pre-construction MMMP (Completed)

The primary aim of the pre-construction MMMP was to collect baseline data on the occurrence of bottlenose dolphin in the coastal area adjacent to the Seagreen Project. In addition, data was also collected on the baseline occurrence of harbour porpoises, white-beaked dolphins and vocalising minke whales in the wind farm area and between the wind farm area and the coast. Ambient noise levels were also measured.

#### 7.4.3 Monitoring Survey Methodology

Data collection was carried out using passive acoustic monitoring (PAM) in collaboration with MSS. Data collected over the pre-construction period will be integrated with data collected over previous years and from the wider ECOMMAS array.

Agreed pre-construction survey methods are detailed in the pre-construction MMMP (LF000009-CST-OF-REP-0024) and consisted of moored broadband noise recorders and cetacean detection devices (CPODs). These were deployed in an array extending from the coastline into the wind farm site. The pre-construction surveys were designed to complement existing datasets on the east coast of Scotland for bottlenose dolphin and other echolocating small cetaceans and minke whales, using equipment compatible with that previously deployed by MSS.

#### 7.4.4 Reporting

The annual report for the 2019/2020 (pre-construction) monitoring year was presented in Quarter 3 2020. Seagreen provided quarterly updates to FTRAG and submitted annual reports of all monitoring activity.

#### 7.4.5 Construction MMMP

It was originally anticipated that data obtained from the PAM stations during the pile driving phase of the construction period would be analysed to relate changes in underwater noise from pile driving to changes in levels of vocalising marine mammal activity between the baseline, piling and post-piling periods. However, since the extent and duration of piling is substantially less than that assessed and consented, the ability to make detailed inferences about the influence of pile driving on fine scale temporal and spatial response of cetaceans will be limited.

The aims of the construction phase MMMP, ref. LF000009-CST-OF-DIS-REP-0001 (Seagreen 2021a) were to continue the collection of regional scale data on vocalising cetacean activity to determine any broadscale changes in abundance and distribution as a result of all construction activities at Seagreen (and NNG where there is an overlap in construction programmes).

The objectives of the construction phase MMMP were largely continuations of the pre-construction MMMP (described above) and therefore the same data collection methodology was adopted. This approach was discussed and agreed via the FTRAG-MM.

Seagreen are also supporting an ongoing bottlenose dolphin photo identification study carried out by the University of St Andrews and the University of Aberdeen's Lighthouse Field Station with the aim of ensuring sufficient survey coverage across the expanding southern range of the population and robust estimation of total population abundance and important vital rate parameters (survival and fertility rates). This work will also inform understanding of movements of individuals between different parts of their range. The photo identification work (as funded by Seagreen) runs until 2023.

#### 7.4.6 Post-Construction MMMP

The objective of post-construction monitoring is to monitor the recovery of any changes detected during construction and will adopt the same methodology as applied for the pre-construction and construction monitoring, as detailed in the construction phase MMMP. This approach has been agreed with the FTRAG-MM via approval of the MMMP and exchange of e-mails in June 2023 (see Table 7.2 above). Full analysis of pre-construction and construction phase data will be undertaken upon completion of the post-construction monitoring. Acoustic data will continue to be collected until March 2024 (one year after the completion of noise-generating construction activities – i.e. the completion of suction caisson foundation installation).

In addition, detailed analysis and reporting of the data obtained during the bottlenose dolphin photo identification surveys will be carried out during 2024.

#### 7.4.7 Additional relevant monitoring

A programme of monthly digital aerial surveys was undertaken across the wind farm area between March 2019 and September 2020, as part of the ornithology monitoring programme. For further details on this programme, see Section 3 Ornithology Monitoring. The aerial surveys included overflights of the PAM array deployed under the MMMP.

Although these are primarily for monitoring ornithological interests, detections of marine mammal species will be processed and presented in survey reports and analysis. These data will provide a useful pre-construction validation of the baseline abundance and distribution of marine mammals, with respect to the species present and any seasonal variation in abundance and distribution.

### 7.5 Reporting

Following completion of each marine mammals monitoring stage a report will be produced and submitted to FTRAG for discussion, primarily on an annual basis.

The reporting approach for each phase was or will be determined in liaison with MD, NatureScot, RSPB and FTRAG-O at the time.

The focus and timing of the reporting during each phase was or is expected to be as follows:

#### Pre-construction

- Bottlenose dolphin photo identification 2020 survey report – Q2 2021
- Acoustic monitoring data report 2019-20 – Q2 2021
- Bottlenose dolphin photo identification 2021 survey report – Q2 2022
- Acoustic monitoring data report 2020-21 – Q2 2022

*Construction*

- Bottlenose dolphin photo identification 2022, 2023 survey reports
- Acoustic monitoring data reports 2022, 2023

*Post construction*

- Bottlenose dolphin photo identification final report - 2024
- Acoustic monitoring data and final report - 2024

Additional analysis and reporting may be submitted in response to discussions at FTRAG, if required.

## 7.6 Programme

The programme for all marine mammal monitoring surveys is detailed in Table 7.3.

*Table 7.3: Summary of marine mammal monitoring programme*

Development stage		
Pre-construction	Construction	Post-construction
Acoustic monitoring of vocalising cetaceans March 2019-June 2021  Ambient noise monitoring July 2019-June 2021	Continuation of the methodology adopted in pre-construction for acoustic monitoring of vocalising cetaceans and noise measurement throughout the construction period.	Continuation of the methodology adopted for pre-construction and construction phase for acoustic monitoring of vocalising cetaceans and noise measurement for one-year following the cessation of noise-generating construction activities to monitor recovery from changes detected during those activities.
Marine mammal detections during digital aerial surveys (part of the ornithology monitoring plan) March 2019-September 2020	If digital aerial surveys during construction are undertaken, marine mammal detections will be recorded. Analysis supported by monthly aerial surveys conducted by NNG which are expected to continue through the Seagreen construction period.	Marine mammal detections during digital aerial surveys (part of the ornithology monitoring plan). To resume in breeding season 2024.
Bottlenose dolphin identification surveys July-September 2020 June-September 2021	Continuation of ID surveys throughout the construction period (ending 2023)	None - support for the ID surveys concludes in September 2023.

## **8. Compliance with the Environmental Statement**

### **8.1 Compliance with Methods Assessed in the ES and Addendum**

The relevant conditions of the S36 Consent and the Marine Licences require that the Seagreen Project is constructed in accordance with the methods assessed in the ES and Addendum. The ES for the Seagreen project described the range of methods that could be applied during the construction of the Development. This was presented as a 'Rochdale Envelope' incorporating a variety of options in relation to the development design and the approach to installation. In each case, the worst-case design option was assessed in respect of each impact.

Since the grant of the consents for Seagreen, the design of the project and the approach to installation has been substantially refined, as set out within the relevant consent plans, which has informed the approach to monitoring as set out in this PEMP.

### **8.2 Delivery of Mitigation and Monitoring Proposed in the ES and Addendum**

The ES and Addendum for the Seagreen project detailed a number of mitigation commitments specific to environmental monitoring. Appendix C presents the commitments made by Seagreen in the ES to environmental and monitoring measures. The table provides details of the commitments and a cross-reference to where each commitment is implemented, as set out in this PEMP.

A complete register of the mitigation, management and monitoring commitments made in the ES and Addendum and required by consent conditions is set out in the commitment's registers included as part of the Project CEMP.

## 9. References

Reference	SWEL Document Number	Title
FTRAG-O (2016).	N/A	Seabird Monitoring for Forth and Tay Offshore Wind Farms – Discussion Document, March 2016 (unpublished internal FTRAG-O report).
Seagreen, 2012	A4MRSEAG-Z-DOC100-SPR-060	Seagreen Offshore Environmental Statement
Seagreen, 2013	A4MR-SEAG-Z-DEV275-SRP-233	Addendum to the Offshore Environmental Statement
Seagreen, 2019a	LF000009-CST-OF-REP-0016	Ornithology Monitoring Strategy
Seagreen, 2019b	LF000009-CST-OF-REP-0019	Seagreen Marine and Migratory Fish Monitoring Strategy
Seagreen, 2019c	LF000009-CST-OF-REP-0017	Benthic Monitoring Strategy
Seagreen, 2019d	LF000009-CST-OF-REP-0024	Pre-Construction Marine Mammals Monitoring Plan
Seagreen, 2021a	LF000009-CST-OF-DIS-REP-0001	Construction Phase Marine Mammals Monitoring Plan
Seagreen, 2021b	LF000009-CST-OF-SUR-REP-0007	Construction Phase Ornithology Monitoring Strategy
In preparation	LF000009-CST-OF-PLN-0001	Offshore Operational Environmental Management Plan
	LF000009-CST-OF-PLN-0003	Offshore Piling Strategy
	LF000009-CST-OF-PRG-0003	Offshore OWFs Environmental Monitoring Programme
	LF000009-CST-OF-PLN-0006	Offshore Vessel Management Plan
	LF000009-CST-OF-PLN-0008	Offshore Wind Farm Cable Plan
	LF000009-CST-OF-PLN-0009	Offshore Transmission Assets Cable Plan
	LF000009-CST-OF-PRG-0001	Operations and Maintenance Programme – Wind Farm Assets
	LF000009-CST-OF-PRG-0004	Operations and Maintenance Programme – Offshore Transmission Assets

## Appendix A – PEMP List of Abbreviations and Definitions

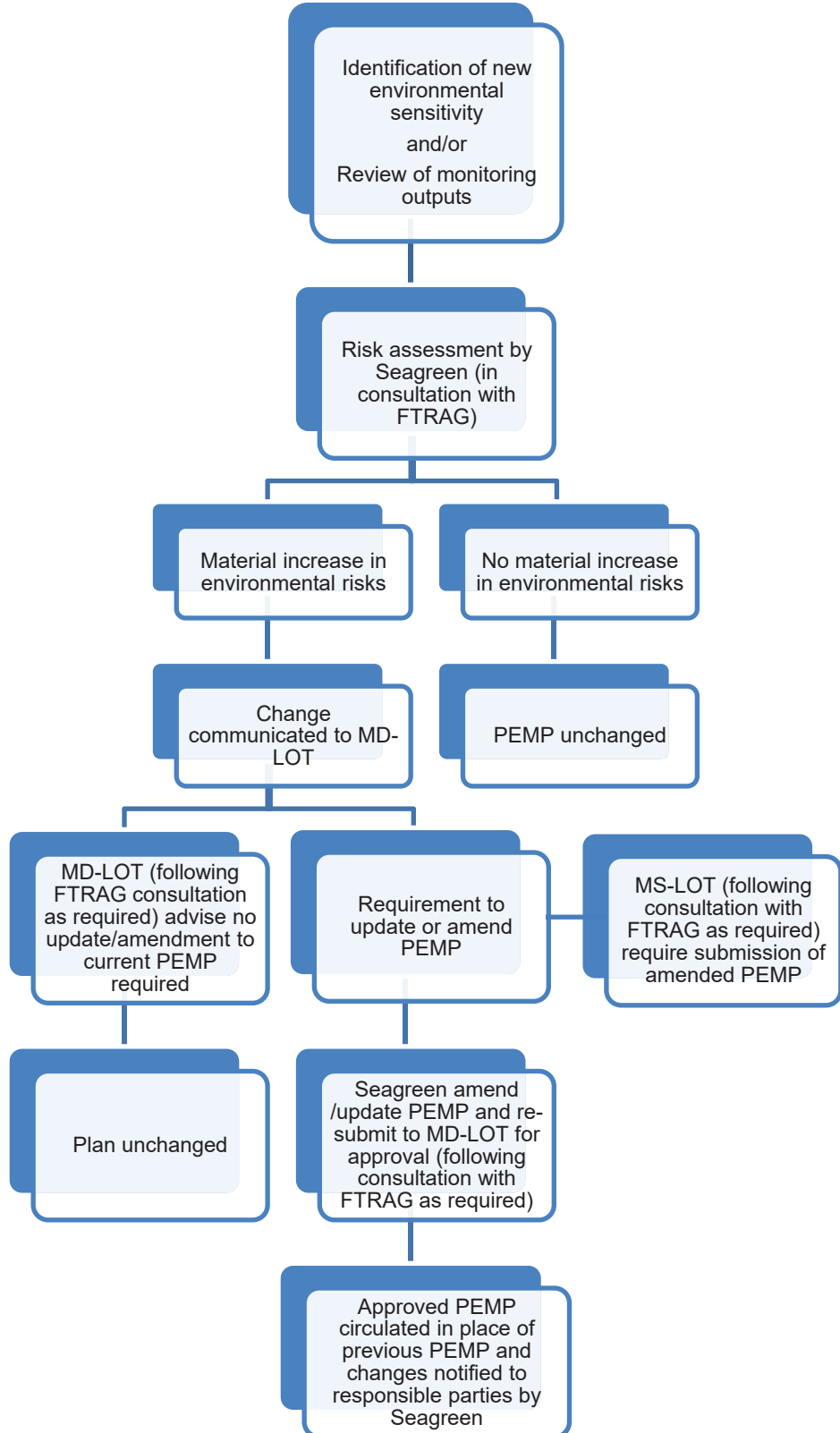
Term	Description
ASFB	Association of Salmon Fishery Boards (Now superseded by Fisheries Management Scotland, FMS)
Seagreen Alpha Marine Licence	Marine licence granted by the Scottish Ministers under the Marine (Scotland) Act 2010 and the Marine and Coastal Access Act 2009 in respect of Seagreen Alpha Wind Farm on 10 October 2014 (as amended) (current reference MS-00010136)
Seagreen Bravo Marine Licence	Marine licence granted by the Scottish Ministers under the Marine (Scotland) Act 2010 and the Marine and Coastal Access Act 2009 in respect of Seagreen Bravo Wind Farm on 10 October 2014 (as amended) (current reference MS-00010137)
BMP	Benthic Monitoring Plan
commitments register	A register that sets out all commitments to manage and mitigate potential environmental impacts made by SWEL
(the) consents	Collective term used to describe the Section 36 consents and Marine Licences issued to SAWEL, SBWEL and SWEL
CEMP	Construction Environmental Monitoring Plan
Diadromous fish	Fish species that migrate between fresh and salt water
ECOMMAS	East Coast Marine Mammal Acoustic Study
ECOW	Ecological Clerk of Works as required under Alpha and Bravo Section 36 Condition 29 and the OTA Marine Licence Condition 3.2.2.12.
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ES	Environmental Statement
SEIS and SEIS Erratum	The ES Addendum submitted to the Scottish Ministers by the Company on 18 October 2013 as part of the application for the consents
FMP	Fish Monitoring Plan
FTRAG	Forth and Tay Regional Advisory Group, required under Condition 27 of the S36 consent and Conditions 3.2.2.18 and 3.2.3.10 of the OTA Marine Licence
JNCC	Joint Nature Conservation Committee
Licensing Authority	Marine Scotland acting on behalf of the Scottish Ministers
Licensee	Seagreen Wind Energy Ltd (Seagreen), and having its registered office at Forbury House, 43 Forbury Road, Reading, RG1 3JH on behalf of SAWEL and SBWEL
Marine Licences	The Wind Farm Marine Licences and the OTA Marine Licence
MD	Marine Directorate



Term	Description
MD-LOT	Marine Directorate Licensing and Operations Team
MHWS	Mean High Water Springs
MMMP	Marine Mammals Monitoring Programme
MS	Marine Scotland (now Marine Directorate)
MS-LOT	Marine Scotland Licensing and Operations Team (now Marine Directorate Licensing and Operations Team (MD-LOT))
MSS	Marine Scotland Science (now Marine Directorate – Science, Evidence, Data and Digital (MD-SEDD))
NS	NatureScot
NSBMF	National Strategic Bird Monitoring Framework
OMS	Ornithology Monitoring Strategy
OTA	Offshore Transmission Asset includes the transmission cable required to connect the Wind Farm to the onshore transmission works. This covers the OTMs and the cable route from the OTMs to the MHWS at the landfall at Carnoustie
OTA Marine Licence	Marine licence granted by the Scottish Ministers under the Marine (Scotland) Act 2010 and the Marine and Coastal Access Act 2009 in respect of the Seagreen Offshore Transmission Asset on 10 October 2014 (as amended) (current reference MS-00010078)
OSP	Offshore Substation Platform means an alternating current offshore substation structure housing transformers and control equipment for the transmission of generated power through the wind farm export cables.
PEMP	Project Environmental Monitoring Programme as required under Alpha and Bravo S36 Condition 26 and the Offshore Transmission Assets Marine Licence Condition 3.2.1.1
PrePARED	Predator and Prey Around Renewable Energy Development
RSPB	Royal Society for the Protection of Birds
PS	Piling Strategy, as required for approval under Condition 11 of the S36 consent and Condition 3.2.2.5 of the Marine Licence
S36 Consents	consent under section 36 of the Electricity Act 1989 granted by the Scottish Ministers on 10 October 2014 in respect of the Seagreen Alpha and Seagreen Bravo offshore wind farms, both as varied by the Scottish Ministers by decision letter issued pursuant to an application under section 36C of the Electricity Act 1989 on 28 August 2018
SAC	Special Area of Conservation
SAWEL	Seagreen Alpha Wind Energy Ltd (SAWEL) (company number 07185533) and having its registered office at No.1 Forbury Place, 43 Forbury Road, Reading, United Kingdom, RG1 3JH

Term	Description
SBWEL	Seagreen Bravo Wind Energy Ltd (SBWEL) (company number 07185543) and having its registered office at No.1 Forbury Place, 43 Forbury Road, Reading, United Kingdom, RG1 3JH
ScotMER	Scottish Marine Energy Research Programme
Seagreen Project	Collective term used to describe the Wind Farm Assets and Offshore Transmission Asset
SHE	Safety, Health, Environment
Site	The area outlined in red in Figure 1 attached to the S36 consent Annex 1 and the area outlined in red and the area outlined in red in the figure contained in Part 4 of the OTA Marine Licence
SNH	Scottish Natural Heritage (now NatureScot)
SPA	Special Protection Area, protected sites classified in accordance with Article 4 of the EC Birds Directive
SSMEG	Scottish Strategic Marine Environment Group, as required under Condition 28 of the S36 consent and Conditions 3.2.2.19 and 3.2.3.10 of the OTA Marine Licence
UKHO	United Kingdom Hydrographic Office
VMP	Vessel Management Plan, required under Condition 15 of the S36 consent and Condition 3.2.2.8 of the Marine Licence
WDC	Whale and Dolphin Conservation
Wind Farm Marine Licences	the Seagreen Alpha Marine Licence and the Seagreen Bravo Marine Licence
WTG	Wind turbine generator

## Appendix B – Change Management Procedure



### Appendix C – Seagreen Environmental Statement (ES) and ES Addendum Commitments

The following table presents the commitments made by Seagreen in the 2012 ES and in the 2013 Addendum to environmental monitoring of the Project. The table provides details of the commitments and a cross-reference to the relevant location in this PEMP where this is addressed.

Source	Reference (Chapter, page, paragraph)	Details of Commitment	Implementation
ES	Ch.7 Physical Environment, p67, 7.303	Seagreen will undertake monitoring if scour protection is used at the seabed adjacent to the substructures/foundations to confirm its suitability in limiting scour and assess the development of any secondary scour	See section 6.3
ES	Ch.10 Ornithology, p127, 10.510	A monitoring programme should be developed in consultation with JNCC and SNH. The programme should be largely comparable with the baseline programme to allow direct comparison of density and population size.	See section 3.5
ES	Ch.10 Ornithology, p127, 10.511	The continuation of tracking studies (Daunt et al., 2011a, b,c) is also recommended, both upon the same species and sites but also including other species/sites such as Razorbill and Guillemot from Fowlsheugh if at all possible. Otherwise, Kittiwake remains a priority species for investigation.	See section 3.5
ES	Ch.11 Benthic and Intertidal Ecology, p73, 11.333 – 11.334	Seagreen is committed to development of a post construction monitoring plan, if appropriate and requested by the regulators. Any monitoring program will be designed in consultation with Marine Scotland and SNH to ensure it collects suitable data to answer appropriate questions raised during the project consenting process, in particular in relation to rare or important benthic habitats.	See section 5.5
ES	Ch.12 Natural Fish and Shellfish Resource, p103, 12.453 – 12.454	The Applicants make a commitment to development of monitoring plan if appropriate and requested by the regulators. Any monitoring survey programs will be agreed with Marine Scotland and SNH to ensure that they provide suitable data to answer the appropriate questions.	See section 4.4

Source	Reference (Chapter, page, paragraph)	Details of Commitment	Implementation
ES	Ch.13 Marine Mammals, p152, 13.653	Seagreen will work with the Regulatory Authorities and their advisors (Marine Scotland, JNCC and SNH) as well as other key stakeholders in developing further an appropriate monitoring package.	See sections 7.3 and 7.4
ES	Ch.13 Marine Mammals, p152, 13.654	At a Project level the Marine Mammal Monitoring Programme will be developed in consultation with key regulators, advisors, academics and experts and will focus on undertaking data gathering which over time can provide a statistically robust data set, which builds on on-going research.	See section 7.4
ES	Ch.13 Marine Mammals, p152, 13.655	During the development of Project Alpha and Project Bravo Seagreen will adopt the JNCC Guidelines (JNCC, 2010) to minimise the potential for fatal or non-auditory injury from pile driving.	To be addressed through the Piling Strategy
Addendum	Ch.3 Marine Mammals, p3-82, 3.362	A Marine Mammal Monitoring Protocol in line with the JNCC guidelines for minimising the impact of piling activities will be applied	To be addressed through the Piling Strategy
Addendum	Ch.4 Fish and Shellfish, p4-58, 4.304	Seagreen remains committed to engagement with MSS on the development of future studies, including potential monitoring effort	See section 4.4

Appendix D – Annex 1 Reef Habitats

