



# Beatrice Offshore Wind Farm Consent Plan

## Project Environmental Monitoring Programme (Wind Farm Assets)

November 2020

*[Page intentionally left blank]*

Project Title/ Location	Beatrice Offshore Wind Farm
Project Reference Number	LF000005
Date:	November 2020

# Project Environmental Monitoring Programme

## Wind Farm Assets

Pursuant to Section 36 consent Condition 27

For the approval of the Scottish Ministers

This document contains proprietary information belonging to Beatrice Offshore Windfarm Ltd and/or affiliated companies and shall be used only for the purpose for which it was supplied. It shall not be copied, reproduced, disclosed or otherwise used, nor shall such information be furnished in whole or in part to third parties, except in accordance with the terms of any agreement under which it was supplied or with the prior consent of Beatrice Offshore Windfarm Ltd and shall be returned upon request.

© Copyright of Beatrice Offshore Windfarm Ltd 2020.

**This is a 'living' document. It will be regularly reviewed and updated to reflect the status of the Project Environmental Monitoring Programme. All revisions to this document are tracked in the table immediately below.**

*Beatrice Environmental Management Plan (Wind Farm Assets)*

Rev	Prepared By	Sign Off	Checked By	Sign Off	ECoW Review By	Sign-Off	Approved By	Sign-Off	Date of Issue
1.0	GoBe Consultants	N/A	Joseph Deimel, BOWL	[Redacted]	Naomi Campbell, Freshwater Consultants	[Redacted]	Andrew Allan, BOWL	[Redacted]	18/01/2019

Rev	Prepared By	Sign-Off	Approved By	Sign Off	Date of Issue
2.0	Joseph Deimel, BOWL	[Redacted]	Andrew Allan, BOWL	[Redacted]	11/02/2020

Rev	Prepared By	Sign off	Approved By	Sign Off	Date of Issue
3.0	Joseph Deimel, BOWL	[Redacted]	Andrew Allan, BOWL	[Redacted]	24/09/2020

Rev	Prepared By	Sign off	Approved By	Sign Off	Date of Issue
4.0	Joseph Deimel, BOWL	[Redacted]	Andrew Allan, BOWL	[Redacted]	04/11/2020

## Consent plan overview

### Purpose of this PEMP

This Project Environmental Monitoring Programme (PEMP) for the Beatrice Wind Farm Assets has been prepared to address specific post-construction and operation and maintenance (O&M) requirements of Condition 27 of the Section 36 (S36) consent for the Beatrice Offshore Wind Farm.

The overall aim of this PEMP is to outline and define the approach taken to environmental monitoring of potential environmental impacts associated with post-construction and O&M and is designed to provide guidance to those involved in the management of the Wind Farm Assets.

### Scope of this PEMP

This PEMP includes:

- Summary on the environmental monitoring undertaken for the pre-construction and construction phases of the Beatrice Offshore Wind Farm (building on the detail presented in LF000005-PLN-179 BOWL PEMP).
- Details the environmental monitoring proposals covering post-construction and O&M on the following (where relevant):
  - > birds;
  - > cod;
  - > herring;
  - > sandeels;
  - > diadromous fish;
  - > benthic communities;
  - > seabed scour and local sediment deposition; and,
  - > marine mammals.
- The objectives and methodologies for the monitoring surveys.
- Evidence of consultation on and approval of monitoring approach and survey methodology.
- Reference to monitoring survey reports, where available.
- The programme for proposed monitoring surveys and reporting.

### Structure of this PEMP

This PEMP is structured as follows:

**Sections 1 to 4** set out the scope and objectives of this PEMP, provide an overview of the Wind Farm Assets, set out statements of compliance and detail the process for making updates and amendments to this document.

**Section 5** provides detail on the parties responsible for the implementation and delivery of this PEMP.

**Section 6** outlines the structure of the subsequent sections to demonstrate compliance with Condition 27 of the S36 consent.

**Sections 7 to 14** summarise the approach to monitoring for each topic identified in Condition 27 of the S36 consent. These sections also detail the aims and objectives of the monitoring approach, the approved survey methodology, survey reports and provide a programme of the survey works for each topic.

**Section 15** summarises the programme of survey works for each topic identified in Condition 27 of the S36 consent.

**Section 16** details the licensing and legal requirements associated with the PEMP surveys which BOWL will adhere to.

**Section 17** demonstrates BOWL's compliance with the monitoring measures proposed in the Application, the Environmental Statement (ES) and the Supplementary Environmental Information Statement (SEIS).

**Appendix A** details the relevant commitments made in the ES and SEIS and cross references to where this has been or is to be implemented.

### Programme audience

This PEMP is intended to summarise the environmental monitoring programme associated with the post-construction and O&M phases of the Beatrice Offshore Wind Farm (Wind Farm Assets) for stakeholders and regulators.

**Table of contents**

<b>List of abbreviations and definitions.....</b>	<b>10</b>
<b>1 Introduction.....</b>	<b>14</b>
1.1 Background .....	14
1.2 Objectives of this Project Environmental Monitoring Programme .....	14
1.3 Linkages with other Consent Plans .....	18
1.4 PEMP document structure .....	19
<b>2 Statements of compliance .....</b>	<b>21</b>
2.1 Introduction.....	21
2.2 Statements of compliance.....	21
<b>3 Updates and amendments to this PEMP .....</b>	<b>22</b>
<b>4 Overview of the Wind Farm Assets.....</b>	<b>24</b>
4.1 Introduction.....	24
4.2 Wind Farm Assets .....	24
<b>5 PEMP roles and responsibilities .....</b>	<b>26</b>
5.1 Beatrice Offshore Windfarm Limited (BOWL).....	26
5.2 Ecological survey contractors .....	26
<b>6 Environmental monitoring programme .....</b>	<b>27</b>
6.1 Introduction.....	27
<b>7 Birds .....</b>	<b>28</b>
7.1 Introduction.....	28
7.2 Consent conditions .....	28
7.3 Approach to monitoring.....	29
7.4 Aims and objectives .....	34
7.5 Methodology .....	35
7.6 Reporting .....	36
7.7 Programme.....	36
7.8 ScotMER evidence map linkages to BOWL monitoring.....	36
<b>8 Cod.....</b>	<b>38</b>
8.1 Introduction.....	38
8.2 Consent conditions .....	38
8.3 Approach to monitoring.....	39

8.4	Aims and objectives .....	40
8.5	Methodology .....	40
8.6	Reporting .....	40
8.7	Programme .....	40
8.8	ScotMER evidence map linkages to BOWL monitoring .....	41
<b>9</b>	<b>Herring .....</b>	<b>43</b>
9.1	Introduction .....	43
9.2	Consent conditions .....	43
9.3	Approach to monitoring .....	44
9.4	Aims and objectives .....	45
9.5	Methodology .....	45
9.6	Reporting .....	46
9.7	Programme .....	46
<b>10</b>	<b>Sandeels .....</b>	<b>47</b>
10.1	Introduction .....	47
10.2	Consent conditions .....	47
10.3	Approach to monitoring .....	47
10.4	Aims and objectives .....	50
10.5	Methodology .....	50
10.6	Reporting .....	50
10.7	Programme .....	50
10.8	ScotMER evidence map linkages to BOWL monitoring .....	51
<b>11</b>	<b>Diadromous fish .....</b>	<b>52</b>
11.1	Introduction .....	52
11.2	Consent conditions .....	52
11.3	Approach to monitoring .....	53
11.4	Aims and objectives .....	54
11.5	Methodology .....	54
11.6	Reporting .....	55
11.7	Programme .....	55
<b>12</b>	<b>Benthic communities .....</b>	<b>56</b>
12.1	Introduction .....	56
12.2	Consent conditions .....	56



12.3	Approach to monitoring .....	57
12.4	Aims and objectives .....	58
12.5	Methodology.....	58
12.6	Reporting .....	59
12.7	Programme .....	59
12.8	ScotMER evidence map linkages to BOWL monitoring .....	60
<b>13</b>	<b>Seabed scour and local sediment deposition .....</b>	<b>63</b>
13.1	Introduction .....	63
13.2	Consent conditions.....	63
13.3	Approach to monitoring .....	64
13.4	Aims and objectives .....	65
13.5	Methodology.....	65
13.6	Reporting .....	66
13.7	Programme .....	67
<b>14</b>	<b>Marine mammals.....</b>	<b>68</b>
14.1	Introduction .....	68
14.2	Consent conditions.....	68
14.3	Approach to monitoring .....	69
14.4	Aims and objectives .....	71
14.5	Methodology.....	73
14.6	Reporting .....	73
14.7	Programme .....	75
<b>15</b>	<b>Programme of survey works.....</b>	<b>76</b>
<b>16</b>	<b>Licenses and legal requirements .....</b>	<b>77</b>
<b>17</b>	<b>Compliance with the Application, ES and SEIS .....</b>	<b>79</b>
<b>18</b>	<b>References .....</b>	<b>80</b>
	<b>Appendix A - ES and SEIS Commitments .....</b>	<b>87</b>

### List of abbreviations and definitions

<b>Term</b>	<b>Definition / Description</b>
ADD	Acoustic Deterrent Device.
AGDS	Acoustic Ground Discrimination Sonar.
AC	Alternating Current.
Application	The Application letters and ES submitted to the Scottish Ministers by BOWL on 23 April 2012 and SEIS submitted to the Scottish Ministers by BOWL on 29 May 2013.
ASFB	Association of Salmon Fishery Boards.
BOWL	Beatrice Offshore Windfarm Limited (Company Number SC350248) and having its registered office at Inveralmond House, 200 Dunkeld Road, Perth, PH1 3AQ.
consent	The term used to mean the S36 consent and wind farm marine licence.
consent conditions	The terms that are imposed on BOWL under the S36 consent and/or the wind farm marine licence that must be fulfilled throughout the period that the consent is valid.
Consent Plan	Plan as stated within the conditions of the consent.
cMMMP	construction Marine Mammal Monitoring Programme.
dBht	Decibel metric taking into account species hearing sensitivity.
DP	The Decommissioning Programme as required under Condition 3 of the S36 consent and Condition 3.2.2.8 of the Marine Licence.
DNV	Det Norske Veritas.
DSFB	District Salmon Fishery Boards.
DDV	Drop Down Video.
ECC	East Caithness Cliffs [SPA].
EIA	Environmental Impact Assessment.
EPS	European Protected Species.
ES	The Environmental Statement submitted to the Scottish Ministers by BOWL on 23 April 2012 as part of the Application.
final commissioning	Means the date on which all WTGs have supplied electricity on a commercial basis to the National Grid.
GPS	Global Positioning System.
HRA	Habitats Regulations Assessment.
HV	High Voltage (220kV).

<b>Term</b>	<b>Definition / Description</b>
IAC	Inter-array cable. Part of the IAC AC electrical cable network that connect the WTGs to the OTMs.
JNCC	Joint Nature Conservation Committee.
km	kilometre.
kV	kilovolts.
Licensing Authority	the Scottish Ministers.
Marine Licence	The written consents granted by the Scottish Ministers (referred to on the licence as the Licensing Authority) under the Marine (Scotland) Act 2010, Part 4. The Wind Farm Marine Licence was issued under reference 04462/14/1 and dated 2 September 2014, as revised and superseded by the issue of licence with reference 04462/16/0 on 27 April 2016, as revised and superseded by the issue of licence with reference 04462/17/12 on 11 October 2017, as subsequently revised and superseded by the licence with reference 04462/18/0 on 9 April 2018, and as subsequently revised and superseded by the licence with reference 04462/18/1 on 25 May 2018.
MMMP	Marine Mammal Monitoring Programme.
MMO	Marine Management Organisation.
MS-LOT	Marine Scotland Licensing and Operations Team.
MSS	Marine Scotland Science.
MHWS	Mean High Water Springs.
MV	Medium Voltage (33kV).
m	metre.
MFRAG	Moray Firth Regional Advisory Group. A group responsible for overseeing monitoring and mitigation on a regional scale, set up by the Scottish Ministers.
MFRAG-MM	Moray Firth Regional Advisory Group Marine Mammals subgroup.
MORP	Moray Offshore Renewable Power.
NRMSD	National Research and Monitoring Strategy for Diadromous Fish.
OTM	Offshore Transformer Module means an AC offshore substation platform which is a standalone modular unit that utilises the same substructure and foundation design as a WTG.

<b>Term</b>	<b>Definition / Description</b>
Offshore Transmission Assets	The Offshore Transmission Assets includes the transmission cable required to connect the wind farm to the onshore transmission works (OnTW). This covers the OTMs and their HV connector cable, and the cable route from the OTMs to the transition joint bays just landward of MHWS at the landfall west of Portgordon on the Moray coast.
OfTW	Offshore Transmission Works. The term used during project development and construction to describe the Offshore Transmission Assets.
OnTW	The onshore transmission works landward from the transition joint bays, consisting of onshore buried export cables to the onshore substation and connection to the National Grid network.
O&M	Operation and Maintenance.
OMP	The Operation and Maintenance Programme as required under Condition 17 of the S36 consent and Condition 3.2.3.6 of the Marine Licence.
OEMP	Operational Environmental Management Plan, as required under Condition 15 of the S36 consent and as contained within the OMP.
PSA	particle size analysis.
PS	The Piling Strategy as required under Condition 12 of the S36 consent.
PCoD	Population Consequences of Disturbance model.
PEMP (Wind Farm Assets)	This Project Environmental Monitoring Programme as required under Condition 27 of S36 consent.
PEMP (Offshore Transmission Assets)	The Project Environmental Monitoring Programme as required under Condition 3.2.1.1 of the OfTW Marine Licence.
PAD	The Protocol for Archaeological Discoveries as required under Condition 37 of the S36 consent.
ROV	Remotely Operated Vehicle.
RSPB Scotland	Royal Society for the Protection of Birds Scotland.
S36 consent	The written consent granted by the Scottish Ministers under Section 36 and Section 36A of the Electricity Act 1989, on 19 March 2014.
SAC	Special Area of Conservation, protected sites classified in accordance with Article 3 of the EC Habitats Directive.
SCENE	Glasgow University Scottish Centre for Ecology & the Natural Environment.

<b>Term</b>	<b>Definition / Description</b>
ScotMER	Scottish Marine Energy Research (formerly SSMEG)
SEIS	The Supplementary Environmental Information Statement submitted to the Scottish Ministers by BOWL on 29 May 2013 as part of the Application.
SMRU	Sea Mammal Research Unit.
SNH	Scottish Natural Heritage.
Soft start	The gradual increase of piling power, incrementally over a set period, until full operational power is achieved.
SPA	Special Protection Area, protected sites classified in accordance with Article 4 of the European Commission Birds Directive.
SSMEG	Scottish Strategic Marine Environment Group. A group yet to be formed, responsible for overseeing monitoring and mitigation on a national scale, set up by the Scottish Ministers.
TRRMP	The Television and Radio Reception Mitigation Plan as required under Condition 26 of the S36 consent.
UXO	unexploded ordnance.
UoA	University of Aberdeen.
WDC	Whale and Dolphin Conservation.
Wind Farm Assets	The offshore array development as assessed in the ES including the WTGs, their foundations, and the IACs.
Wind Farm CaP	The Wind Farm Cable Plan as required under Condition 19 of the S36 consent.
wind farm lease site	The wind farm site upon the bed of the sea at Beatrice under lease with the Crown Estate Scotland.
WP	Work Package.
WSI	Written Scheme of Investigation, which establishes the mitigation procedures that must be followed to avoid damage to cultural heritage assets and targets of archaeological potential.
WTG	Wind Turbine Generator.

## 1 Introduction

### 1.1 Background

1.1.1 The Beatrice Offshore Wind Farm received consent under Section 36 (Ref.1) and Section 36A (Ref.2) of the Electricity Act 1989 from the Scottish Ministers on 19 March 2014 (the S36 consent) and was granted a Marine Licence from the Scottish Ministers (Ref.3), dated 02 September 2014 (the Marine Licence) and revised in 2016 (Ref.4), 2017 (Ref.5), 2018 (Ref.6) and most recently revised by the issue of licence 04462/18/1 (Ref.7) on 25 May 2018. In combination these approvals are referred to as 'the consent'.

### 1.2 Objectives of this Project Environmental Monitoring Programme

1.2.1 The purpose of this Wind Farm Assets Project Environmental Monitoring Programme (PEMP) is to provide the over-arching framework by which the environmental effects, in the vicinity of the Beatrice Offshore Wind Farm, will be monitored throughout the post-construction and operations and maintenance (O&M) phases (excluding decommissioning) of the Wind Farm Assets. A separate PEMP (Ref.8) has been prepared to cover the post-construction and O&M phases (excluding decommissioning) of the Beatrice Offshore Transmission Assets.

1.2.2 This PEMP supersedes the overarching, development-wide (i.e. both wind farm and transmission assets) PEMP (Ref.9) which was approved by Scottish Ministers on 02 August 2016. This approval confirmed that the implementation of the PEMP Revision 1.1 satisfied the requirements of S36 consent Condition 27 regarding the pre-construction monitoring programme, and in this respect the condition was discharged.

1.2.3 This PEMP, together with the Offshore Transmission Assets PEMP (Ref.8), supersede the overarching PEMP and are required to be submitted on account that ownership of the wind farm and offshore transmission assets will be split, marine licenses reassigned to respective owners<sup>1</sup> and thus responsibility for the implementation of the respective PEMPs will reside with the respective owners.

1.2.4 This PEMP summarises the programme of environmental monitoring that BOWL intends to undertake (during O&M) or has already undertaken (pre-construction and/or construction) in relation to the Wind Farm Assets and provides cross-references, where relevant, to detailed method statements and any monitoring reports completed to date.

---

<sup>1</sup> Marine licence will only be reassigned if ownership transfers.

1.2.5 It should be noted that method statements and monitoring reports have been subject to prior, separate consultation and approval by relevant statutory bodies and stakeholders, including discussion and agreement at the Moray Firth Regional Advisory Group (MFRAG), and the MFRAG marine mammal and ornithology subgroups where appropriate.

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

<b>Consent reference</b>	<b>Condition text</b>	<b>PEMP reference</b>
S36 consent Condition 27	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.	PEMP Rev 1.1 was approved by the Scottish Ministers on 02 August 2016.
	Such approval may only be granted following consultation by the Scottish Ministers with the JNCC, SNH, RSPB Scotland, Whale and Dolphin Conservation (WDC), Association of Salmon Fishery Boards (ASFB) and any other ecological advisor as required at the discretion of the Scottish Ministers.	PEMP Rev 1.1 was approved, following consultation, by the Scottish Ministers on 02 August 2016.
	The PEMP must be in accordance with the ES as it relates to environmental monitoring.	Appendix A.
	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.	Sections 7 to 14. This PEMP focuses on the operational phase. This PEMP excludes decommissioning.
	Monitoring should 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.	Section 6 to 14.
	Monitoring may also serve the purpose of verifying key predictions in the ES.	Section 6 to 14.
	Additional monitoring may be required if further potential adverse environmental effects are identified for which no predictions were made in the ES. The Scottish Ministers may agree that monitoring may cease before the end of the lifespan of the Development.	Section 6 to 14

Consent reference	Condition text	PEMP reference
	<p>The PEMP must cover, but not be limited to the following matters:</p> <ul style="list-style-type: none"> <li>a. Pre-construction, construction (if considered appropriate by the Scottish Ministers) and post-construction monitoring surveys as relevant in terms of the ES and any subsequent surveys for               <ul style="list-style-type: none"> <li>1. Birds;</li> <li>2. Cod;</li> <li>3. Herring;</li> <li>4. Sandeels;</li> <li>5. Diadromous fish;</li> <li>6. Benthic communities; and</li> <li>7. Seabed scour and local sediment deposition</li> </ul> </li> <li>b. The participation by the Company in surveys to be carried out in relation to marine mammals as set out in the MMMP; and</li> <li>c. The participation by the Company in surveys to be carried out in relation to regional and strategic bird monitoring;</li> </ul>	<p>Section 6 to 14.</p> <p>This PEMP focuses on the operational phase.</p> <p>This PEMP excludes decommissioning.</p>
	<p>All the initial methodologies for the above monitoring must be approved, in writing, by the Scottish Ministers and, where appropriate, in consultation with the MFRAG referred to in condition 28 of this consent.</p>	<p>Section 6 to 14.</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.</p>	<p>Section 6 to 14.</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 MFRAG to identify the appropriateness of on-going monitoring. Following such reviews, the Scottish Ministers may, in consultation with the MFRAG, require the Company to amend the PEMP and submit such an amended PEMP, in writing, to the Scottish Ministers, for their written approval. Such approval may only be granted following consultation with MFRAG 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.</p>	<p>Section 3.</p>
	<p>The Company must submit written reports of such monitoring surveys to the Scottish Ministers at timescales to be determined by the Scottish Ministers in consultation with the MFRAG. 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.</p>	<p>Sections 7 to 14.</p>
	<p><i>Reason: To ensure that appropriate and effective monitoring of the impacts of the Development is undertaken.</i></p>	<p>n/a</p>



1.2.6 In addition to the specific consent requirements for a PEMP and the requirements thereof (as set out in Table 1.1), this PEMP also includes information in respect of a number of other conditions within the S36 consent which are linked to the matter of post-construction and O&M phase environmental monitoring; these are set out in Table 1.2 and references to where matters are addressed in this PEMP are given.

**Table 1.2: Other consent conditions relevant to this PEMP.**

<b>Consent reference</b>	<b>Summary of condition</b>	<b>PEMP reference</b>
S36 consent Condition 28	<b>Participation in Moray Firth Regional Advisory Group</b> The Company must participate in any Moray Firth Regional Advisory Group (“MFRAG”) established by the Scottish Ministers for 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 SSMEG be established (refer to condition 29), the responsibilities and obligations being delivered by the MFRAG will be subsumed by the SSMEG at a timescale to be determined by the Scottish Ministers.	Sections 7 to 14.
S36 consent Condition 29	<b>Participation in Scottish Strategic Marine Environment Group</b> The Company must participate in any Scottish Marine Environmental 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.	Section 2.
S36 consent Condition 31	<b>Participation in Scottish Atlantic Salmon, Sea Trout and European Eel Monitoring Strategy</b> The Company must, to the satisfaction of the Scottish Ministers, participate in the monitoring requirements as laid out in the ‘Scottish Atlantic Salmon, Sea Trout and European Eel Monitoring Strategy’ so far as they apply at a local level (the Moray Firth). The extent and nature of the Company’s participation is to be agreed by the Scottish Ministers in consultation with the MFRAG.	Section 11
S36 consent Condition 35	<b>Cod surveys</b> The Company must undertake a post-construction cod survey in the first February and March, occurring no earlier than 12 months, following the Final Commissioning of the Development. This cod survey must be undertaken in an area, to be agreed with the Scottish Ministers, unless prior written approval is sought and obtained from the Scottish Ministers. A full survey report and data set must be submitted, in writing, to the Scottish Ministers within 3 months following completion of any post-construction cod survey for approval, in writing, by the Scottish Ministers.	Section 8

<b>Consent reference</b>	<b>Summary of condition</b>	<b>PEMP reference</b>
S36 consent Condition 36	<p><b>Sandeel surveys</b></p> <p>The Company must undertake a post-construction sandeel survey in the first February and March, occurring no earlier than 12 months, following the Final Commissioning of the Development. This sandeel survey must be undertaken in an area, to be agreed with the Scottish Ministers, unless prior written approval is sought and obtained from the Scottish Ministers. A full survey report and data set must be submitted, in writing, to the Scottish Ministers within 3 months following completion of any post-construction sandeel survey for approval, in writing, by the Scottish Ministers.</p>	Section 10

### 1.3 Linkages with other Consent Plans

- 1.3.1 This PEMP sets out the proposed framework for the monitoring of each topic identified in the S36 consent Condition 27. In addition, S36 consent Condition 17 and Marine Licence condition 3.2.3.6 requires an Operation and Maintenance Programme (OMP) to be submitted to Scottish Ministers that is, so far as is reasonably practicable, informed by and/or consistent with this PEMP.
- 1.3.2 The OMP (Wind Farm Assets) (Ref.10) revision 1.0 was approved by Scottish Ministers on 03 July 2018. This PEMP forms a suite of documents, including the OMP that are active following final commissioning.
- 1.3.3 The linkages between this PEMP and other operational Consent Plans are summarised in Table 1.3. It should be noted that other relevant Consent Plans are cross-referenced as appropriate in this PEMP but the detail from those other plans is not repeated here.

**Table 1.3: Linkages between this PEMP and other operational Consent Plans.**

<b>Other operational Consent Plans</b>	<b>Consistency with and linkage to PEMP</b>
PEMP (Offshore Transmission Assets) (Ref.8)	<p>The purpose of the PEMP (as required under Offshore Transmission Works (OfTW) Marine Licence Condition 3.2.1.1) is to provide the over-arching framework by which the environmental effects, in the vicinity of the Offshore Transmission Assets, will be monitored throughout their operational lifetime (excluding decommissioning).</p> <p>The PEMP (Offshore Transmission Assets) must align and run in parallel with (unless otherwise agreed with Scottish Ministers) this PEMP.</p>

<b>Other operational Consent Plans</b>	<b>Consistency with and linkage to PEMP</b>
<p>OMP (Wind Farm Assets) (including the Operational Environmental Management Plan (OEMP)) (Ref.10)</p>	<p>The OMP sets out an intended programme of O&amp;M activities in relation to the Wind Farm Assets. The OMP forms a single-source document that contains operational commitments relating to:</p> <ul style="list-style-type: none"> <li>a. vessel management;</li> <li>b. navigational safety;</li> <li>c. inter-array cabling;</li> <li>d. lighting and marking;</li> <li>e. traffic and transport;</li> <li>f. commercial fisheries; and</li> <li>g. marine pollution contingency planning.</li> </ul> <p>The OMP also includes the OEMP (as required under S36 consent Condition 15) which sets out the over-arching environmental management framework for the Wind Farm Assets during their operation.</p> <p>The OMP considers known environmental sensitivities considering the results of ongoing monitoring as detailed within this PEMP.</p> <p>The OMP must be informed by surveys and monitoring undertaken as part of this PEMP.</p>
<p>Archaeology Written Scheme of Investigation (WSI) and Procedures for Archaeological Discoveries (PAD) (Beatrice Offshore Wind Farm) (Ref.11)</p>	<p>The WSI sets out the mitigation procedures that must be followed in order to seek to avoid damage to cultural heritage assets and targets of archaeological potential.</p> <p>The PAD sets out the protocols and procedures that must be followed in the event of any unexpected archaeological discoveries whilst undertaking O&amp;M activities.</p>
<p>Television and Radio Reception Mitigation Plan (TRRMP) (Ref.12)</p>	<p>Sets out the results of a baseline television survey and details a strategy for remedial action to deal with any impairment issues as a result of the operational Wind Farm Assets.</p>
<p>Decommissioning Programme (DP) (Wind Farm Assets) (Ref.13)</p>	<p>Sets out the strategy for decommissioning the Wind Farm Assets at the end of the operational lifecycle.</p>

#### **1.4 PEMP document structure**

1.4.1 In response to the specific requirements of the S36 consent, this PEMP has been structured so as to be clear that each part of the specific requirements have been met and that the relevant information, to allow the Scottish Ministers to approve the PEMP, has been provided. The document structure is set out in Table 1.4.

**Table 1.4: PEMP document structure.**

Section	Title	Overview
1	Introduction	Background to consent requirements and overview of the PEMP scope and structure; and Identifies those other Consent Plans relevant to the environmental monitoring process and details the relationship between the PEMP and those plans.
2	Statements of compliance	Sets out the statements of compliance in relation to the consent.
3	Updates and amendments to this PEMP	Sets out the procedures for any required updating to or amending of the approved PEMP and subsequent further approval by the Scottish Ministers.
4	Wind Farm Assets	Provides an overview of the Wind Farm Assets.
5	PEMP roles and responsibilities	Provides information on the roles and responsibilities of BOWL and other parties in the implementation and delivery of the PEMP.
6	Environmental monitoring programme	Sets out the approach to developing monitoring strategies for each of the topics identified in the S36 consent.
7	Birds	Summarises the monitoring strategy and programme (and any subsequent surveys) in respect of birds.
8	Cod	Summarises the monitoring strategy and programme (and any subsequent surveys) in respect of cod.
9	Herring	Summarises the monitoring strategy and results in respect of herring.
10	Sandeels	Summarises the monitoring strategy and programme (and any subsequent surveys) in respect of sandeel.
11	Diadromous fish	Summarises the monitoring strategy and results in respect of migratory fish species.
12	Benthic communities	Summarises the monitoring strategy and programme (and any subsequent surveys) in respect of benthic communities.
13	Seabed scour and local sediment deposition	Summarises the monitoring strategy and programme (and any subsequent surveys) in respect of seabed scour and local sediment deposition.
14	Marine mammals	Summarises the monitoring strategy and programme (and any subsequent surveys) in respect of marine mammals.
15	Programme of survey works	Summarises the monitoring programme for all environmental topics.
16	Licences and legal requirements	Sets out the licences that must be sought and legal requirements associated with delivering the PEMP.
17	Compliance with the Application, ES and SEIS	Demonstrates that the programme of monitoring set out in this PEMP is consistent with that proposed in the ES and SEIS.

## **2 Statements of compliance**

### **2.1 Introduction**

2.1.1 This section is intended to re-affirm the commitment to ensuring that the Beatrice Offshore Wind Farm is monitored in such a manner as to meet the relevant requirements set out by the consents but also broader legislative requirements.

### **2.2 Statements of compliance**

2.2.1 BOWL in instructing environmental monitoring will require compliance with this PEMP as approved by the Scottish Ministers (and as updated or amended from time to time following the procedure set out in Section 3 of this PEMP).

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

2.2.3 BOWL in undertaking environmental monitoring will require compliance with other, relevant Consent Plans as approved by the Scottish Ministers, as set out in Section 1.3 above.

2.2.4 BOWL in undertaking environmental monitoring will require compliance with the environmental monitoring commitments set out in the original Application and the Environmental Statement (ES) and Supplementary Environmental Information Statement (SEIS) and referred to in Annex 1 of the S36 consent (Ref.1) except in so far as amended by the terms of the S36 consents (unless otherwise approved by the Scottish Ministers) (see Section 17 and Appendix A).

2.2.5 BOWL will, in instructing environmental monitoring, require compliance with all other relevant legislation and require that all necessary licences and permissions are obtained.

2.2.6 BOWL have committed to participating in MFRAG, including any relevant subgroups, and SSMEG (now ScotMER). Potential linkages to ScotMER evidence gaps are discussed in the receptor chapters of this PEMP.

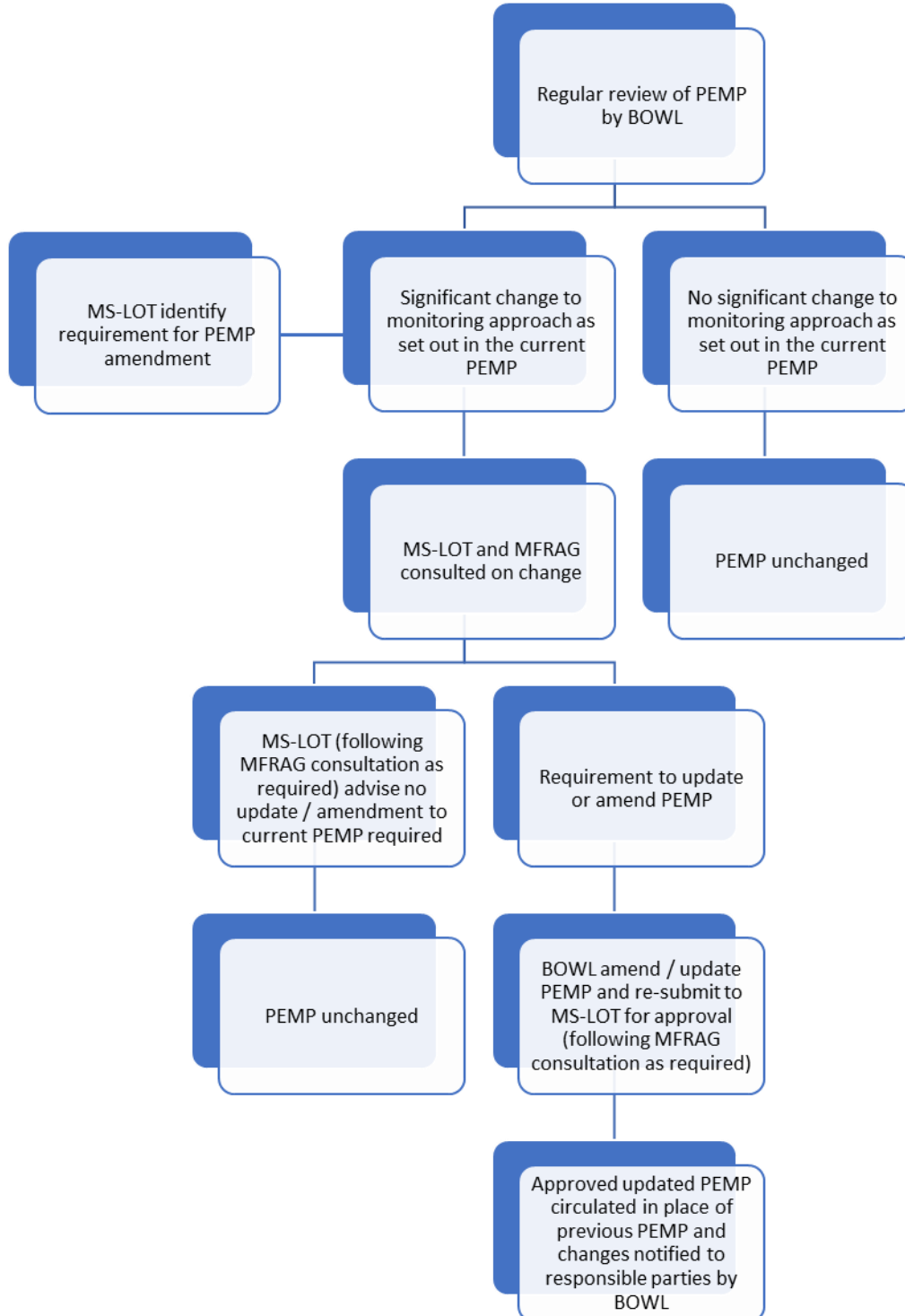
### 3 Updates and amendments to this PEMP

- 3.1.1 S36 consent Condition 27 recognises that updates or amendments to this PEMP may be required, stating that:

*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 MFRAG to identify the appropriateness of on-going monitoring. Following such reviews, the Scottish Ministers may, in consultation with the MFRAG, require the Company to amend the PEMP and submit such an amended PEMP, in writing, to the Scottish Ministers, for their written approval. Such approval may only be granted following consultation with MFRAG 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.*

- 3.1.2 Where it is necessary to update this PEMP in light of significant new information, or upon notification by the Scottish Ministers, the change management process, as set out in Figure 3.1, will be used to identify such information, communicate changes to the Scottish Ministers, update the PEMP, seek further approval of amendments or updates (in consultation with MFRAG or such other advisors as may be required by the Scottish Ministers), and disseminate the updated version of the PEMP.

**Figure 3.1. PEMP change management procedure.**



## **4 Overview of the Wind Farm Assets**

### **4.1 Introduction**

4.1.1 Figure 4.1 shows the boundaries of the wind farm lease site and the OfTW lease site within which the Wind Farm Assets and the Offshore Transmission Assets are located.

### **4.2 Wind Farm Assets**

4.2.1 The Wind Farm Assets mainly comprise the 84 Wind Turbine Generators (WTGs) each installed on jacket substructures connected to four pile foundations driven into the seabed and the network of inter-array cable (IAC) infrastructure. The WTGs are connected at a medium voltage (MV) of 33 kilovolts (kV) by inter-array cabling. There are a total of 91 IACs arranged in fourteen circuits (also referred to as strings) and six WTGs per string. The first WTG in a string is connected by an IAC to an Offshore Transmission Module (OTM)<sup>2</sup>. The circuits are cross-connected at the ends in pairs. These cross connections are to provide auxiliary power to the string in the event of an outage on a circuit.

---

<sup>2</sup> There are two OTMs within the Beatrice Offshore Wind Farm and these form part of the Offshore Transmission Assets.



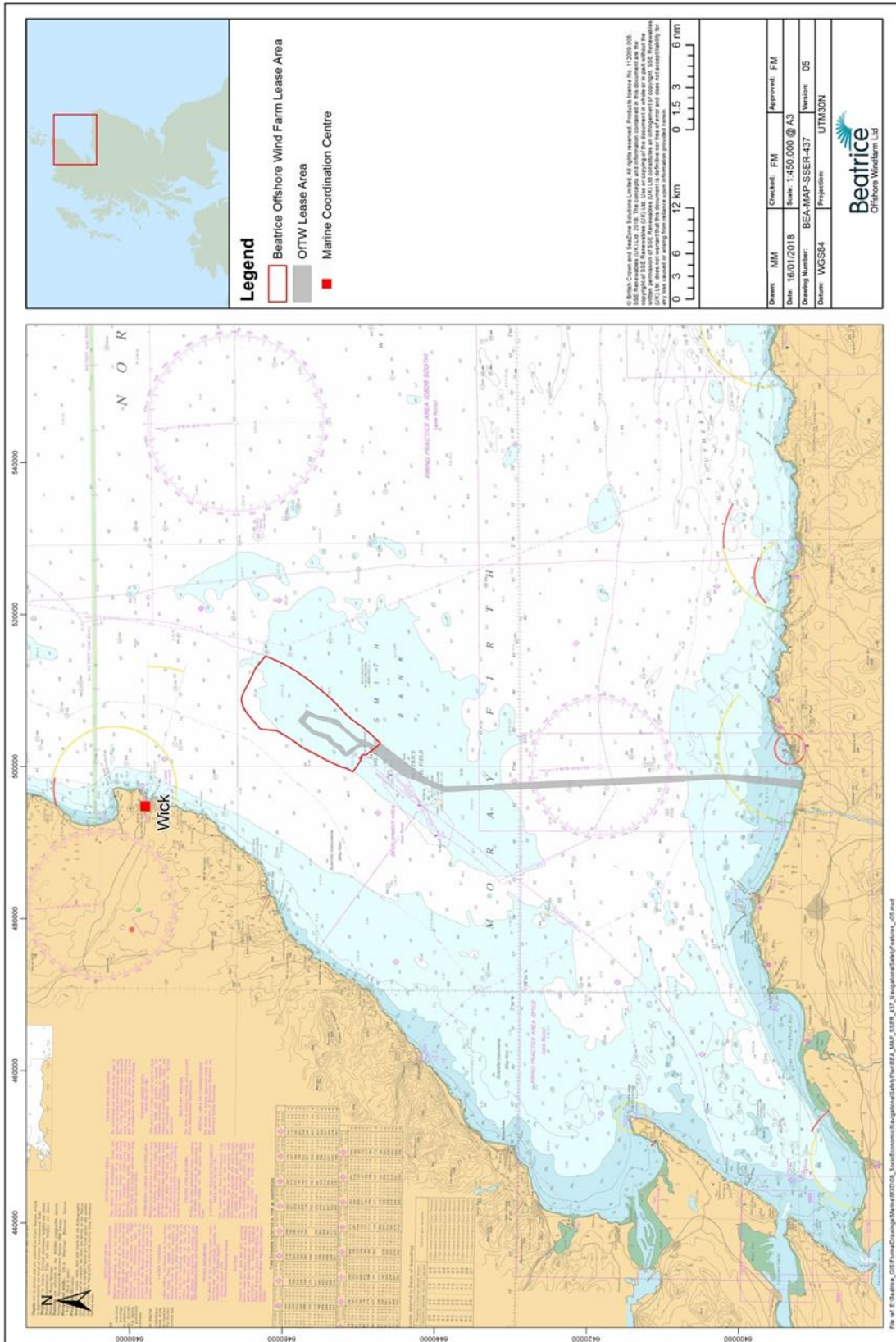


Figure 4.1: Location of the wind farm lease site and OfTW lease site

## 5 PEMP roles and responsibilities

### 5.1 Beatrice Offshore Windfarm Limited (BOWL)

5.1.1 BOWL will have overall responsibility for the following:

- Maintaining and updating the PEMP document, in consultation with and as required by the relevant authorities;
- Requiring that all environmental monitoring or specialist studies required under the PEMP are undertaken at the appropriate time;
- Reviewing the monitoring reports and submitting the reports to either MFRAG or the appropriate subgroup for consultation before submission to the Scottish Ministers; and
- Liaising with the relevant consultees, including the MFRAG, on matters related to this PEMP.

### 5.2 Ecological survey contractors

5.2.1 BOWL have engaged specialist survey contractors to input to the design of the monitoring programme and undertake monitoring surveys, as required. Table 5.1 details the contractors currently involved in the delivery of the proposed monitoring for each receptor group.

**Table 5.1: Specialist contractors who have been or are currently involved in the delivery of monitoring surveys.**

<b>Receptor</b>	<b>Specialist contractor</b>
Birds	MacArthur Green / HiDef Aerial Surveying
Cod	Brown and May Marine Ltd
Herring	Brown and May Marine Ltd
Sandeels	Brown and May Marine Ltd
Diadromous fish	Glasgow University Scottish Centre for Ecology & the Natural Environment (SCENE)
Benthic communities	RPS / APEM Ltd
Seabed scour and local sediment deposition	Bluestream Offshore (on behalf of Seaway Heavy Lift) Fugro
Marine mammals	Aberdeen University, Lighthouse Research Station / RPS

## **6 Environmental monitoring programme**

### **6.1 Introduction**

6.1.1 This section of the PEMP summarises the approach to monitoring for each topic identified in the relevant S36 consent (See Section 1).

6.1.2 This PEMP document is not intended to present the detail of the monitoring proposals, but rather to summarise the agreed approach to environmental monitoring. Where separate detailed monitoring strategy documents or technical survey reports are available, reference to these is made and a brief summary is provided.

6.1.3 In line with the rationale for post-consent monitoring presented in the Marine Management Organisation's (MMO's) strategic review of offshore wind farm environmental monitoring (Ref.14), the monitoring proposals set out in this PEMP aim to:

- Validate, or reduce uncertainty in predictions on environmental impacts recorded in supporting Environmental Impact Assessments (EIAs) and Habitats Regulations Assessments (HRAs);
- Provide evidence on the effectiveness of mitigation measures; and
- Allow identification of any unforeseen impacts.

6.1.4 The S36 consent requires BOWL to undertake and/or participate in strategic, regional and project-specific monitoring. Whilst the focus of the PEMP is on specific monitoring, under each topic heading in Sections 7 to 14, commitments to participate in regional and strategic monitoring are also captured where relevant.

6.1.5 Under each monitoring topic heading, the following structure is followed:

- Consent conditions;
- Approach to monitoring;
- Aims and objectives;
- Methodology;
- Reporting; and
- Programme.

## 7 Birds

### 7.1 Introduction

7.1.1 This section of the PEMP summarises BOWL's approach to monitoring of seabirds in relation to the Wind Farm Assets. BOWL has committed to undertake post-construction bird surveys to better understand seabird activity in the vicinity of the wind farm and to validate assumptions made within the ES and SEIS.

### 7.2 Consent conditions

7.2.1 S36 consent conditions relevant to bird monitoring are summarised in Table 7.1 below.

**Table 7.1: Consent conditions requiring bird monitoring.**

Consent reference	Summary of condition	Discharge status
S36 consent Condition 27.a.1	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 as relevant in terms of the ES and any subsequent surveys for; 1. Birds;	<b>Pre-construction:</b> Discharge of pre-construction element of Condition 27.a.1 has been confirmed by Marine Scotland Licensing Operations Team (MS-LOT) (02/08/2016) (Ref.15)
		<b>Construction:</b> Agreed by MFRAG ornithology subgroup that construction monitoring is not required. MS-LOT have confirmed that the construction element of Condition 27.a.1 does not apply. (Ref.15)
		<b>Post-construction:</b> The outline scope of post construction monitoring has been agreed with MFRAG (Ref.16). The amount, duration and frequency of monitoring is still under discussion with MFRAG. BOWL will seek confirmation from MS-LOT on discharge of the post-construction element of Condition 27.a.1 at the appropriate time.
S36 consent Condition 27.c	c. The participation by the Company in surveys to be carried out in relation to regional and strategic bird monitoring;	Monitoring strategy developed in collaboration with the MFRAG ornithology subgroup to consider regional considerations. Part discharge of Condition 27.c, in relation to regional monitoring, has been confirmed by MS-LOT (02/08/2016) (Ref.15).

<b>Consent reference</b>	<b>Summary of condition</b>	<b>Discharge status</b>
S36 consent Condition 28	The Company must participate in any Moray Firth Regional Advisory Group (“MFRAG”) for the purpose of advising the Scottish Ministers on research, monitoring and mitigation programmes for ornithology.	Monitoring strategy developed in collaboration with the MFRAG ornithology subgroup to consider regional considerations.  BOWL will seek confirmation from MS-LOT on discharge of Condition 28 at the appropriate time.

### **7.3 Approach to monitoring**

- 7.3.1 An ornithology subgroup has been set up as part of MFRAG, to discuss and agree appropriate bird monitoring for the Beatrice Offshore Wind Farm and for the Moray East and Moray West offshore wind farms. The following organisations are represented on the subgroup: BOWL, Moray Offshore Renewable Power (MORP), Marine Scotland Science (MSS), Scottish Natural Heritage (SNH), Joint Nature Conservation Committee (JNCC) and Royal Society for the Protection of Birds (RSPB) Scotland.
- 7.3.2 BOWL has appointed MacArthur Green to provide advice on bird monitoring options, engage in discussions with the MFRAG ornithology subgroup, develop monitoring scopes to obtain discharge of conditions and undertake analysis and reporting as necessary.
- 7.3.3 A summary of the MFRAG ornithology subgroup discussions is provided in Table 7.2. Meeting agendas and minutes (once finalised) referred to in Table 7.2 can be obtained on the Scottish Government website.

**Table 7.2. MFRAG ornithology subgroup discussions and agreements on monitoring.**

<b>Date</b>	<b>Summary of key discussions and agreements</b>
14/11/2014	Initial discussion to identify key seabird issues for BOWL (and MORP) and potential monitoring options.
16/12/2014	Refinement of monitoring focus and determination of appropriate survey methods. Agreement that great black-backed gull, herring gull and puffin are the primary focus.
02/03/2015	Further discussion on suitable monitoring methods for focal species, including, but not limited to, survey timings.
30/03/2015	Discussion of proposed BOWL pre-construction breeding season aerial survey and of planned SNH survey of the East Caithness Cliffs Special Protection Area colonies.

Date	Summary of key discussions and agreements
03/07/2015	<p>Sign-off of agreement on BOWL pre-construction aerial survey design. Note that agreement was obtained via email from group members prior to this meeting (see Table 7.1), with that decision minuted at this meeting. Discussion on timing for post-construction monitoring.</p> <p>Agreement that the completion of the aerial surveys could be extended from 31 July to 07 August if necessary due to weather delays experienced during the survey period.</p>
12/11/2015	<p>Review and discussion of results from BOWL 2015 pre-construction breeding season aerial survey.</p>
21/02/2018	<p>Discussion of BOWL construction progress.</p>
01/05/2018	<p>Initial discussion on suitability of a phased approach to post-construction monitoring, with Year 1 of aerial surveys being carried out in 2019 as planned, with further monitoring years potentially delayed until completion of other offshore wind farm projects nearby.</p>
29/11/2018	<p>Agreement that post-construction aerial surveys will start in 2019, with results analysis taking account of piling activity at Moray East, and potentially of O&amp;M work at BOWL.</p> <p>Discussion of how BOWL could achieve strategic monitoring objectives; this could potentially include participation in the East Caithness cliffs puffin time-lapse photography monitoring.</p>
05/06/2019	<p>Discussion of ongoing research in puffin colony monitoring, and gull tagging will be held in future MFRAG meetings. Agreement that BOWL commission MacArthur Green to develop a summary note on these, with potential monitoring proposals that BOWL could investigate.</p>
26/09/2019	<p>BOWL to commission initial feasibility paper on gull tagging, followed by a 2020 breeding season reconnaissance site visit.</p> <p>Discussions on puffin camera work to be continued in future MFRAG meetings.</p> <p>Agreement that aerial surveys will be repeated in 2020.</p>
09/07/2020	<p>2020 post construction ornithological monitoring aerial surveys postponed to 2021, due to COVID19 working restrictions.</p> <p>2020 gull tagging reconnaissance work also rescheduled for 2021 due to COVID19 working restrictions.</p> <p>Discussion of AI puffin monitoring technology developed by SSER and software development partners. Initial field trials proposed for spring 2020, on Isle of May.</p> <p>Review and discussion of results from 2019 post construction aerial surveys.</p>

7.3.4 Through discussions with the MFRAG ornithology subgroup it was agreed that the primary focus for monitoring should be the East Caithness Cliffs (ECC) Special Protection Area (SPA) breeding populations of:

- Great black-backed gull;
- Herring gull; and,
- Puffin.

- 7.3.5 These species were selected due to their status as the main focus of the ornithology assessments undertaken as part of the EIA, SEIS, and the HRA. Secondary species, which were also considered during the assessment but for which impacts were determined to be of a lower significance were guillemot, razorbill, kittiwake and gannet and therefore, no targeted monitoring of these species is proposed. However, opportunistic data on the abundance and distribution of the secondary species will be collected during monitoring targeted at the key species.
- 7.3.6 The scope of ornithology monitoring, including the principles and timing of the monitoring activities, has been discussed at each MFRAG ornithology subgroup meeting. At the MFRAG ornithology subgroup meeting on 12/11/2015 it was agreed that fully defined monitoring plans will no longer be discussed within a joint BOWL/MORP document (referring to the document 'Moray Firth Ornithology Monitoring Strategy: Outline Programme' (Ref.16).
- 7.3.7 As a result, two monitoring survey programmes pertinent to this PEMP have been devised through discussion with the MFRAG ornithology subgroup:
- digital aerial surveys of the Wind Farm Assets and the waters extending to the Caithness coast, conducted during the core seabird breeding season months (May to July). The scope of the aerial surveys is provided in the document 'Aerial Survey Method for Pre-Construction Surveys' (Ref.17); and,
  - deployment of Global Positioning System (GPS) tags on adult great black-backed gulls and herring gulls breeding in the ECC SPA. The principles and timing of this monitoring are set out in the document 'Moray Firth Ornithology Monitoring Strategy: Outline Programme (Ref.16). The detailed scope of this tagging study will be discussed and agreed within the MFRAG ornithology subgroup.
- 7.3.8 An additional requirement to monitor the breeding populations and obtain demographic estimates (e.g. productivity rates) of the three-named species at the ECC SPA has been discussed by the MFRAG ornithology subgroup.
- 7.3.9 The proposed timescales for the above monitoring are presented in the document 'Moray Firth Ornithology Monitoring Strategy: Outline Programme (Ref.16) and are summarised in Tables 7.3 and 7.4.

**Table 7.3: Pre-construction seabird monitoring programme as agreed with the MFRAG ornithology subgroup.**

Type	Timings and duration	Data acquired	Reason	Status
Aerial surveys	Breeding season (e.g. May - July) Confirmed as 1 year following the results from 2015 survey work	Sea bird distributions Flight heights and direction	Baseline bird data (distributions and flight heights) for comparison with later phases. Connectivity (inferred) and flight heights for comparison with baseline and post-construction.	Complete

**Table 7.4: Post construction seabird monitoring programme as agreed with the MFRAG ornithology subgroup.**

Type	Timings and duration	Data acquired	Reason	Status
Aerial surveys	Breeding season (e.g. May - July). The first post-construction survey will be conducted across the BOWL site following completion of the first phase of turbine installation, i.e. in 2019 Monitoring will follow an iterative programme which is still to be discussed and agreed via MFRAG, with a review of key questions and the ability to address them following the third year of surveys post-construction.	Post-construction seabird distributions, and flight directions. Possibly flight speed if technology is available.	Displacement during operation (range of scales considered: exclusion from site and from vicinity of turbines). Connectivity (inferred) for comparison inside and outside the wind farm area. Small scale displacement due to construction disturbance if applicable.	2019 aerial surveys complete, results analysis underway  2020 aerial surveys will be postponed until breeding season 2021 due to COVID-19 operational restrictions.



Type	Timings and duration	Data acquired	Reason	Status
Gull tagging	<p>Breeding season (e.g. May - July).</p> <p>Selection of years (to be determined, but unlikely to be consecutive).</p> <p>First year expected to be following full BOWL installation (in 2020).</p> <p>Timing and requirement of later years to be agreed following review of year 1 tagging results and supplementary data (e.g. from aerial surveys).</p> <p>Requirement for later years dependent on results of preliminary survey. If results indicate that connectivity with BOWL is minimal or absent, there will be little value in continuing to tag from the sampled colonies.</p> <p>MFRAG will review the requirement for follow-on gull tagging (after year 1) in light of the evidence obtained from previous surveys. The emphasis should be on the likelihood of connectivity to the SPA population and hence collision risk.</p>	Gull locations and movements Flight data; i.e. flight speed	Connectivity. Collision parameters.	<p>Initial feasibility study prepared by MacArthur Green, regulator responses received by BOWL.</p> <p>Site reconnaissance will be postponed until 2021 breeding season due to COVID-19 operational restrictions.</p>

Type	Timings and duration	Data acquired	Reason	Status
ECC large gull and puffin colony monitoring: counts (inc. plot sampling), productivity estimation, ringing	<p>Breeding season (e.g. May - July).</p> <p>MFRAG to review the requirements for colony monitoring for ECC large gulls based on the results from tagging work and aerial survey.</p> <p>If this indicates a very low likelihood of connectivity between the wind farms (BOWL and MORP) and the SPA, then the requirement for colony monitoring can be removed.</p> <p>MFRAG to review the requirements for colony monitoring for ECC puffin based on results from the 2014 colony survey to indicate whether or not there are any suitable locations for such monitoring.</p>	<p>Population counts</p> <p>Demographic rates</p>	<p>Monitor and understand trends</p>	<p>Discussions ongoing with regulators and MFRAG on puffin colony monitoring including initial feasibility studies of application of AI image analysis monitoring technology.</p>

#### 7.4 Aims and objectives

7.4.1 The objectives of seabird monitoring on and around the wind farm area to improve understanding of seabird interactions with offshore WTGs and validate assumptions made in the ES and SEIS. The key seabird concerns identified in the ES, SEIS and HRA assessments were collision risk for large gulls (great black-backed gull and herring gull) and displacement risk for auks (puffin, guillemot and razorbill).

7.4.2 Monitoring surveys aim to address three key questions:

- Is there connectivity between the ECC SPA and the Beatrice Offshore Wind Farm?
- If there is connectivity, are there detectable effects (i.e. collisions and displacement) occurring at the Beatrice Offshore Wind Farm?
- Are the impacts sufficiently large to have an effect on the populations of concern?

### **Digital aerial surveys**

7.4.3 The primary aims of the digital aerial surveys are:

- To collect seabird distribution data during the breeding season to permit spatial modelling of seabird distributions and estimation of abundance both before and after construction and estimate the magnitude (if any) of displacement resulting from avoidance of the WTGs (with a particular emphasis on puffin);
- Estimate the extent of connectivity between the Beatrice Offshore Wind Farm and the ECC SPA through analysis of flight directions; and

### **GPS tagging surveys**

7.4.4 The primary aims of the GPS tagging surveys are to:

- Use foraging distribution data obtained through tag deployment to investigate the extent of connectivity between the wind farm and the ECC SPA populations and potentially finer scale movements in relation to WTGs;
- Obtain data on flight characteristics (e.g. speed if possible) and to permit discrimination of behaviour (e.g. flying, sat on sea surface, etc.). These data will be used to inform collision risk modelling methods with a view to improving methods for estimating collision risk; and
- Build on the previous tagging work conducted.

7.4.5 This study will be planned for a single breeding season, with the requirement for any necessary subsequent work to be discussed and agreed with MFRAG ornithology subgroup following review by BOWL and MFRAG of the results from year one.

## **7.5 Methodology**

### **Digital aerial surveys**

7.5.1 The scope of the post-construction aerial surveys is provided in the document 'Aerial Survey Method for Pre-construction Surveys' (Ref.17). This is to allow comparison with the pre-construction baseline data.

7.5.2 The pre-construction survey data, analysis methods and results are presented in the 'Pre-Construction Aerial Survey Report' (Ref.18). This report has been accepted by the MFRAG ornithology subgroup, and the subgroup confirmed that BOWL were not required to complete any further pre-construction aerial surveys (confirmation emails received from the subgroup members were provided to MS-LOT on 25 March 2016).

### **Gull GPS tagging study**

7.5.3 A pilot tagging study of the ECC SPA great black-backed gulls and herring gulls was conducted during the 2014 breeding season with the aim of investigating connectivity to the wind farm and habitat preferences (Ref.19). This study found no evidence for connectivity although the study does acknowledge that this may have reflected the

tagging locations which were not adjacent to the wind farm area.

## 7.6 Reporting

7.6.1 BOWL will aim to submit survey reports to the MFRAG ornithology subgroup for consultation within 3 months of receipt of data from the survey contractors. Once the reports have been consulted on with the MFRAG ornithology subgroup, BOWL will issue the reports to MS-LOT (on behalf of the Scottish Ministers) in support of the discharge of conditions where appropriate.

7.6.2 To date the following key reports have been produced to inform the ornithology monitoring requirements:

- Moray Firth Ornithology Monitoring Strategy: Outline Programme (Ref.16) extracts detailed in Tables 7.3 and 7.4).
- Pre-Construction Aerial Survey Report (Ref.18). The report and its conclusion have been approved by the MFRAG ornithology subgroup (see Section 7.5.1).
- Foraging behaviour of large gulls and implications for offshore wind site selection Work Package 2: Analysis of gull foraging behaviour and implications for offshore wind farm site selection (Ref.19). This report details the results of the 2014 pilot tagging study of the ECC SPA great black-backed gulls and herring gull.

## 7.7 Programme

7.7.1 The programme for pre-construction monitoring was discussed and agreed with the MFRAG ornithology subgroup (see Table 7.3). A programme of Year 1 post-construction monitoring has been proposed (aerial surveys, in line with proposals in Table 7.4) and will be agreed following consultation with MFRAG. The timings of subsequent monitoring are under discussion with MFRAG.

## 7.8 ScotMER evidence map linkages to BOWL monitoring

7.8.1 Ornithological monitoring at Beatrice may help address a number of evidence gaps identified by ScotMER. These linkages to ScotMER evidence gaps are described in table 7.5 below.

**Table 7.5. Summary of ScotMER evidence map linkages to BOWL monitoring**

ScotMER knowledge gap and ID	Summary of ScotMER evidence map description (latest version at <a href="https://www2.gov.scot">https://www2.gov.scot</a> as of 02/11/2020)	Linkages to BOWL monitoring	Current Status
Colony of origin of birds at sea during the breeding	Ensure apportioning of at-sea effects during the breeding	Beatrice plans to carry out tagging of Great Black Backed Gulls at East Caithness Cliffs cliff-top	Beatrice monitoring likely to help address

season. OR.09	season to the appropriate population/s.	colonies in the 2022 breeding season (dependent on successful outcomes of site reconnaissance work in 2021). In 2021, site reconnaissance work will also be carried out to assess the feasibility of at-sea capture of Great Black Backed Gulls. If capture and tagging at sea is deemed feasible, Beatrice will look to undertake a tagging campaign in the 2022 breeding season. If this work can go ahead, it may contribute to understanding of colonies-of-origin for Great Black Backed Gulls foraging at sea.	Knowledge Gap
Baseline colony population data. OR.11	These form the basis of assessments, with effects compared against them.	This evidence gap links to Beatrice's Section 36 consent, condition 27, on appropriate and effective monitoring of the impacts of the development. Working in conjunction with software development companies, Beatrice plans to trial AI technology on the Isle of May during 2021 breeding season. The intention is to demonstrate technology which will enable remote monitoring of Puffin colonies to build upon baseline colony data.	Beatrice monitoring likely to help address Knowledge Gap
Distance from activity effect occurs.OR.21.	Fundamental component of quantifying displacement effects for an assessment.	The results of post-construction aerial surveys when compared with pre-construction results should help provide an indication of displacement magnitude and timings.	Beatrice monitoring likely to help address Knowledge Gap

## 8 Cod

### 8.1 Introduction

8.1.1 This section of the PEMP summarises BOWL's approach to monitoring of Cod in relation to the Wind Farm Assets.

8.1.2 BOWL have committed to undertake pre- and post-construction cod surveys to better understand cod spawning activity in the vicinity of the Wind Farm Assets and to validate assumptions made within the ES and SEIS.

### 8.2 Consent conditions

8.2.1 S36 consent conditions relevant to cod monitoring are summarised in Table 8.1 below.

**Table 8.1: Consent conditions requiring the monitoring of cod.**

Consent reference	Summary of condition	Discharge status
S36 consent Condition 27.a.2	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 as relevant in terms of the ES and any subsequent surveys for; 2. Cod;	<b>Pre-construction:</b> Discharge of pre-construction element of Condition 27.a.2 confirmed by MS-LOT (02/08/2016) (Ref.15).
		<b>Construction:</b> Confirmed (via approved Piling Strategy (PS)) that construction monitoring is not required should piling operations be avoided during February and March (02/11/2015) (Ref.20).
		<b>Post-construction:</b> BOWL will seek confirmation from MS-LOT on discharge of the post-construction element of Condition 27.a.2 at the appropriate time.
S36 consent Condition 35	BOWL must conduct baseline cod surveys prior to Commencement of the Development and also undertake post-construction cod surveys in the first February and March occurring no earlier than 12 months following the Final Commissioning of the Development.	<b>Pre-construction:</b> Discharge of pre-construction element of Condition 35 confirmed by MS-LOT (19/02/2016) (Ref.21).
		<b>Post-construction:</b> BOWL will seek confirmation from MS-LOT on discharge of the post-construction element of Condition 35 at the appropriate time.

### 8.3 Approach to monitoring

8.3.1 BOWL appointed Brown and May Marine Limited to advise on the scope of, and to undertake, the pre-construction cod monitoring survey.

8.3.2 The approach to the pre-construction cod monitoring was presented to MSS and MS-LOT and agreed with MSS, as summarised in Table 8.2. The pre-construction survey was completed in March 2014 (Ref.22).

**Table 8.2. Summary of key consultation meetings and agreements for cod monitoring.**

Date	Summary of key discussion and agreements
06/02/2014	Proposal for 'Undertaking of a Cod Spawning and Sandeel Survey for the Beatrice Offshore Windfarm Ltd' (Ref.22).
15/02/2014	Confirmation by MS-LOT that survey methodology as proposed will meet pre-construction survey requirement (Ref.23).
24/07/2014	2014 pre-construction cod survey report submitted to MS-LOT (Ref.22).
09/09/2014	MS-LOT comments on cod survey report seeking provision of further information on survey results analysis and on other fish species caught (Ref.24).
25/09/2014	BOWL response to MS-LOT confirming methodology and seeking meeting to discuss finalisation of report (Ref.24).
11/03/2015	BOWL issue of revised pre-construction cod survey report following MSS confirmation of the corrected method for calculating cod spawning intensity from the survey results (Ref.22).
24/04/2015	MS-LOT acceptance of pre-construction survey report as meeting condition requirements (Ref.25).
19/02/2016	MS-LOT confirm discharge of the pre-construction element of S36 consent Condition 35 (Ref.21).
02/08/2016	MS-LOT confirm S36 consent Condition 27.a.2. (cod) is discharged where it relates to pre-construction surveys (Ref.15).

8.3.3 As required by S36 consent Condition 35, BOWL will complete a post-construction cod survey in the first February and March, occurring no earlier than 12 months, following the Final Commissioning of the Development. Final Commissioning of the Development is expected to take place in March 2019 as set out in the Construction Programme (Ref.26). As such it is anticipated that this survey will be completed in the February or March 2021. The post-construction surveys will be agreed with MS-LOT and MSS prior to undertaking any survey work.

## **8.4 Aims and objectives**

8.4.1 The aims and objectives of pre-construction, and post-construction surveys are to:

- Characterise cod spawning occurring within the zone of potential underwater noise impact; and
- Provide a pre-construction baseline against which post-construction monitoring can be compared.

## **8.5 Methodology**

8.5.1 Methods employed for cod spawning surveys have been developed in consultation with MSS, following relevant published guidelines and MSS advice (Table 8.2).

8.5.2 A total of 40 stations across the Beatrice Offshore Wind Farm were sampled using a commercial rock-hopper otter trawl. Full details of the survey methods employed during the pre-construction cod spawning surveys are outlined in the 'Proposal for the Undertaking of a Cod Spawning and Sandeel Survey for the Beatrice Offshore Windfarm Ltd.' (Ref.27).

8.5.3 The survey methodology to be employed for the post-construction survey will be the same as that utilised in the pre-construction survey to ensure that the data collected are consistent and comparable.

8.5.4 As piling operations (commenced on 02 April 2017 and completed on 02 December 2017) did not take place during the cod spawning period (February and March) no cod spawning monitoring was required during construction.

## **8.6 Reporting**

8.6.1 BOWL will aim to issue all survey reports to MS-LOT within 3 months of survey completion.

8.6.2 A pre-construction survey was completed in 2014 and a report was submitted to MS-LOT. Following discussion of the analysis of the survey data with MSS an updated report was submitted to MS-LOT (see Table 8.2) (Ref.22). This report has been accepted by MSS and the pre-construction element of cod monitoring S36 consent condition 35 has been formally discharged by MS-LOT on behalf of the Scottish Ministers.

## **8.7 Programme**

8.7.1 The intended programme of monitoring for cod is set out in Table 8.3.



**Table 8.3. Summary of cod monitoring programme.**

Pre-construction	Construction	Post-construction
2014 spawning survey completed. Survey report accepted. Pre-construction monitoring complete.	None required as piling operations did not take place in February and March.	Post construction spawning survey currently anticipated to be undertaken in February and March 2021.

## 8.8 ScotMER evidence map linkages to BOWL monitoring

8.8.1 The monitoring of Cod at Beatrice may help address a number of evidence gaps identified by ScotMER. These linkages to ScotMER evidence gaps are described in table 8.4 below.

**Table 8.4. Summary of ScotMER evidence map linkages to BOWL monitoring**

ScotMER knowledge gap and ID	Summary of ScotMER evidence map description (Latest version at <a href="https://www2.gov.scot">https://www2.gov.scot</a> as of 02/11/2020)	Linkages to BOWL monitoring	Current Status
Strategic fisheries management. FF.05	Promote potential synergies in MSP	Beatrice will be undertaking surveys for cod and Sandeel spawning/larvae in winter 2020/21, for comparison with the pre-construction survey results. This will contribute to data on stocks of these species in the northern Moray Firth. The sandeel surveys will also contribute and be directly comparable to ICES sandeel survey assessments for the North Sea as they are carried out at the same time of year.	Beatrice monitoring likely to help address Knowledge Gap. Post-construction surveys not yet underway.
Essential fish habitat – especially fish spawning & nursery grounds FF.10	Currently used sensitivity maps provide indicative areas. Greater clarification on essential fish habitat would be useful when assessing effects from marine projects.	Beatrice will be undertaking surveys for cod and sandeel spawning/larvae in winter 2020/21, for comparison with the pre-construction survey results. Beatrice surveys will contribute to knowledge on spawning areas for Cod.	Beatrice monitoring likely to help address Knowledge Gap. Post-construction surveys not yet underway.
Reef / fish aggregation effects. FF.11	Linked with diving seabirds	Beatrice aerial bird surveys are providing data which may help with	Beatrice monitoring likely to help

		investigations of potential attraction effects of WTGs to diving seabirds.	address Knowledge Gap. Post-construction surveys not yet underway.
--	--	--	--

## 9 Herring

### 9.1 Introduction

9.1.1 BOWL have committed to undertake pre-and post-construction herring larval surveys to better understand herring spawning activity in the vicinity of the Beatrice Offshore Wind Farm and validate assumptions made within the ES and SEIS.

### 9.2 Consent conditions

9.2.1 S36 consent conditions relevant to herring monitoring are summarised in Table 9.1 below.

**Table 9.1. Consent conditions requiring the monitoring of herring.**

Consent reference	Summary of condition	Discharge status
S36 consent Condition 27.a.3	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 as relevant in terms of the ES and any subsequent surveys for; 3. Herring;	<b>Pre-construction:</b> Pre-construction surveys completed. Discharge of pre-construction element of Condition 27.a.3 confirmed by MS-LOT (02/08/2016) (Ref.15).
		<b>Construction:</b> MS-LOT have confirmed that no surveys are required during construction, based on the results of the pre-construction surveys (02/08/2016) (Ref.15).
		<b>Post-construction:</b> MS-LOT have confirmed that no post-construction surveys would be required following review of the pre-construction surveys and therefore the post-construction element of S36 consent Condition 27.a.3 does not apply (Ref.15).
		S36 consent Condition 27.a.3 has been fully discharged and therefore no further actions are required

<b>Consent reference</b>	<b>Summary of condition</b>	<b>Discharge status</b>
S36 consent Condition 34	In the event that pile foundations are to be used, the Company must undertake herring surveys during the months of August and September. The survey methodology to be agreed, in writing, by the Scottish Ministers, following consultation with MSS. Survey results will be used devise mitigation options for piling noise impacts on herring.	<b>Pre- and post-construction:</b> Full discharge of S36 consent Condition 34 confirmed by MS-LOT (24/03/2016) (Ref.28).

### 9.3 Approach to monitoring

9.3.1 BOWL have appointed Brown and May Marine Limited to advise on the scope of, and undertake, herring monitoring surveys.

9.3.2 The approach to herring monitoring was presented to and agreed by MSS as summarised in Table 9.2.

**Table 9.2. Summary of key consultation meetings and agreements for herring monitoring.**

<b>Date</b>	<b>Summary of key discussions and agreements</b>
21/11/2013	Meeting (BOWL, MORP, MSS, MS-LOT) to discuss requirements for herring surveys (Ref.29).
26/06/2014	Issue of draft herring larval survey methodology to MSS and MS-LOT (Ref.30).
08/07/2014	Meeting to confirm proposed herring larval survey methodology, analysis and number of surveys (Ref.31).
15/07/2014	BOWL issue final herring larval survey methodology report to MS-LOT (Ref.32).
18/07/2014	MS-LOT confirmed the approval of survey design and methodology of herring larvae survey for August/September 2014 (Ref.33).
12/11/2014	Herring larval survey technical report (2014) completed and submitted to MSS (Ref.34).
07/01/2015	Herring larval survey technical report (2014) accepted by MSS (Ref.35).
19/01/2015	Meeting to present pre-construction herring survey results. Attended by MS-LOT, MSS, SNH, JNCC. MSS confirmed they approve the survey methodology (Ref.36).

<b>Date</b>	<b>Summary of key discussions and agreements</b>
02/11/2015	Approach to requirement for mitigation measures for herring set out in approved PS (Ref.37).
25/02/2016	Herring larval survey technical report (2015) issued to MSS for acceptance (Ref.38).
25/02/2016	Summary report of the 2014 and 2015 larval survey results issued to MSS for acceptance with justification for no piling noise mitigation requirement (Ref.39).
26/02/2016	MSS confirm acceptance of survey reports and agree that piling installation activities will not adversely affect spawning of the Orkney-Shetland herring stock (Ref.40).
02/03/2016	Email from BOWL to MS-LOT requesting discharge of S36 consent Condition 34 (Ref.41).
24/03/2016	MS-LOT confirm no requirement for piling mitigation or piling restriction, MS-LOT confirm S36 consent Condition 34 is fully discharged (Ref.28).
02/08/2016	MS-LOT confirm S36 consent Condition 27.a.3. (herring) is fully discharged (Ref.15).

#### **9.4 Aims and objectives**

9.4.1 The aims and objectives of the pre-construction surveys were to:

- Characterise herring spawning occurring within the zone of potential underwater noise impact;
- To better inform the knowledge of spawning behaviour of the Orkney/ Shetland herring stock, to enable mitigation options to minimise noise impacts from piling activity on herring to be devised
- To inform the Piling Strategy (PS) ((Ref.37); and
- Provide a pre-construction baseline against which any post-construction monitoring can be compared, if required, in order to validate the predictions made within the ES and SEIS.

9.4.2 Based on the results from the 2014 and 2015 herring spawning surveys BOWL did not complete any surveys during construction and do not propose to undertake any post construction surveys.

#### **9.5 Methodology**

9.5.1 Methods employed for herring spawning surveys were developed in consultation with MSS, following relevant published guidelines and MSS advice (see Table 9.2).

9.5.2 Pre-construction herring spawning surveys have been undertaken in August and September 2014, and 2015. Surveys were undertaken using a Gulf VII high speed plankton sampler tows at 25 locations in the outer Moray Firth, within the predicted 90dBht noise contour range. The survey duration was 8 weeks with tows undertaken at each station once each week, (weather permitting). Full details of the survey

methods employed during the pre-construction herring spawning surveys are outlined in the 'Herring Larval Survey Methodology Report' (Ref.32).

9.5.3 The pre-construction survey methodology and a larval age back-calculation methodology was agreed with MSS (Ref.32).

## 9.6 Reporting

9.6.1 Two pre-construction surveys were completed in 2014 and 2015. Results of the 2014 pre-construction larval surveys are provided in the 'Herring Larval Survey Results – Technical Report' (Ref.34). This report has been accepted by MSS. Results of the 2015 pre-construction larval surveys are provided in the 'Herring Larval Survey Results – Technical Report' (Ref.38). This report has also been accepted by MSS (see Table 9.2).

9.6.2 A summary of the results of both the 2015 and 2014 pre-construction herring larval surveys was provided in the 'Pre-construction Baseline Herring Larval Survey Report' (Ref.39). This report states that there is good agreement between the results of the 2014 and 2015 surveys, indicating that no significant herring spawning takes place within the survey area and, therefore, there is no requirement for piling noise mitigation for herring, as stated in the approved PS (Ref.37). This report has been accepted by MSS and approved by MS-LOT (see Table 9.2).

## 9.7 Programme

9.7.1 The intended programme of monitoring for herring is set out in Table 9.3.

**Table 9.3. Summary of herring monitoring programme.**

Pre-construction	Construction	Post-construction
2014 and 2015 larval survey completed, and reports submitted. Survey reports accepted by MSS and S36 consent Condition 34 fully discharged by MS-LOT. Pre-construction monitoring complete.	Not required	Not required

## 10 Sandeels

### 10.1 Introduction

10.1.1 BOWL have committed to undertake pre- and post-construction sandeel surveys to better understand the distribution and abundance of sandeels in the vicinity of the Development and validate assumptions made within the ES and SEIS.

### 10.2 Consent conditions

10.2.1 S36 consent conditions relevant to sandeel monitoring are summarised in Table 10.1 below.

**Table 10.1. Consent conditions requiring the monitoring of sandeel.**

Consent reference	Summary of condition	Discharge status
S36 consent Condition 27.a.4	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 as relevant in terms of the ES and any subsequent surveys for; 4. Sandeel;	<b>Pre-construction:</b> Discharge of pre-construction element of S36 consent Condition 27.a.4 confirmed by MS-LOT (02/08/2016) (Ref.15).
		<b>Construction:</b> MS-LOT have confirmed that the construction element of S36 consent Condition 27.a.4 does not apply (02/08/2017) (Ref.15).
		<b>Post-construction:</b> BOWL will seek confirmation from MS-LOT on discharge of the post-construction element of S36 consent Condition 27.a.4 at the appropriate time.
S36 consent Condition 36	BOWL must conduct baseline sandeel surveys prior to Commencement of the Development and also undertake post-construction sandeel surveys in the first February and March occurring no earlier than 12 months following the Final Commissioning of the Development	<b>Pre-construction:</b> Discharge of pre-construction element of S36 consent Condition 36 confirmed by MS-LOT (19/02/2016) (Ref.21).
		<b>Post-construction:</b> BOWL will seek confirmation from MS-LOT on discharge of the post-construction element of S36 consent Condition 27.a.4 at the appropriate time.

### 10.3 Approach to monitoring

10.3.1 BOWL have appointed Brown and May Marine Limited to advise on the scope of, and undertake, sandeel monitoring surveys.

10.3.2 The approach to sandeel monitoring was presented to MSS and MS-LOT and agreed with MSS, as summarised in Table 10.2.

**Table 10.2. Summary of key consultation meetings and agreements for sandeel monitoring.**

Date	Summary of key discussions and agreements
06/02/2014	Proposal for the 'Undertaking of a Cod Spawning and Sandeel Survey for the Beatrice Offshore Windfarm Ltd' (Ref.42).
15/02/2014	Confirmation by MS-LOT that survey methodology as proposed will meet pre-construction survey requirement (Ref.23).
26/06/2014	Sandeel survey results technical report completed by BOWL and issued to MSS (Ref.43).
02/09/2014	Written acceptance of 2014 pre-construction sandeel survey reports by MSS and MS-LOT (Ref.44).
25/09/2014	Written response to MS-LOT concerning points raised by MSS in response to report (Ref.24).
19/02/2016	MS-LOT confirm discharge of the pre-construction element of S36 consent Condition 36 (Ref.21).
02/08/2016	MS-LOT confirm S36 consent Condition 27.a.4. (sandeels) is discharged where it relates to pre-construction surveys (Ref.15).
29/11/2019	MFRAG advised that sandeel surveys include analysis of otolith samples, to provide age data.
10/12/2019	<p>PEMP consultation response from MSS advised that BOWL should carry out sandeel surveys during early spring (April) or late autumn (September-October) to survey the presence of adult and juvenile sandeels instead of larvae. By changing survey month, this would avoid risk to the planktonic larvae. MSS noted that the survey results would not be comparable to the pre-construction surveys results but that if surveys take place in April then the season will remain the same.</p> <p>In their consultation response, MMS also asked that BOWL consider carrying out acoustic surveys alongside trawling. This would give more reliable estimates of the biomass and abundance of sandeels buried in the sediment and active in the water column.</p>
12/02/2020	Further clarification received from MSS, noting that to avoid disturbance of spawning activity and egg incubation in the sediment which would result in egg/larval mortality and impact recruitment, and to potentially coincide with timing of the North Sea ICES sandeel survey which takes place annually using the same demersal trawl dredge (ICES 2016), surveys in November – mid-December would be optimal.

10.3.3 Post-construction, a single monitoring survey for sandeels will be undertaken in the first November to mid-December occurring no earlier than 12 months following the Final Commissioning of the Development to characterise the abundance and



distribution of sandeels within the defined survey area. Final Commissioning of the Development took place in July 2019, such it is anticipated that this survey will be completed in November to mid-December 2020. The data will be used to validate the conclusions of the assessment as presented in the ES and be compared against the results of the pre-construction surveys.

10.3.4 No sandeel monitoring was undertaken during the construction phase.

10.3.5 The key focus of the post-construction monitoring programme will be on the recovery of sandeel habitats which have been affected by construction of the Beatrice Offshore Wind Farm. Comparison with pre-construction monitoring data will give an indication on whether or not sandeels have recolonised areas directly or indirectly affected by construction operations and provide details on the rate of recovery.

## 10.4 Aims and objectives

10.4.1 The aims and objectives of the pre-construction surveys are to:

- Establish the abundance and distribution of sandeels within the Beatrice Offshore Wind Farm; and
- Provide a pre-construction baseline against which post-construction monitoring can be compared in order to validate the predictions made within the ES and SEIS.

## 10.5 Methodology

10.5.1 Methods employed for sandeel surveys were developed in consultation with MSS, following relevant published guidelines and MSS advice (see Table 10.2).

10.5.2 A total of 103 stations were sampled over a 2.1 km square grid across the Beatrice Offshore Wind Farm area using a towed dredge. Full details of the survey methods employed during the pre-construction sandeel surveys are outlined in 'Proposal for the Undertaking of a Cod Spawning and Sandeel Survey for the Beatrice Offshore Windfarm Ltd.' (Ref.42).

10.5.3 The survey methodology to be employed for post-construction surveys will be the same to that utilised in the pre-construction surveys to ensure that the data collected are consistent and comparable. A single post-construction sandeel monitoring survey will be undertaken between November to mid-December, no earlier than 12 months following Final Commissioning of the Development.

## 10.6 Reporting

10.6.1 BOWL will aim to issue all survey reports to MS-LOT within 3 months of survey completion.

10.6.2 A pre-construction survey and monitoring report has been completed (Ref.43). and submitted to MS-LOT. This report has been accepted by MSS and the pre-construction element of the sandeel monitoring S36 consent Condition 36 has been formally discharged by MS-LOT (Ref.21) on behalf of the Scottish Ministers.

## 10.7 Programme

10.7.1 The intended programme of monitoring for sandeels is set out in Table 10.3.

**Table 10.3. Summary of sandeel monitoring programme**

Pre-construction	Construction	Post-construction
2014 sandeel survey completed. Survey report accepted. Pre-construction monitoring complete.	Not required.	Post-construction sandeel survey currently anticipated to be undertaken in November to mid-December 2020.

## 10.8 ScotMER evidence map linkages to BOWL monitoring

10.8.1 The Sandeel monitoring at Beatrice may help address a number of evidence gaps identified by ScotMER. These linkages to ScotMER evidence gaps are described in table 10.4 below.

**Table 10.4. Summary of ScotMER evidence map linkages to BOWL monitoring**

ScotMER knowledge gap and ID	Summary of ScotMER evidence map description (Latest version at <a href="https://www2.gov.scot">https://www2.gov.scot</a> as of 02/11/2020)	Linkages to BOWL monitoring	Current Status
Strategic fisheries management. FF.05	Promote potential synergies in MSP	Beatrice will be undertaking surveys for cod and Sandeel spawning/larvae in winter 2020/21, for comparison with the pre-construction survey results. This will contribute to data on stocks of these species in the northern Moray Firth. The sandeel surveys will also contribute and be directly comparable to ICES sandeel survey assessments for the North Sea as they are carried out at the same time of year.	Beatrice monitoring likely to help address Knowledge Gap. Post-construction surveys not yet underway.
Reef / fish aggregation effects. FF.11	Linked with diving seabirds	Beatrice aerial bird surveys are providing data which may help with investigations of potential attraction effects of WTGs to diving seabirds.	Beatrice monitoring likely to help address Knowledge Gap. Post-construction surveys not yet underway.

## 11 Diadromous fish

### 11.1 Introduction

11.1.1 BOWL committed to participate in the National Research and Monitoring Strategy for Diadromous Fish (NRMSD) through undertaking a pre-construction Atlantic salmon smolt tracking study. The completed study has provided information to support better understanding of natural migration pathways and behaviour of smolts in the Moray Firth.

### 11.2 Consent conditions

11.2.1 Consent conditions relevant to diadromous fish monitoring are summarised in Table 11.1 below.

**Table 11.1. Consent conditions requiring monitoring of diadromous fish.**

Consent reference	Summary of condition	Discharge status
S36 consent Condition 27.a.5	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 as relevant in terms of the ES and any subsequent surveys for; 5. Diadromous fish;	<b>Pre-construction:</b> Pre-construction element of condition discharged by MS-LOT (29/01/2016) (Ref.44).
		<b>Construction:</b> MS-LOT have confirmed that the construction element of Condition 27.a.5 does not apply (02/08/2017) (Ref.15).
		<b>Post-construction:</b> MS-LOT have confirmed that the post-construction element of Condition 27.a.5 does not apply (02/08/2017) (Ref.15).
S36 consent Condition 28	The Company must participate in any Moray Firth Regional Advisory Group ("MFRAG") for the purpose of advising the Scottish Ministers on research, monitoring and mitigation programmes for diadromous fish.	MFRAG approval of the proposed methodology for pre-construction smolt tracking survey (18/01/2016) (Ref.45).

Consent reference	Summary of condition	Discharge status
S36 consent condition 31	The Company must, to the satisfaction of the Scottish Ministers, participate in the monitoring requirements as laid out in the 'Scottish Atlantic Salmon, Sea Trout and European Eel Monitoring Strategy' so far as they apply at a local level (the Moray Firth).	Condition fully discharged by MS-LOT (29/01/2016) (Ref.44).

### 11.3 Approach to monitoring

11.3.1 BOWL appointed SCENE (University of Glasgow) to advise on the scope of and undertake an Atlantic salmon smolt tracking study.

11.3.2 The approach to the pre-construction study was developed in discussion with MFRAG and MSS as summarised in Table 11.2 below.

11.3.3 BOWL do not propose to undertake any post construction monitoring for diadromous fish.

**Table 11.2. Summary of key consultation meetings and agreements for diadromous fish monitoring.**

Date	Summary of key discussions and agreements
12/09/2014	Meeting with MSS, MS-LOT to discuss BOWL participation in Pentland Salmon Initiative to achieve required monitoring (Ref.46). This study was not taken forward.
26/06/2015	BOWL issued a briefing note including proposed methodology for smolt tracking in the Cromarty Firth for discussion with MSS (Ref.47).
03/07/2014	Meeting with MSS at Battleby. MSS requested that BOWL enhance marine tracking element of proposed study (Ref.48).
26/08/2015	BOWL issued a revised scope including a greater tracking element to MSS (Ref.49).
28/08/2015	Meeting with local District Salmon Fishery Boards (DSFB) who provided support for the study proposal (Ref.50).
23/09/2015	Letter issued to MSS requesting acceptance of proposed Cromarty Firth smolt tracking study methodology (Ref.51).

Date	Summary of key discussions and agreements
07/10/2015	MSS letter confirming acceptance of Cromarty Firth smolt tracking study (Ref.52).
02/11/2015	Cromarty Firth smolt tracking study methodology issued for acceptance by MFRAG (Ref.53).
18/01/2016	MFRAG accept the proposed methodology for smolt tracking survey (Ref.45).
29/01/2016	MS-LOT letter confirming discharge of S36 consent Condition 31 as set out in Table 11.1 (Ref.44).
23/02/2017	Meeting with local DSFB to present the results of the Cromarty Firth smolt tracking study (Ref.54).
04/04/2017	BOWL issued the Cromarty smolt tracking final report to MS-LOT (Ref.55 and Ref.56).

11.3.4 The study was designed to track the seawards migration of Atlantic salmon smolts through the Cromarty Firth and into the Moray Firth. The study was designed to align with the research requirements of NRMSD.

11.3.5 The data collected during this monitoring programme has increased the understanding of the speed and pathway of migrating Atlantic salmon smolts and their mortality during the early stages of migration. The study has provided information on the direction preferences displayed by smolts as they leave the Cromarty Firth and their behavioural responses to the tidal and residual flows during migration. This data, together with other studies on smolt migration, build upon the understanding of Atlantic salmon smolt behaviour in Scottish waters.

#### **11.4 Aims and objectives**

11.4.1 The overall aim of the proposed monitoring programme was to increase the knowledge base of the behaviour of Atlantic salmon in the Moray Firth and to contribute to the NRMSD.

#### **11.5 Methodology**

11.5.1 The smolt tracking study involved the capture and tagging of smolts as they commenced their seawards migration from a tributary of the River Conon. The smolts' passage past acoustic receiver arrays in the Cromarty Firth was recorded. MSS deployed an additional array of acoustic receivers in the Moray Firth, which further added to the outcome of the study. Attempts were made to actively track a small number of smolts from a small boat, however the combination of background noise levels, tidal and wind conditions and fish behaviour prevented any meaningful data collection. Details of the survey methods employed during the pre-construction smolt tracking surveys were provided in the document 'Cromarty Firth Smolt Tracking Study' (Ref.53) and approved by MFRAG on 18 January 2016.

## 11.6 Reporting

11.6.1 The final survey report entitled 'Atlantic salmon, *Salmo salar*, smolt movements in the Cromarty and Moray Firths' (Ref.55) was completed in 2017. This study is the first to identify the migration direction and swimming depths of downstream migrating Atlantic salmon in both estuarine and marine environments in Scotland. The results of the study suggest that smolts initially migrate in an eastwards direction from the Cromarty Firth rather than in a more northerly direction close to the coast as hypothesised.

11.6.2 The survey report was accepted by MSS and was issued to MS-LOT on 04 April 2017 (Ref.56). The report demonstrated the full implementation of the agreed study methodology as required by MS-LOT in respect of the full discharge of S36 consent Condition 31 and discharge of S36 consent Condition 27.a.5, as relating to diadromous fish (Ref.44 and Ref.15).

## 11.7 Programme

11.7.1 The programme of monitoring for diadromous fish is set out in Table 11.3.

**Table 11.3. Summary of diadromous fish monitoring programme.**

Pre-construction	Construction	Post-construction
Pre-construction survey completed in spring 2016.	Not required.	Not required.

## 12 Benthic communities

### 12.1 Introduction

12.1.1 BOWL have committed to undertake pre- and post-construction benthic surveys to better understand the recovery rates of benthic communities in the vicinity of the wind farm to validate assumptions made within the ES and SEIS.

### 12.2 Consent conditions

12.2.1 Consent conditions relevant to benthic monitoring are summarised in Table 12.1 below.

**Table 12.1. Consent conditions requiring monitoring of benthic communities.**

Consent reference	Summary of condition	Discharge status
S36 consent Condition 27.a.6	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 as relevant in terms of the ES and any subsequent surveys for; 6. Benthic communities;	<b>Pre-construction:</b> Pre-construction element of condition discharged by MS-LOT (02/08/2016) (Ref.15).
		<b>Construction:</b> MS-LOT have confirmed that the construction element of Condition 27.a.6 does not apply (02/08/2017) (Ref.15).
		<b>Post-construction:</b> MS-LOT have confirmed that completion of the post-construction surveys as set out in the benthic post construction survey strategy report (Ref.57) will discharge the post-construction element of Condition 27.a.6 (02/08/2016) (Ref.15). BOWL will seek confirmation from MS-LOT on discharge of the post-construction element of Condition 27.a.6 at the appropriate time.
S36 consent Condition 19	The Company must submit a Cable Plan that includes the results of survey work (including geophysical, geotechnical and benthic surveys) which will help inform cable routing.	Pre-construction surveys of the wind farm area were completed in 2015. Survey results were used to inform the Wind Farm Cable Plan (CaP) (Ref.58) which was approved by MS-LOT on the (18/11/2016) (Ref.59).



### 12.3 Approach to monitoring

12.3.1 BOWL appointed RPS to advise on the scope and methodology for benthic monitoring surveys. APEM Ltd. OR.09 were appointed to undertake the pre-construction monitoring surveys for the wind farm.

12.3.2 BOWL completed pre-construction benthic surveys within the wind farm area during June 2015 to establish baseline conditions for comparison against the results of post-construction surveys to validate predictions made regarding potential impacts on benthic habitats and their subsequent recovery.

12.3.3 The approach to benthic monitoring was presented to and discussed with MS-LOT, MSS, SNH and JNCC and confirmed in subsequent meetings and correspondence (Table 12.2).

### 12.2. Summary of key consultation meetings and agreements for benthic monitoring.

Date	Summary of key discussions and agreements
19/01/2015	Meeting to present and discuss the scope of pre-construction benthic surveys. Attended by MS-LOT, MSS, SNH and JNCC (Ref.60).
09/04/2015	BOWL response to MSS post-meeting comments regarding benthic survey strategy (Ref.61).
11/05/2015	MFRAG meeting to discuss benthic post-construction monitoring and scope of monitoring (Ref.62).
18/06/2015	BOWL confirmation to MSS and MS-LOT of pre-construction benthic grab sample locations (Email from BOWL to MSS and MS-LOT) (Ref.63).
14/12/2015	BOWL 'Wind Farm Pre-construction Benthic Survey Report' completed (Ref.64).
17/12/2015	BOWL issue pre-construction survey reports and benthic post-construction survey strategy report to MSS for acceptance (Ref.65 and Ref.66).
25/01/2016	MSS accepted benthic survey reports. Query raised regarding the implications of the reported change in the dominant biotope across the wind farm area for the post-construction monitoring strategy (Ref.67).
19/02/2016	BOWL response addressing MSS query concerning proposed post-construction monitoring strategy (Ref.68).
21/03/2016	MSS confirm acceptance of the survey report and the proposed post-construction monitoring strategy (Ref.69).
02/08/2016	MS-LOT confirm acceptance of the PEMP and confirm discharge of the pre-construction elements of the S36 consent Condition 27 (Ref.15).
18/11/2016	MS-LOT confirm acceptance and approval of the Wind Farm CaP (Ref.58 and Ref.59).

Date	Summary of key discussions and agreements
20/11/2019	MFRAG requested that benthic surveys record and report any ocean quahog found, including data on size, age and similar variables. Also, that the surveys are carried out in such a way as to ensure minimal damage to <i>Nephrops</i> habitat.
10/12/2019	MSS requested consideration of opportunistic data collection; BOWL noted that should suitable opportunities arise for opportunistic or incidental data collection (DDV/ ROV) during engineering surveys of the cable route these will be explored as appropriate.
11/06/2020	Discussion of hard substrate sampling methodology with MFRAG. APEM Ltd and BOWL to finalise proposals to then be circulated to MFRAG for agreement.
08/09/2020	Conclusion of discussions with MFRAG on post-construction survey methodology – acceptance of methodology, including provision for surveys to extend into early October 2020 if required.

## 12.4 Aims and objectives

12.4.1 The aims and objectives of the proposed benthic monitoring surveys are to characterise the benthic communities within the wind farm area and establish the pre-construction baseline against which post-construction monitoring can be compared in order to validate the predictions made within the ES and SEIS.

## 12.5 Methodology

12.5.1 Methods employed for the pre-construction benthic surveys involved grab samples for infaunal analysis and particle size analysis (PSA).

12.5.2 Full details of the survey methods employed in the pre-construction benthic surveys are outlined in report entitled 'Wind Farm Pre-construction Benthic Survey Report' (Ref.64).

12.5.3 Post-construction benthic monitoring is proposed to be undertaken one, two and five years following the completion of construction activities within the wind farm area (expected to be in 2020, 2021 and 2024). The number of years of repeat surveys will depend on the degree of habitat disturbance and the rate of recovery.

12.5.4 The survey methodology to be employed for the post-construction survey will be the same to that utilised in the pre-construction survey to ensure that the data collected are consistent and comparable.

12.5.5 Post-construction surveys were originally planned to include monitoring of pile soil plug arisings due to construction activities, however these features did not arise during construction and so monitoring is not required. Monitoring of the colonisation of hard substrates, such as jacket foundation structures, will also be undertaken. The post-construction benthic monitoring strategy is described in the report 'Post-Construction Benthic Monitoring Strategy' (Ref.66), and the final post-construction methodology has

been developed in conjunction with MFRAG and APEM (BOWL post-construction survey methods document\_01-09-2020).

## **12.6 Reporting**

12.6.1 BOWL will aim to issue all survey reports to MS-LOT within 3 months of survey completion.

12.6.2 The 'Wind Farm Pre-construction Benthic Survey Report' (Ref.64) was issued and accepted by MSS as detailed in Table 12.2.

12.6.3 The 'Post-Construction Benthic Monitoring Strategy' report (Ref.66) has been issued to and accepted by MSS.

## **12.7 Programme**

12.7.1 Post construction benthic monitoring surveys will be undertaken one, two and five years, as required, following the completion of construction activities.

12.7.2 Details of the benthic monitoring survey programme are summarised at Table 12.3 (next page) and provided in report 'Post-Construction Benthic Monitoring Strategy' report (Ref.66).

**Table 12.3. Summary of benthic community monitoring programme.**

Pre-construction	Construction	Post-construction
<p>2015 surveys completed. Pre-construction monitoring complete.</p>	<p>No surveys required.</p>	<p>Wind farm area - benthic grabs 12 locations as per pre-construction survey (2020, 2021 and 2024)</p> <p>Wind farm area – Drop Down Video (DDV) or ROV monitoring of hard substrates and adjacent seabed at 4 turbine locations (2020, 2021 and 2024). Including extended ROV and DDV transects (out from the 4 turbine locations), to provide a baseline visual dataset for future seabed enrichment studies (should these studies be required in association with biofouling removal, if removal becomes necessary).</p> <p>Wind farm area – PSA samples, 2 locations spoil mounds (2020, 2021 and 2024) (No longer in survey programme, as no spoil mounds were generated during wind farm installation).</p> <p>Wind farm area – PSA samples, 2 locations spoil mounds (2020, 2021 and 2024) (<i>No longer in survey programme, as no spoil mounds were generated during wind farm installation</i>).</p> <p>Due to Covid-19 site operational restrictions, surveys could not be carried out in June 2020 as planned. Following discussions with MFRAG and assessment of Covid-19 restrictions, surveys rescheduled targeted for September 2020 and likely to be carried out in late September / early October.</p>

## 12.8 ScotMER evidence map linkages to BOWL monitoring

12.8.1 Benthic monitoring at Beatrice may help address a number of evidence gaps identified by ScotMER. These linkages to ScotMER evidence gaps are described in table 12.4 below.

**Table 12.4. Summary of ScotMER evidence map linkages to BOWL monitoring**

<b>ScotMER knowledge gap and ID</b>	<b>Summary of ScotMER evidence map description (Latest version available at <a href="https://www2.gov.scot">https://www2.gov.scot</a> as of 02/11/2020)</b>	<b>Linkages to BOWL monitoring</b>	<b>Current Status</b>
Spatial and temporal scale B.01	Expansion of Marine Renewable Energy Devices (MREDS) in UK waters means that the question of how the spatial extent (spatial scale) and the length of time that MREDS are in the water (temporal scale) are central to understanding and interpreting the effects on benthic ecosystems. How do ecosystem effects vary from one turbine to a commercial scale wind farm? Is their connectivity between windfarms or other installations and their associated infrastructure? The ecosystems in question are those that are likely impacted by MREDS, e.g. sand and gravels, stony reefs and habitats on the routes of interconnector cables, e.g. mud, kelp and rocky reef.	Benthic monitoring surveys will help indicate any changes in community composition, particularly during the initial post-construction phase.	Beatrice monitoring may indirectly help address Knowledge Gap. Post construction surveys not yet underway.
Baseline B.02	Knowledge of habitat and community changes on the sites of MREDS is imperative to inform the decision-making process. A baseline knowledge of habitats and species on the site is required pre- and post-development. An effective way to monitor for habitat and species changes is in relation to thresholds, i.e. a target level based on the avoidance of unacceptable outcomes or an ecologically defined shift in ecosystem status.	Baseline benthic studies from pre and post construction (including control sites) have been undertaken at Beatrice. The data collected should help with understanding habitat and community changes on the sites of MREDS	Beatrice monitoring likely to help address Knowledge Gap. Post construction surveys not yet underway.
Commercial species B.07	Sandeels play a key role in the North Sea ecosystem. They spend much of their life cycle buried in the sand and lay their eggs to the substrate. The effect of a fishing closure on the distribution of sandeels, before and after the development of a Danish offshore wind farm was studied. A similar BACI study in Scottish waters on OWFs would be a useful comparison and enable better understanding of the short and long term effects of sandeels and the benthic ecosystem.	Links to Beatrice s.36 consent condition number 36 re baseline sandeel surveys. Data collected from Beatrice pre and post construction sandeel surveys will help to better inform the effect	Beatrice monitoring likely to help address Knowledge Gap. BOWL pre-construction surveys were carried out in 2015 and post-construction Sandeel surveys

		of a fishing closure on the distribution of sandeels, before and after the development.	are scheduled for November 2020.
Mapping species distribution B.09	Data on benthic species distribution from the offshore realm is lacking. Benthic species have often been recorded in surveys but are not routinely added to online databases, so establishing whether a species is rare in the offshore area is difficult. Transferring records of benthic species from surveys in the offshore regions would be invaluable in order for decision makers to establish rarity of species and whether the removal of a certain species as a result of an MRED would have a significant population level effect. Data that could be incorporated may include past Marine Scotland Science surveys or baseline surveys conducted for EIA purposes.	Data from the Beatrice pre and post construction benthic surveys could contribute to this evidence gap.	Beatrice monitoring may indirectly help address Knowledge Gap. Pre-construction benthic survey data is in the process of upload to the MEDIN database, and the intention is for post-construction benthic survey data to also be uploaded when available.

## 13 Seabed scour and local sediment deposition

### 13.1 Introduction

13.1.1 BOWL considers that seabed scour and local sediment deposition is an engineering issue and is not specifically linked to a sensitive environmental receptor. The MMO have undertaken a review of post-consent offshore wind farm monitoring (Ref.14). This report noted that monitoring of scour should only be required in relation to the structural integrity of foundations or other associated infrastructure over the lifetime of an offshore wind farm project. This section of the PEMP is therefore informed by proposed seabed surveys required for engineering purposes for the pre-construction, post installation and post-construction phases.

### 13.2 Consent conditions

13.2.1 Consent conditions relevant to seabed scour and local sediment deposition monitoring are summarised in Table 13.1

**Table 13.1. Consent conditions requiring the monitoring of seabed scour and local sediment deposition.**

Consent reference	Summary of condition	Discharge status
S36 consent Condition 27.a.7	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 as relevant in terms of the ES and any subsequent surveys for; 7. Seabed scour and local sediment deposition.	<b>Pre-construction:</b> MS-LOT have confirmed that the pre-construction element of S36 consent Condition 27.a.7 is discharged by approval of the 'Scour and Local Sediment Deposition Monitoring Strategy Report' (Ref.70) (30/08/2016) <sup>3</sup> (Ref.71).
		<b>Construction:</b> MS-LOT has confirmed that the 'Scour and Local Sediment Deposition Monitoring Strategy Report' (Ref.70) has been approved in relation to the construction element of S36 consent Condition 27.a.7.
		<b>Post-construction:</b> BOWL will seek confirmation from MS-LOT on discharge of the post-construction element of S36 consent Condition 27.a.7 at the appropriate time.

<sup>3</sup> The 'Scour and Local Sediment Deposition Strategy' provided a summary of the pre-construction surveys conducted to date and a consideration of post-construction monitoring. The pre-construction elements of the monitoring strategy remain relevant. Engineering-led post-construction monitoring strategies are being developed for specific assets (i.e. WTG foundations and IACs). The 'Scour and Local Sediment Deposition Strategy' will therefore be superseded by focused methodologies.

Consent reference	Summary of condition	Discharge status
S36 consent Condition 19	The Company must submit a Cable Plan that includes measures to address exposure of any cables.	Pre-construction geophysical and geotechnical surveys of the wind farm area were completed in 2015 and 2016. Survey results were used to inform the Wind Farm CaP (Ref.58) which was approved by MS-LOT on the (18/11/2016) (Ref.59).

### 13.3 Approach to monitoring

13.3.1 BOWL intends to use the results of pre-construction geophysical and geotechnical surveys and post-construction engineering-led surveys to monitor the extent of any scour or local sediment deposition that might result from the installation of the wind farm. This approach has been presented to and discussed with MS-LOT, MSS, SNH and JNCC (Ref.60).

13.3.2 Prior to construction start, but before the finalisation of the wind farm detailed design, a strategy document entitled 'Scour and Local Sediment Deposition Monitoring Strategy Report' (Ref.71) was prepared that detailed BOWL's proposals for scour and local sediment deposition monitoring. MS-LOT confirmed acceptance of the monitoring strategy document in respect of the relevant consent conditions (Table 13.1)

**Table 13.2. Summary of key consultation meetings and agreements for seabed scour and local sediment deposition monitoring.**

Date	Summary of discussion and agreements
19/01/2015	Meeting to present BOWL's outline scour monitoring strategy. Attended by MS-LOT, MSS, SNH and JNCC (Ref.60).
19/05/2016	BOWL issued the 'Scour and Local Sediment Deposition Monitoring Strategy Report' (Ref.70) to MS-LOT.
30/08/2016	MSS confirm acceptance of the 'Scour and Local Sediment Deposition Monitoring Strategy Report' (Ref.71).
18/11/2016	MS-LOT confirm acceptance and approval of the Wind Farm CaP (Ref.58 and Ref.59).

13.3.3 A review was undertaken by the MMO of post-consent offshore wind farm monitoring (Ref.14). The review states that scour is not specifically linked to a sensitive environmental receptor and therefore does not inform the environmental receptor impacts. The review describes scour as essentially an engineering issue, and states that scour monitoring should only be conducted by developers and their engineers in order to monitor the structural stability of any foundations and other associated infrastructure over the lifetime of the offshore wind farm project.



13.3.4 BOWL's strategy document (Ref.71) reiterated the conclusions of the MMO report and set out a number of distinct strategies for monitoring scour and sediment deposition around the Wind Farm Assets.

13.3.5 The strategy document has now been superseded by this PEMP. The monitoring required by the consent conditions will be delivered through the surveys and inspections required for engineering purposes. The surveys will conform to the Det Norske Veritas (DNV) offshore standards for wind turbine structures (DNV-OS-J101). The final detail of these will be determined post-construction through design and construction verification requirements and by operational requirements for specific project elements.

#### **13.4 Aims and objectives**

13.4.1 The aims and objectives of any monitoring undertaken for seabed scour and local sediment deposition are:

- To monitor development, if any, of scour at WTG foundations; and
- To monitor any exposure of IACs.

#### **13.5 Methodology**

13.5.1 The primary method for monitoring scour and local sediment deposition will be through geophysical survey. Geophysical surveys may include use of multi-beam echo sounder and side scan sonar equipment to provide high resolution bathymetry and data on seabed features.

13.5.2 Pre-construction survey data was reviewed to develop an understanding of seabed conditions and identify any areas that may be susceptible to scour. This work is intended to facilitate an initial estimation of the potential for scour around Wind Farm Assets. Any locations considered susceptible to significant scour will be identified for potential future monitoring. The actual scour extent will be monitored at a suitable frequency and remediation will be undertaken if necessary following the installation of the structure.

13.5.3 Post installation surveys will be undertaken on behalf of BOWL to verify the installation completion of the required infrastructure works. This will include surveys of WTG foundations. Post installation monitoring of soil plug deposits was originally included in the survey proposals, to inform the benthic monitoring (See Section 12), however soil plug deposits were not formed during construction, and therefore this monitoring item is not required. Post installation surveys will also be undertaken to confirm IACs burial depth and protection.

13.5.4 During O&M bathymetric surveys will be undertaken to assess scour around WTG structures and to monitor burial and exposure of the IACs, if required.

**Table 13.3. Summary of post-construction scour and local sediment deposition monitoring.**

Asset	Monitoring strategy
WTG foundations	<p>Geophysical surveys of WTG foundation substructures at ten sample locations per year (following methodology established in Seaways Heavy Lifting post-installation surveys).</p> <p>If significant scour is identified further geophysical survey work will be undertaken and/or the number of monitoring locations will be increased.</p> <p>The surveys are planned to be undertaken annually for five years commencing in 2020 (allowing the foundations of 50 WTGs to be inspected), and then reviewed.</p>
IACs	<p>Following installation, an assessment will be completed identifying areas of cable at potential risk of exposure in the future. Monitoring of these 'at-risk' areas will be conducted annually initially.</p> <p>Subject to the findings of the surveys, the frequency of these will be adapted to the appropriate level of risk exposure.</p>

13.5.5 The precise post-construction monitoring strategy for scour is to be confirmed and will be based on all design information and as built outputs and may incorporate engineering survey results during the first year of operations.

### 13.6 Reporting

13.6.1 BOWL will aim to issue all survey reports to MS-LOT within 3 months of survey completion.

13.6.2 The pre-construction geophysical survey datasets are summarised in Tables 13.4 below. These surveys form the pre-construction baseline. The spatial coverage of the surveys includes one full site survey, with subsequent surveys focusing on selected areas around the WTG foundation locations and IAC routes.

**Table 13.4. Pre-construction baseline geophysical data**

Date	Reference	Type	Spatial coverage
2010	Osiris (Ref.72)	Multi-beam echo sounder, Acoustic Ground Discrimination Sonar (AGDS), side scan sonar, sub-bottom profiler	100% of wind farm area.
2013	Fugro EMU (Ref.73)	Unexploded ordnance (UXO) survey (multi-beam echo sounder, side scan sonar, magnetometer)	150m boxes at 45 WTG foundation locations.
2014	Fugro Survey (Ref.74)	UXO survey (multi-beam echo sounder, side scan sonar, magnetometer)	50m boxes at all WTG foundation locations.

Date	Reference	Type	Spatial coverage
2015	MMT (Ref.75)	Multi-beam echo sounder, side scan sonar, sub-bottom profiler, magnetometer, ROV imagery	200m corridor along all IAC routes.

### 13.7 Programme

13.7.1 The programme for post-construction monitoring as set out in Table 13.6 will be confirmed based on the level of risk associated with scour around installed assets, following initial monitoring results, based on the extent of scour around WTG foundations and exposure of IACs.

**Table 13.5. Summary of seabed scour and local sediment deposition monitoring programme.**

Pre-construction	Construction	Post-construction
Pre-construction surveys completed	No surveys required. Pre-construction data analysis completed to inform engineering and Consent Plans.	Scour monitoring at selected WTG foundation locations (initially annually) Scour monitoring at IACs (if required).

## 14 Marine mammals

### 14.1 Introduction

14.1.1 BOWL has committed to undertake pre-construction, construction and post-construction marine mammal monitoring surveys to better understand the effect of construction activities on marine mammal populations, and validate assumptions made within the ES and SEIS.

### 14.2 Consent conditions

14.2.1 Consent conditions relevant to marine mammal monitoring are summarised in Table 14.1 below.

**Table 14.1. Consent conditions requiring marine mammal monitoring.**

Consent reference	Summary of condition	Discharge status
S36 consent Condition 27.b	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);	<b>Pre-construction:</b> Pre-construction surveys completed. The 'Pre-construction MMMP Year 3 Annual Report' (Ref.76) was accepted at the MFRAG Marine Mammals (MFRAG-MM) subgroup meeting on 20 June 2017 (Ref.77).
		<b>Construction:</b> BOWL will seek confirmation from MS-LOT on discharge of the construction element of S36 consent Condition 27.b monitoring requirements at the appropriate time. MS-LOT letter (Ref.15) states delivery of construction MMMP will discharge preconstruction requirements. The results were still emerging at that stage. Final discharge of the condition has not yet been sought. Final detailed monitoring design for the construction MMMP (cMMMP), as described in Ref.78 was approved by the MFRAG-MM subgroup (as noted in Table 17.2).
		<b>Post-construction:</b> BOWL will seek confirmation from MS-LOT on discharge of the post-construction element of S36 consent Condition 27.b monitoring requirements at the appropriate time

Consent reference	Summary of condition	Discharge status
S36 consent Condition 28	The Company must participate in any Moray Firth Regional Advisory Group ("MFRAG") established by the Scottish Ministers for the purpose of advising the Scottish Ministers on research, monitoring and mitigation programmes for, marine mammals.	A pre-construction MMMP and cMMMP have been developed in collaboration with the MFRAG-MM subgroup, which takes into account strategic considerations.

### 14.3 Approach to monitoring

14.3.1 Based on recommendations made by MSS, BOWL and MORP agreed in consultation with MS-LOT to contribute to a regional Marine Mammal Monitoring Programme (MMMP) that is being managed by Professor Paul Thompson from the University of Aberdeen (UoA).

14.3.2 A marine mammal subgroup has been set up as part of MFRAG (referred to as MFRAG-MM<sup>4</sup>), to discuss and agree the regional MMMP. The scope and objectives of both the pre-construction MMMP and the construction MMMP (cMMMP) were developed by Professor Paul Thompson and agreed in consultation with the MFRAG-MM and additional stakeholders. The following organisations are represented on the MFRAG-MM sub-group: BOWL, MORP, MS-LOT, MSS, SNH, JNCC, and Whale and Dolphin Conservation (WDC).

14.3.3 Following formal approval of the pre-construction MMMP by MS-LOT pre-construction monitoring commenced in 2014 and has now been completed. The 'Pre-construction MMMP Year 3 Annual Report' (Ref.76) was submitted to MFRAG-MM sub-group for approval at the meeting of 20 June 2017.

14.3.4 The scope of the cMMMP has been agreed with the MFRAG-MM and was approved by MFRAG-MM on 17 November 2016 (Ref.79).

14.3.5 A summary of the process by which the pre-construction MMMP has been agreed and approved, and the cMMMP agreed, is presented in Table 14.2 below. Agreement has been reached primarily via discussions within the MFRAG-MM. Meeting agendas and minutes can be obtained on the Scottish Government website.

<sup>4</sup> MFRAG-MM subgroup was known as the Moray Firth Marine Mammal Monitoring Steering Group prior to 01 April 2015. For ease of reference the Steering Group is referred to as the MFRAG-MM subgroup in this PEMP.

**Table 14.2. Summary of key consultation meetings and agreements for marine mammal monitoring.**

Date	Summary of key discussion and agreements
02/04/2014	Final draft of the pre-construction MMMP issued to MS-LOT and stakeholders for consultation (Ref.80).
April /May 2014	Stakeholders respond to the pre-construction MMMP. MMMP updated and issued to MFRAG (Ref.81).
10/10/2014	Pre-construction monitoring scope and methodology approved by MS-LOT (Ref.82).
27/11/2014	'MMMP Interim Report' relating to monitoring surveys undertaken between May and September of 2014 completed and circulated to the MFRAG-MM (Ref.83).
16/12/2014	MFRAG-MM meeting to discuss data collected since commencement of the pre-construction MMMP. The next steps for monitoring since the issuing of the MMMP in April 2014 were identified. Discussed the approach to construction monitoring (Ref.84).
26/03/2015	Draft cMMMP circulated to MFRAG-MM for review and comment (Ref.85).
30/03/2015	MFRAG-MM meeting to discuss draft cMMMP and potential scope of a post-construction MMMP. Results from the continuing pre-construction MMMP surveys also discussed. Noted that certain studies under the remit of the pre-construction MMMP will be continued in the cMMMP. As a result of BOWL's intended use of Acoustic Deterrent Devices (ADDs) during piling operations, the cMMMP includes monitoring of responses of harbour seals and harbour porpoises to ADD. MSS agree the outline construction monitoring programme suitably covers the Moray Firth (Ref.86).
24/04/2015	Comments on the draft cMMMP received from SNH and JNCC. CMMMP updated and issued to MFRAG-MM.
06/05/2015	Pre-construction MMMP annual report relating to surveys completed in 2014/2015 were completed and circulated to the MFRAG-MM (Ref.87).
19/06/2015	MFRAG-MM meeting to allow further discussion of suitable construction monitoring methods for focal species and survey timing (Ref.88).
25/11/2015	'Pre-construction MMMP Interim Report' relating to monitoring surveys undertaken between May and September of 2015 completed and circulated to MFRAG-MM (Ref.89).
15/12/2015	MFRAG-MM meeting. Professor Paul Thompson presented the final cMMMP proposal in detail.  Seal usage of wind farm areas (both BOWL's and MORP's) was discussed. Due to low usage, it was agreed that there was limited opportunities for investigating harbour seal responses to ADDs and piling soft starts (WP 3.1) (Ref.90).

Date	Summary of key discussion and agreements
05/02/2016	cMMMP issued to MFRAG-MM for consultation. The cMMMP was updated following receipt of comments from attendees at the MFRAG-MM meeting on 15/12/2015 and circulated to the sub-groups for approval (Ref.85).
22/09/16	Meeting with MS-LOT and MSS to present and discuss BOWL's cMMMP (Ref.91).
17/11/16	Professor Paul Thompson presented the final cMMMP approach to MFRAG-MM members for approval (Ref.78 and Ref.79).
20/06/2017	The 'Year 3 Pre-Construction MMMP Annual Report' was accepted by MFRAG-MM (Ref.77 and Ref.76).
21/02/2018	MFRAG-MM meeting: BOWL presented the interim results of the cMMMP and confirmed full analysis of results is underway (minutes in preparation).
08/11/2019	MFRAG-MM meeting: BOWL confirmed interest in helping to support the ongoing long term monitoring programme in the Moray Firth, as BOWL post-construction monitoring. Meeting discussions indicated that support would become useful from 2022.

14.3.6 Through discussion with MFRAG-MM it was agreed that the primary focus for monitoring during pre-construction and construction should be harbour seal and bottlenose dolphin. The final cMMMP approved through the MFRAG-MM also incorporated additional shorter-term studies of harbour seal and harbour porpoise responses to Acoustic Deterrent Devices (ADDs) and piling soft start, and noise measurement modelling from piling operations and ADD deployment.

#### 14.4 Aims and objectives

##### Pre-construction MMMP

14.4.1 The primary aim of the pre-construction MMMP was to collect baseline data on the distribution, abundance and vital rates for the two-priority species: bottlenose dolphin and harbour seal, during the pre-construction period (2014-2017) and validate assumptions made in the ES and SEIS.

14.4.2 The pre-construction MMMP consisted of a number of discrete work packages (WPs) for both priority species; the WPs and their objectives are as follows:

##### **WP 1 - Harbour seal monitoring:**

**WP 1.1:** Assess the variability in individual based reproduction and survival.

**WP 1.2:** Assess the variability of harbour seal trends in abundance in summer and winter.

**WP 1.3:** Characterise the at-sea distribution and foraging patterns of harbour seals breeding at haul outs in the Moray Firth.

14.4.3 WPs 1.1 and 1.2 ran continuously over the duration of the pre-construction MMMP,

with data acquisition and analysis taking place in each year from 2014 to 2016. WP 1.3 involved data acquisition and analysis during 2014 and 2015.

**WP 2 - Bottlenose dolphin monitoring:**

**WP 2.1:** Assess the variability in individual based reproduction and survival rates.

**WP 2.2:** Assess the long-term variability in the trends in abundance of bottlenose dolphins in the Moray Firth Special Area of Conservation (SAC).

14.4.4 WPs 2.1 and 2.2 ran continuously over the duration of the pre-construction MMMP with data acquisition and analysis taking place in each year.

**Construction MMMP**

14.4.5 The aims of the cMMMP are to use the baseline data obtained from the pre-construction MMMP studies to support studies of harbour seal and bottlenose dolphin behavioural responses to pile driving noise and any broader scale changes in their distribution during the construction. The cMMMP consists of the continuation of WPs 1 and 2 as outlined above, and also includes two additional work packages, WP 3 and WP 4.

14.4.6 Additionally, under WP 2 (bottlenose dolphin monitoring) a further element, WP 2.3, has been developed that aims to assess the effects of construction on bottlenose dolphins.

14.4.7 WPs 3 and 4 specifically aim to monitor the broad-scale and fine-scale responses of both harbour seal and harbour porpoise to the deployment of an ADD and piling soft start procedures, which were deployed as part of BOWL's PS during piling operations. However, it was discussed at the MFRAG-MM meeting on 15/12/2015, that there is limited opportunity to conduct this monitoring for harbour seal within the wind farm area due to the low numbers of individuals using these offshore foraging areas as indicated by the results from the pre-construction MMMP. Instead, broader scale tracking work under WP 1.3 (at-sea distribution and foraging patterns of harbour seals) may provide opportunistic evidence of responses to ADD and soft start if harbour seal were in nearfield areas prior to start of piling activities.

14.4.8 The objectives of the WPs included in the cMMMP, in addition to those carried over from the pre-construction MMMP (described above) are:

**WP 2 – Bottlenose dolphin monitoring:**

**WP 2.3:** Assess the variability in the baseline occurrence of bottlenose dolphins in favoured areas (key sites) within the Moray Firth SAC and southern Moray Firth coast during construction.

**WP 3 - Monitoring deployment of ADD**

**WP 3.2:** Assess the broad-scale and fine-scale responses of harbour porpoises to ADD and piling soft starts.



#### **WP 4 – Noise measurement and modelling**

**WP 4.1:** Quantify the temporal variation in source levels of piling noise in relation to differences in hammer energy and ground conditions across the wind farm area; and

**WP 4.2:** Quantify the spatial variation in received levels of piling noise and ADD noise exposure.

14.4.9 The scope of any post-construction MMMP will be informed by the outcomes of pre-construction and construction monitoring, developed in consultation with the MFRAG-MM and subject to approval by MS-LOT on behalf of Scottish Ministers.

#### **14.5 Methodology**

14.5.1 Agreed pre-construction survey methods were detailed in the pre-construction MMMP (referred to in full as the 'Strategic Regional Marine Mammal Monitoring Programme for Assessing the Population Consequences of Constructing the BOWL and Moray Offshore Renewables Limited [now MORP] Wind Farm Developments') (Ref.83).

14.5.2 The pre-construction surveys have been designed to complement existing datasets within the Moray Firth and wider region for the two-priority species: bottlenose dolphin and harbour seal.

14.5.3 Agreed methods for during construction surveys are provided in the cMMMP report (Ref.78). The final cMMMP was approved by the MFRAG-MM sub-group members on the 17 November 2016. Work under the cMMMP commenced in February/March 2017, prior to the start of piling operations in April 2017, with the capture and tagging of harbour seals at Loch Fleet and the deployment of an array of acoustic devices.

#### **14.6 Reporting**

14.6.1 All pre-construction fieldwork from 2014 to 2016 was successfully completed, the data have been archived and analyses used to address key WP objectives. These data sets now provide a robust baseline on the vital rates, population status and distributions of harbour seal and bottlenose dolphin populations in the Moray Firth. This information underpinned ongoing construction monitoring for the wind farm.

14.6.2 Results and data analysis for the pre-construction surveys during 2014 to 2016 have been detailed in annual reports, culminating in the final pre-construction monitoring report entitled 'Strategic Regional Pre-Construction Marine Mammal Monitoring Programme Annual Report 2017' (Ref.76). This presents the results and analysis of data collected between 2014 and 2016 and confirms the successful completion of the planned pre-construction data collection to provide a robust baseline for comparison against construction and post-construction monitoring results.

14.6.3 Piling operations associated with the construction of the wind farm commenced on 02 April 2017 and were completed on 02 December 2017.

14.6.4 cMMMP fieldwork was started in February 2017 and all core fieldwork was completed by the end of 2018. Some work within WP 1.2, WP 2.3 and WP 3.2 will continue until March 2019.

14.6.5 A summary of initial results from the different work packages is provided below.

**WP 1 - Harbour seal monitoring:** Photo-ID studies and counts of harbour seals at Loch Fleet indicate that numbers at this site remained high through the construction period, with 55-60 mothers being recorded with pups in both pre-construction and construction years.

Loch Fleet continued to be the most important pupping site in region, with small numbers recorded at other sites along the north coast of the Moray Firth in both summer and winter.

GPS tracking of 31 Loch Fleet harbour seals demonstrated that none of these individuals used areas within 25km of the BOWL site; either in the two months prior to piling or during the first three months of piling. Integration of these seal tracks with predicted received levels from noise propagation models indicate that no seals received cumulative noise exposures that exceeded current NOAA thresholds.

**WP 2 - Bottlenose dolphin monitoring:** Dolphins were encountered all photo-ID trips undertaken within the SAC during both 2017 and 2018. Initial analyses indicate that over 100 individuals were recorded in both years; representing a similar proportion of the East coast population to that seen during the pre-construction period. PAM monitoring of occurrence at core sites within the SAC and along the southern coast of the Moray Firth suggest that all areas continued to be in-line with baseline data.

**WP 3 - Monitoring deployment of ADD:** Extensive monitoring of porpoise was carried out during two phases of work in the early and late phase of piling. These data highlighted that behavioural responses to piling were lower than predicted under current assessment models, and further declined through the construction period. Analyses also highlighted that responses were also related to vessel noise and were stronger in the presence of ADD use. Lower intensity PAM monitoring of porpoise occurrence at key sites has been continued throughout 2017 and 2018 to further explore responses to different phases of the construction period.

**WP 4 – Noise measurement and modelling:** Noise measurements were made at key sites throughout 2017 and 2018. More intensive studies were carried out in March to characterise ADD signals and September to explore how received levels varied with hammer energy. These data were used to optimise noise propagation models that could then be used to predict received levels at other sites. Analyses of these data have also highlighted that received levels of noise are not directly related to hammer energy but appear to vary markedly depending upon the piles penetration depth.

14.6.6 The analysis of data collected within all Work Packages is continuing. Data from WP 1 and WP 2 will be built upon through further data collection during construction at

MORP. These integrated data from the regional MMMP will be used to address the broader aims within these work packages. The final fieldwork report, and scientific publications on key findings within WP 3 and WP 4, were submitted to MRAG-MM by University of Aberdeen on 27<sup>th</sup> April 2020.

## 14.7 Programme

14.7.1 The programme for all marine mammal monitoring surveys is detailed in the cMMMP (Ref.85) and summarised in Table 14.3 below.

**Table 14.3: Summary of marine mammal monitoring programme.**

Pre-construction	Construction	Post-construction
<p>WP 1 (harbour seal monitoring) and WP 2 (bottlenose dolphin monitoring) monitoring surveys undertaken during 2014-2016.</p> <p>Pre-construction monitoring complete.</p>	<p>WP 1 (harbour seal monitoring) and WP 2 (bottlenose dolphin monitoring) monitoring has been carried out throughout 2017 and 2018</p> <p>WP 3 (monitoring responses to ADDs) was carried out through experimental ADD exposures prior to piling, and through an integrated analysis of exposure to piling noise and ADD exposure during two phases of construction.</p> <p>WP 4 (noise measurement and modelling) commenced in advance of piling operations and was completed in Quarter 4 2017.</p> <p>Construction monitoring complete.</p>	<p>BOWL have confirmed interest in exploring contributions to the ongoing long term monitoring programme in the Moray Firth, as BOWL post-construction monitoring. Discussions have indicated that contributions would become useful from 2022.</p>

## 15 Programme of survey works

15.1.1 Table 15.1 provides an overview of when the monitoring activities set out in this PEMP for each receptor group have or will be conducted.

Environmental consideration	Development Phase and Year										
	Pre-construction			Construction			Post-construction- Operations				
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Birds		✓				✓					
Cod	✓										
Herring	✓	✓									
Sandeels	✓										
Diadromous Fish			✓								
Benthic communities		✓									
Seabed scour	✓	✓	✓			✓					
Marine mammals	✓	✓	✓	✓	✓	✓					

✓	Survey has been completed
	Survey currently underway
	Survey will be completed
	Survey may be conducted but none determined
	Support for Moray Firth monitoring programme
	No surveys will be undertaken

**Table 15.1: Summary of monitoring programme for each topic**

## 16 Licenses and legal requirements

16.1.1 In order to allow survey activity to proceed, licences and dispensations may need to be sought by BOWL in advance of planned surveys. Table 16.1 below identifies the licensing requirements associated with PEMP surveys, which BOWL will adhere to.

**Table 16.1. Notices, licenses and approvals of PEMP survey activity.**

<b>PEMP aspect</b>	<b>Licence / Other legal requirement</b>
All offshore surveys	Issue of a Notice to Mariners stating the location, nature and duration of the survey.
	Issue of a notice in the Kingfisher Fortnightly Bulletin stating the location, nature and duration of the survey.
Benthic surveys	Submission of a Notice of Exempted Activity form to MS-LOT prior to commencing any benthic survey activities. Application for Small Works Licence (are similar) from Crown Estate Scotland.
Sandeel surveys	Request for a dispensation from MSS, in accordance with the terms of Section 9 of the Sea Fish Conservation Act 1967 and Article 43 of Council Regulation No. 850/98 related to days at sea. Specific reference to catching and landing of sandeels using a fixed tooth bar dredge.
Cod surveys	Request for a dispensation from MSS, in accordance with the terms of Section 9 of the Sea Fish Conservation Act 1967 and Article 43 of Council Regulation No. 850/98 related to days at sea. Specific reference to catching and landing undersized and out of quota cod, using undersized mesh.
Herring surveys	Request for a dispensation from MSS, in accordance with the terms of Section 9 of the Sea Fish Conservation Act 1967 and Article 43 of Council Regulation No. 850/98 related to days at sea.
Atlantic salmon survey	Application for a licence for carrying out procedures on animals according to the Animals (Scientific Procedures) Act 1986. This will be a personal licence held by one of the surveyors. Home Office Licence for smolt tagging.
	Issue of a Notice to Mariners describing the survey and the duration of deployment of the acoustic receiver arrays. Application for Small Works Licence (are similar) from Crown Estate Scotland.
	Issue of a notice in the Kingfisher Fortnightly Bulletin describing the survey and the duration of deployment of the acoustic receiver arrays.
Marine mammals	Application for a Marine Licence to cover the deployment of moored acoustic devices. Application for Small Works Licence (are similar) from Crown Estate Scotland.
	Application for a licence to disturb European Protected Species (EPS) under the Conservation (Natural Habitats, &c.) Regulations 1994 and the Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007.

<b>PEMP aspect</b>	<b>Licence / Other legal requirement</b>
Birds	Application for a Home Office Licence in accordance with the Animals (Scientific Procedures) Act 1986 (due to the animal capturing and handling involved).

## 17 Compliance with the Application, ES and SEIS

17.1.1 Part of Condition 27 of the S36 consent states:

*"The PEMP must be in accordance with the ES as it relates to environmental monitoring."*

17.1.2 Within the ES and SEIS, BOWL made a number of commitments in relation with environmental monitoring. Commitments made are presented in full in Appendix A, which also identifies how each commitment has been addressed within this PEMP.

17.1.3 Condition 8 of the S36 consent states:

*"The Development must be constructed and operated in accordance with the terms of the Application and related documents, including the accompanying ES, the Supplementary Environmental Information Statement ("SEIS") and Annex 1 of this letter, **except in so far as amended by the terms of this section 36 consent.**" (emphasis added).*

17.1.4 Since the Application for consents was made, BOWL's approach to environmental monitoring has been refined and commitments made in the ES and SEIS are in some cases superseded by the monitoring approach presented in this PEMP. This is envisaged by the emphasised text above, which allows departure from the Application terms in order to ensure compliance with the terms of the PEMP under Condition 27 of the S36 consent.

## 18 References

**Table 18.1: References of consent documentation**

Ref.	Reports	Document no.
1.	Scottish Government (2014). Consent under Section 36 Electricity Act 1989. Marine Scotland, Aberdeen.	LF000005-REP-093
2.	Scottish Government (2014). Consent under Section 36A Electricity Act 1989. Marine Scotland, Aberdeen.	LF000005-REP-097
3.	Scottish Government (2014). 04462/14/0 Windfarm Marine Licence. Marine Scotland, Aberdeen.	LF000005-REP-291
4.	Scottish Government (2016). 04462/16/0 Windfarm Marine Licence. Marine Scotland, Aberdeen.	LF000005-LET-452
5..	Scottish Government (2017). 04462/17/12 Windfarm Marine Licence. Marine Scotland, Aberdeen.	LF000005-LET-665
6.	Scottish Government (2018). 04462/18/0 Windfarm Marine Licence. Marine Scotland, Aberdeen.	LF000005-LET-723
7.	Scottish Government (2018). 04462/18/1 Windfarm Marine Licence. Marine Scotland, Aberdeen.	LF000005-LET-726

**Table 18.2: References of reports**

Ref.	Reports	Document no.
<b>Birds</b>		
16.	MFRAG Moray Firth Ornithology Monitoring Strategy: Outline Programme.	LF000005-REP-800
19.	Bogdanova, M.I., Butler, A., Gunn, C., Kafas, A., Rei, C., Low, P. and Daunt, F. (2015) Foraging behaviour of large gulls and implications for offshore wind site selection. Work Package 2: Analysis of gull foraging behaviour and implications for offshore wind farm site selection. Report produced in support of the project "Foraging Behaviour of large gulls and implications for offshore wind site selection" funded by Innovate UK, Moray Offshore Renewables Ltd. and Beatrice Offshore Windfarm Ltd.	LF000005-REP-879
18.	BOWL (2016) Pre-construction Aerial Survey Report	LF000005-REP-690
<b>Cod</b>		
22.	BOWL (2015) Cod Survey Results Technical Report	LF000005-REP-094
27.	BMM (2014) Proposal for the Undertaking of a Cod Pawning and Sandeel Survey for the Beatrice Offshore Windfarm Ltd.	LF000005-REP-060



Ref.	Reports	Document no.
<b>Herring</b>		
32.	BOWL (2014) Proposal for the Undertaking of a Herring Larval Survey	LF000005-REP-147
34.	BOWL (2014) Herring Larval Survey Results – Technical Report	LF000005-REP-345
38.	BOWL (2016) Herring Larval Survey Results – Technical Report	LF000005-REP-786
39.	BOWL (2016) Pre-construction Baseline Herring Larval Survey Report	LF000005 -REP-813
<b>Sandeels</b>		
42.	BMM (2014) Proposal for the Undertaking of a Cod Pawning and Sandeel Survey for the Beatrice Offshore Windfarm Ltd.	LF000005-REP-060
43.	BOWL (2014) Sandeel Survey Results – Technical Report	LF000005-REP-095
<b>Diadromous fish</b>		
49.	BOWL (2015) Active tracking study	LF000005-REP-598
53.	BOWL (2015) Smolt Tracking Methodology Report	LF000005-REP-671
55.	Newton, M., Main, R., and Adams, C., (2017) Atlantic Salmon <i>Salmo Salar</i> smolt movements in the Cromarty and Moray Firths, Scotland.	LF000005-REP-1854
<b>Benthic communities</b>		
64.	BOWL (2015) Pre-construction Benthic Report Wind Farm	LF000005-REP-585
66.	BOWL (2014) Post-Construction Benthic Monitoring Strategy	LF000005-REP-341
-	BOWL (2015) Pre-construction Annex 1 habitat survey report of the OfTW	LF000005-REP-584
<b>Seabed scour</b>		
70.	BOWL (2015) BOWL Scour and Local Sediment Deposition Monitoring: Proposed Strategy	LF000005-STR-043
-	BOWL (2017) Marine growth and scour monitoring strategy.	LF000005-PLN-662
-	Siemens (2017) Detailed Design – OTM - Scour Assessment Report	LF000005-REP-734
<b>Marine mammals</b>		
76.	Graham, I.M, Cheney, B., Hewitt,R.C., Cordes, L. S., Hastie,G.D and Thompson, P.M (2017) Strategic Regional Pre-Construction Marine Mammal Monitoring Programme Annual Report 2017.	LF000005-REP-1903
78.	BOWL (2016) Addendum to the BOWL Construction MMMP – studies during piling	LF000005-REP-1367

Ref.	Reports	Document no.
83.	(2014) Strategic Regional Marine Mammal Monitoring Programme for Assessing the Population Consequences of Constructing the BOWL and Moray Offshore Renewables Limited [now MORP] Wind Farm Developments	LF000005-REP-355
85.	BOWL (2015) Construction Marine Mammal Monitoring Programme	LF000005-REP-550
87.	Thompson, P.M (2015) Marine Mammal Monitoring Programme Annual Report	LF000005-REP-538
89.	Thompson, P.M (2015) Pre-construction MMMP Interim Report	LF000005-REP-816
<b>General</b>		
14.	MMO (2014). Review of post-consent offshore wind farm monitoring data associated with licence conditions. A report produced for the Marine Management Organisation, pp 194. MMO Project No: 1031. ISBN: 978-1-909452-24-4.	n/a

**Table 18.3: References of correspondence**

Ref.	Letters	Document no.
<b>Cod</b>		
24.	BOWL (2014) letter to MS-LOT confirming methodology	LF000005-LET-079
25.	MS-LOT (2015) confirmation of discharge	LF000005-LET-156
23.	(2014) email from MS-LOT to BOWL Re: BOWL Cod and Sandeel Survey Methodology	LF000005-EMA-013
44.	MS-LOT (2014) comments on cod survey report	LF000005-LET-078
-	BOWL (2015) revised pre-construction cod survey report following MSS confirmation of required analysis	LF000005-LET-126
<b>Herring</b>		
21.	MS-LOT (2016) confirm discharge of pre-construction element of Conditions 35 and 36.	LF000005-LET-352
28.	MS-LOT (2016) confirmation of discharge of Condition 34.	LF000005-LET-379
30.	(2014) email from BOWL to MS-LOT Re: Issue final herring larval survey methodology report to MS-LOT.	LF000005-EMA-033
33.	MS-LOT (2014) confirmation of agreement with the survey methodologies.	LF000005-LET-064
35.	MSS (2015) confirmation of acceptance of 2014 technical report.	LF000005-LET-113
40.	MSS (2016) acceptance of survey reports and agree that piling installation activities will not adversely affect spawning of the Orkney-Shetland herring stock.	LF000005-LET-357

Ref.	Letters	Document no.
41.	(2016) Email from BOWL to MS-LOT requesting discharge of S36 consent Condition 34.	LF000005-EMA-264
<b>Sandeels</b>		
-	BOWL (2014) Written response to MS-LOT concerning points raised by MSS	LF000005-LET-079
-	MSS and MS-LOT (2014) Written acceptance of 2014 pre-construction sandeel survey reports by MSS	LF000005-LET-078
<b>Diadromous fish</b>		
44.	MS-LOT (2016) confirm discharge of pre-construction element of Conditions 27.a.5	LF000005-LET-333
45.	MFRAG (2016) approval of the proposed methodology for pre-construction smolt tracking survey	LF000005-EMA-272
47.	BOWL (2015) issue briefing note including proposed methodology for smolt tracking in the Cromarty Firth for discussion with MSS	LF000005-BRN-076
51.	BOWL (2015) Letter to MSS requesting acceptance of proposed Cromarty Firth smolt tracking study methodology	LF000005-LET-235
52.	MSS (2015) letter confirming acceptance of Cromarty Firth smolt tracking study	LF000005-LET-250
56.	BOWL (2017) issue of survey report to MS-LOT	LF000005-LET-622
<b>Benthic communities</b>		
61.	BOWL (2015) response to MSS regarding comments on benthic survey strategy	LF000005-LET-128
63.	BOWL (2015) confirmation to MSS and MS-LOT of pre-construction benthic grab sample locations	LF000005-EMA-089
65.	BOWL (2015) issue pre-construction survey reports and benthic post-construction survey strategy report to MSS for acceptance	LF000005-LET-290
67.	MSS (2016) accepted benthic survey reports. Query raised regarding the implications of the reported change in the dominant biotope across the wind farm area for the post-construction monitoring strategy.	LF000005-EMA-276
68.	BOWL response to MSS points concerning proposed post-construction monitoring strategy	LF000005-LET-338
69.	MSS (2016) confirm acceptance of the survey report and the proposed post-construction monitoring strategy	LF000005-EMA-273
<b>Seabed scour</b>		
71.	MS-LOT (2016) Written approval of the Scour and Local Sediment Deposition Monitoring: Proposed Strategy.	LF000005-EMA-408

Ref.	Letters	Document no.
<b>Marine mammals</b>		
80.	BOWL (2014) Final draft of the pre-construction MMMP issued to MS-LOT and stakeholders for consultation.	LF000005-LET-037
81.	BOWL (2014) Updated pre-construction MMMP issued to MFRAG following revisions based on stakeholder comments.	LF000005-LET-359
82.	MS-LOT (2014) Letter confirming acceptance or pre-construction MMMP scope and methodology.	LF000005-LET-051
<b>General</b>		
15.	MS-LOT (2016) Written acceptance of the PEMP and discharge of various pre-construction elements of the monitoring programme.	LF000005-LET-630
20.	MS-LOT (2015) Confirmation of the discharge of the PS and approval of fish and marine mammal monitoring and mitigation.	LF000005-LET-280
59.	MS-LOT (2016) Confirmation of discharge of Wind Farm CaP condition and approval of monitoring and mitigation in respect of cable scour/exposure and diadromous fish.	LF000005-EMA-344
-	MS-LOT (2017) Confirmation of discharge of OfTW CaP condition and approval of monitoring and mitigation in respect of cable scour/exposure and diadromous fish.	LF000005-LET-601

**Table 18.4: References of meeting minutes and consultations**

Ref.	Minutes of meetings	Document no.
<b>Herring</b>		
29.	(2013) BOWL, MORL, MSS, MS-LOT, to discuss requirements for herring survey	LF000005-MOM-013
31.	(2014) to confirm proposed herring larval survey methodology, analysis and number of surveys	LF000005-MOM-106
36.	(2015) to present pre-construction herring survey results	LF000005-MOM-230
<b>Diadromous fish</b>		
46.	(2014) Meeting with MSS, MS-LOT to discuss BOWL participation in Pentland Salmon Initiative to achieve required monitoring.	LF000005-MOM-132
48.	(2014) Meeting with MSS at Battleby. MSS request BOWL enhance marine tracking element of proposed study	LF000005-MOM-314
50.	(2015) Meeting with local District Salmon Fishery Boards (DSFBs) who provided positive support for the study proposal	LF000005-MOM-343
54.	(2017) Meeting with local DSFBs to present the results of the Cromarty Firth Smolt tracking study.	LF000005-MIN-686

<b>Benthic communities</b>		
60.	(2015) Meeting to present and discuss the scope of pre-construction benthic surveys	LF000005-MOM-230
62.	(2015) MFRAG meeting to discuss benthic post-construction monitoring and scope of monitoring	LF000005-MOM-310
<b>Marine mammals</b>		
77.	(2017) Meeting with MFRAG-MM in which the 'Pre-construction MMMP Year 3 Annual Report' was accepted	LF000005-MOM-721
79.	(2016) Meeting to finalise and agree final CMMMP	LF000005-MOM-652
84.	(2014) Meeting with MFRAG-MM to present pre-construction marine mammal collected to date.	LF000005-MOM-410
86.	(2015) Meeting with MFRAG-MM to discuss the scope of the CMMMP and subsequent post-construction monitoring.	LF000005-MOM-313
88.	(2015) Meeting with MFRAG-MM to discuss the focus and methodology of the CMMMP.	LF000005-MOM-360
90.	(2015) Meeting with MFRAG-MM to present the full CMMMP.	LF000005-MOM-389
91.	(2016) Meeting with MFRAG-MM to present the full CMMMP.	LF000005-MOM-708

**Table 18.5: References of Consent Plans**

<b>Ref.</b>	<b>Consent Plans</b>	<b>Document no.</b>
8.	Project Environmental Monitoring Programme (Offshore Transmission Assets)	LF000005-PLN-723
9.	Project Environmental Monitoring Programme	LF000005-PLN-179
10.	Operations and Maintenance Plan (Wind Farm Assets)	LF000005-PLN-178
11.	Archaeology Written Scheme of Investigation and Procedures for Archaeological Discoveries (Beatrice Offshore Wind Farm)	LF000005-PLN-724
12.	Television and Radio Reception Mitigation Plan	LF000005-PLN-180
13.	Decommissioning Programme (Wind Farm Assets)	LF000005-PLN-726
26.	Construction Plan	LF000005-PLN-010
37.	Piling Strategy	LF000005-PLN-142
58.	Wind Farm Cable Plan	LF000005-PLN-183

**Table 18.6: References to other documentation**

<b>Ref.</b>	<b>Consent Plans</b>	<b>Document no.</b>
-------------	----------------------	---------------------

17.	BOWL Aerial Survey Method for Pre-Construction Surveys	LF000005-SOW-051
72.	Osiris 2010 Geophysical Survey	BEA-REP-GEP-OSI-051
73.	Fugro EMU 2013 Geophysical Survey	BEA-REP-SAS-BOWL-407
74.	Fugro EMU 2014 Geophysical Survey	LF000005-REP-378
75.	MMT 2015 Geophysical Survey	LF000005-REP-603

## Appendix A - ES and SEIS Commitments

Table A1 presents the commitments made by BOWL in the ES and SEIS to monitoring of the Development. The table provides details of the commitments and a cross-reference to where each commitment is implemented.

**Table A1. ES and SEIS Commitments**

Source	Reference (Chapter, page, paragraph)	Details of Commitment	Implementation
ES	10 Benthic Ecology page 49, paragraph 175	A program of benthic monitoring will be agreed with the relevant authorities.	Section 12 of Wind Farm Assets PEMP (this document)
ES	11 Fish and Shellfish page 43, paragraph 158	BOWL will work with key stakeholders and MS-LOT to identify any future monitoring programmes considered necessary.	Sections 8, 9 and 10 of Wind Farm Assets PEMP (this document)
ES	12 Marine Mammals page 68, paragraph 229	BOWL will continue to work with MS-LOT and key stakeholders to undertake work to fill gaps in the understanding of the effects of underwater noise on marine mammals behaviourally and at a population level. BOWL will work collaboratively with the wider offshore wind industry in Scotland and the UK as well as with key experts in the field of underwater noise and marine mammals to undertake this work.	Section 14.3 of Wind Farm Assets PEMP (this document)
ES	12 Marine Mammals page 69, paragraph 231	BOWL will work with MS-LOT, SNH/JNCC and other key stakeholders to develop the specification for an appropriate monitoring programme.	Section 14 of Wind Farm Assets PEMP (this document)
ES	13 Wind Farm Ornithology page 58, paragraph 196	It is expected that best practice monitoring of bird use within the wind farm area and 4 km buffer will be undertaken. Typically, this comprises periods of pre-construction, construction and post-construction monitoring in order to identify any changes in bird usage of the wind farm area attributable to the wind farm. The scope and periods (e.g. post-consent/pre-construction) of monitoring required will be determined in discussion with SNH and MS-LOT.	Section 7 of Wind Farm Assets PEMP (this document)

<b>Source</b>	<b>Reference (Chapter, page, paragraph)</b>	<b>Details of Commitment</b>	<b>Implementation</b>
ES	16 Commercial Fisheries page 34, paragraph 157 and page 37, paragraph 176	Post construction surveys will be undertaken to assess the seabed status in the immediate vicinity of construction and installation activities.	Section 13 of Wind Farm Assets PEMP (this document)
ES	21 Physical Processes OfTW page 20, paragraph 119	The development of any scour will also be monitored post construction.	Section 13 of Offshore Transmission Assets PEMP
ES	21 Physical Processes OfTW page 20, paragraph 119	Visual and/or bathymetric surveys will be undertaken pre- and post-construction along part or all of the OfTW route and these surveys compared.	Section 13 of Offshore Transmission Assets PEMP
ES	21 Physical Processes OfTW page 20, paragraph 121	Visual and/or topographic surveys will be undertaken pre- and post-construction between the onshore jointing bay and an adjacent point on the beach around or below Mean Low Water Springs. These surveys will be compared to monitor the actual (naturally occurring) rates of beach morphological change and retreat.	Section 13 of Offshore Transmission Assets PEMP
ES	22 Benthic Ecology OfTW page 18, paragraph 95	Monitoring of the effects from cable installation will be included as part of the overall benthic monitoring plan, to be agreed with most notably (but not limited to) MS-LOT and SNH.	Section 12 of Offshore Transmission Assets PEMP
ES	23 Fish and Shellfish OfTW page 33, paragraph 120	BOWL will work with key stakeholders and MS-LOT to identify any future monitoring programmes considered necessary.	Sections 8, 9, 10 and 11 of Offshore Transmission Assets PEMP
ES	27 Commercial Fisheries OfTW page 54, paragraph 230	BOWL will work with key stakeholders and MS-LOT to identify any future monitoring programmes considered necessary.	Sections 8, 9, 10 and 11 of Offshore Transmission Assets PEMP
ES	28 Shipping and Navigation OfTW page 21, table 28.3	Periodic and planned surveys of cable routes to monitor burial depths and seabed mobility.	Section 13 of Offshore Transmission Assets PEMP



<b>Source</b>	<b>Reference (Chapter, page, paragraph)</b>	<b>Details of Commitment</b>	<b>Implementation</b>
SEIS	5 Fish and Shellfish Ecology page 3, table 5.1	Consultation will be undertaken with MSS to discuss the proposal to undertake a pre-construction sandeel survey.	Section 10 of Wind Farm Assets PEMP (this document)
SEIS	5 Fish and Shellfish Ecology page 3, table 5.1	Sandeel survey methodology will be in line with that used by MORL.	Sections 10 of Wind Farm Assets PEMP (this document)
SEIS	5 Fish and Shellfish Ecology page 4, table 5.1	BOWL is engaging with MS-LOT and other developers to define an adequate salmon and sea trout monitoring strategy.	Section 11 of Wind Farm Assets PEMP (this document) and Section 7 of Offshore Transmission Assets PEMP
SEIS	5 Fish and Shellfish Ecology page 11, table 5.1	BOWL is committed, in consultation with MS-LOT, to undertake the appropriate additional surveys as a condition of consent. These may include; sandeel survey; and cod survey.	Section 8 and 10 of Wind Farm Assets PEMP (this document)
SEIS	5 Fish and Shellfish Ecology page 12, table 5.2	A post installation survey is likely to be undertaken following completion of cable installation and protection works trenching and rock dumping, depending on the final construction plans	Sections 8, 9, 10 and 11 of Wind Farm Assets PEMP (this document) and Section 9 of Offshore Transmission Assets PEMP
SEIS	5 Fish and Shellfish Ecology page 55, paragraph 130	BOWL is committed, in consultation with MS-LOT, to undertake the appropriate additional surveys as a condition of consent. These may include; sandeel survey; and cod survey.	Sections 8 and 10 of Wind Farm Assets PEMP (this document)
SEIS	6 Marine Mammals page 3, table 6.1	A MMMP, including the collection of pre-construction baseline data, is proposed.	Sections 14 of Wind Farm Assets PEMP (this document) and Section 10 of Offshore Transmission Assets PEMP

Source	Reference (Chapter, page, paragraph)	Details of Commitment	Implementation
SEIS	6 Marine Mammals page 47, paragraph 83	ADDs are a particularly useful tool for mitigating effects upon seals as a result of the difficulties associated with identifying and observing these species, particularly at night and during periods of poor visibility.	Section 14 of Wind Farm Assets PEMP (this document) and Section 10 of Offshore Transmission Assets PEMP
SEIS	6 Marine Mammals page 48, paragraph 86	BOWL is working together with MORL to devise a MMMP that tests the predictions of the assessment of potential effects.	Section 14 of Wind Farm Assets PEMP (this document) and Section 10 of Offshore Transmission Assets PEMP
SEIS	6 Marine Mammals page 49, paragraph 93	The MMMP will include acoustic surveys to monitor the existing noise levels in the Moray Firth and collation of data from other studies that can provide information on key prey populations, physical processes, by-catch etc. Further information on the Population Consequences of Disturbance (PCoD) model will be sought from the Sea Mammal Research Unit (SMRU) Ltd and UoA study which is due for publication this year.	Section 14 of Wind Farm Assets PEMP (this document) and Section 10 of Offshore Transmission Assets PEMP
SEIS	15 Summary of Residual Effects page 15, paragraph 33	A detailed MMMP is currently being developed in consultation with developers, MS-LOT, MSS, SNH and the UoA to allow the unique existing baseline information of the Moray Firth to be built on, and to provide the opportunity to better understand the interactions between marine mammals and offshore wind farms.	Section 14 of Wind Farm Assets PEMP and Section 10 of Offshore Transmission Assets PEMP (this document)